

PROJECT MANUAL

FOR

DEL SOL HIGH SCHOOL

OWNER

Oxnard Union High School District
309 South K Street
Oxnard, CA 93030

ARCHITECT

WLC ARCHITECTS, INC.
8163 ROCHESTER AVENUE, SUITE 100
RANCHO CUCAMONGA, CA 91730
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PROJECT 1721200
July 2019

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FOR
DEL SOL HIGH SCHOOL

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JULY 2019

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PROJECT MANUAL
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PROJECT 1721200
DSA APPLICATION NO. 03-119965

JULY 2019

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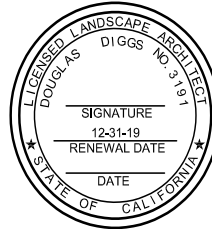
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NOT USED

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NOT USED

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NOT USED

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NOT USED

DIVISION 49 RESERVED

NOT USED

SECTION 01 11 00

SUMMARY OF WORK

1. PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Work Included.
- B. Contractor use of site.
- C. Owner occupancy.
- D. Work restrictions.

1.2 WORK INCLUDED

- A. Work of this Contract comprises general construction of a new comprehensive high school located at north side of Camino Del Sol between North Rose Avenue and Gibraltar Street for Oxnard Union High School District, Owner.
- B. Construct the work under a single lump sum contract.

1.3 WORK UNDER SEPARATE CONTRACTS

- A. General: Cooperate fully with separate contractors so work on those contracts may be carried out smoothly, without interfering with or delaying work under this Contract. Coordinate the Work of this Contract with work performed under separate contracts.

1.4 CONTRACTOR USE OF SITE

- A. Contractor shall have complete use of the site throughout the construction period.
- B. Construction Operations: Limited to property boundaries.

1.5 OWNER OCCUPANCY

- A. Owner Occupancy of Completed Areas of Construction: Owner reserves the right to occupy and to place and install equipment in completed areas of building, before Substantial Completion, provided such occupancy does not interfere with completion of the Work. Such placement of equipment and partial occupancy shall not constitute acceptance of the total Work.
- B. Architect will prepare a Certificate of Substantial Completion for each specific portion of the Work to be occupied before Owner occupancy.
- C. Before partial Owner occupancy, mechanical and electrical systems shall be fully operational, and required tests and inspections shall be successfully completed. On occupancy, Owner will operate and maintain mechanical and electrical systems serving occupied portions of building.
- D. On occupancy, Owner will assume responsibility for maintenance and custodial service for occupied portions of building.
- E. Cooperate with Owner during construction operations to minimize conflicts and facilitate Owner usage.
- F. Perform the Work so as not to interfere with Owner's day-to-day operations.
- G. Maintain existing exits, unless otherwise indicated.

1.6 WORK RESTRICTIONS

- A. On-Site Work Hours: Work shall be generally performed during normal business working hours, Monday through Friday, except as otherwise indicated or required to conform to construction schedule and labor codes.
- B. Existing Utility Interruptions: Do not interrupt utilities serving facilities occupied by Owner or others unless permitted to do so and then only after arranging to provide temporary utility services according to requirements indicated.
 - 1. Notify Architect not less than 5 days in advance of proposed utility interruptions. Do not proceed with utility interruptions without Architect's permission.

2. PART 2 PRODUCTS

Not Used

3. PART 3 EXECUTION

Not Used

END OF SECTION

SECTION 01 20 00

PRICE AND PAYMENT PROCEDURES

1. PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Contingency allowances.
- B. Schedule of Values.
- C. Application for Payment.
- D. Defect assessment.
- E. Non-payment for rejected work.
- F. Change procedures.
- G. Unit prices.

1.2 CONTINGENCY ALLOWANCE:

- A. Include in the contract sum all contingency allowances stated herein.
- B. Costs included in contingency allowance: Cost of work to Contractor or subcontractor, less applicable trade discounts; delivery to site and applicable taxes; product handling, including unloading, uncrating, and storage; protection of products from damage; labor for installation and finishing; reasonable overhead and profit and other expenses required by work.
- C. Funds will be drawn from contingency allowance amount only by written authorization of Owner.
- D. At closeout of Contract, funds remaining in contingency allowance amount will be credited to Owner by Change Order.
- E. Whenever costs are more than contingency allowance amount, the Contract amount will be adjusted accordingly by Change order.
- F. Contractor Responsibilities:
 - 1. Assist Architect in selection of products and suppliers.
 - 2. Obtain proposals from suppliers and offer recommendations.
 - 3. On notification of selection by Owner, execute agreement with designated supplier.
 - 4. Arrange for and process shop drawings, product data, and samples. Arrange for delivery of product to site.
 - 5. Promptly inspect products upon delivery for completeness, damage, and defects. Submit claims for damage.
- G. Contingency Allowance: A stipulated sum of \$4,500,000.00.

1.3 SCHEDULE OF VALUES

- A. Submit Schedule of Values for approval in duplicate within fourteen days after receipt of Notice to Proceed.

- B. Format: Submit typed schedule based upon the attached Schedule of Values augmented by the Table of Contents of this Project Manual. Identify each line item with number and title of the major specification Section.
- C. Include in each line item, the amount of Allowances specified in this Section.
- D. Include within each line item, a directly proportional amount of Contractor's overhead and profit.
- E. Revise schedule to list approved Change Orders, on continuation sheet, with each Application For Payment.

1.4 APPLICATIONS FOR PAYMENT

- A. Submit a PDF copy of each application on AIA Form G702 - Application and Certificate for Payment and AIA Form G703 Continuation Sheet.
- B. Content and Format: Utilize Schedule of Values for listing items in Application for Payment.
- C. Payment Application Times: The date for each progress payment is indicated in the General Conditions of the Contract.
- D. Payment Application Periods: The period of construction covered by each application for payment is the period indicated in the General Conditions of the Contract.
- E. Application Preparation: Complete every entry on form. Notarize and execute by a person authorized to sign legal documents. Architect will return incomplete applications without action.
- F. Waiver of Stop Notices: With each application for payment, submit waivers of stop notices from subcontractors for construction period covered by previous application.
- G. Final Payment: As specified in the General Conditions of the Contract and in Section 01 77 00 - Closeout Procedures.
- H. Refer to the General Conditions of the Contract for additional payment provisions.

1.5 DEFECT ASSESSMENT

- A. Replace the Work, or portions of the Work, not conforming to specified requirements.
- B. If, in the opinion of the Architect, it is not practical to remove and replace the Work, the Architect will direct one of the following remedies:
 - 1. The defective Work may remain, but the listed schedule of value will be adjusted to a new value at the discretion of the Architect.
 - 2. The defective Work will be partially repaired to the instructions and satisfaction of the Architect and the listed schedule of value will be adjusted to reflect a new value at the discretion of the Architect.

1.6 NON-PAYMENT FOR REJECTED WORK

- A. Payment will not be made for any of the following:
 - 1. Products wasted or disposed of in a manner that is not acceptable.
 - 2. Products determined to be unacceptable before or after placement.
 - 3. Products not completely unloaded from the transporting vehicle.
 - 4. Products placed beyond the lines and levels of the required work.
 - 5. Products remaining on hand after completion of the work.

6. Loading, hauling and disposing of rejected products.

1.7 CHANGE PROCEDURES

- A. The Architect will advise of minor changes in the Work not involving an adjustment to Contract Sum/Price or Contract Time as authorized by General Conditions on AIA Form G710 Architect's Supplemental Instructions.
- B. The Architect may issue a Proposal Request which includes a detailed description of a proposed change with supplementary or revised Drawings and specifications. Proposal Requests are for information only and are not to be considered instructions to stop the work or to execute the proposed change. Contractor will prepare and submit a detailed estimate within 14 days.
- C. Any change in the Work which involves the adjustment to contract sum/price or contract time shall be properly certified by the Contractor as indicated in the General Conditions of the contract.
- D. The Contractor may propose a change by submitting a Change Order Request to the Architect, describing the proposed change and its full effect on the Work. Include a statement describing the reason for the change, and the effect on the Contract Sum and Contract Time with full documentation.
- E. Stipulated Sum Change Order: Based on Proposal Request and Contractor's fixed price quotation or Contractor's Change Order Request as approved by Architect.
- F. Time and Material/Force Account Change Order: Submit itemized account and supporting data after completion of change, within time limits indicated in the General Conditions of the Contract.
- G. Maintain detailed records of work done on Time and Material/Force Account basis. Provide full information required for evaluation of proposed changes, and to substantiate costs for changes in the Work as indicated in the General Conditions of the Contract.
- H. Construction Change Directive: Architect may issue a directive, signed by the Owner and Architect, instructing the Contractor to proceed with a change in the Work, for subsequent inclusion in a Change Order. Document will describe changes in the Work, and designate method of determining any change in Contract Sum or Contract Time. Promptly execute the change.
- I. Allowance Adjustment: Adjustment of allowance amounts shall be based upon a properly documented and detailed Change Order Request which substantiates distribution of allowance amounts and actual costs of work in place.
- J. Change Order Forms: AIA G701 Change Order.
- K. Execution of Change Orders: Architect will issue Change Orders for signatures of parties as provided in the General Conditions of the Contract.
- L. All addenda (changes and/or revisions prior to award of contract) and construction changes (changes and revisions after award of contract) shall be approved by the Architect and the Division of the State Architect prior to start of construction covered by those changes and/or revisions in accordance with the requirements of Title 24 of the California Code of Regulations, Part 1, Section 4-338.
- M. Promptly revise Schedule of Values and Application for Payment forms to record each authorized Change Order as a separate line item and adjust the Contract Sum.
- N. Promptly revise progress schedules to reflect any changes in Contract Time, revise sub-schedules to adjust times for other items of work affected by the change and resubmit.
- O. Promptly enter changes in Project Record Documents.

2. PART 2 PRODUCTS

Not Used

3. PART 3 EXECUTION

Not Used

END OF SECTION

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SCHEDULE OF VALUES FORMAT*

Project: Del Sol High School

Contractor: _____

Date: _____

Item Description	Amount
1. Mobilization and initial expenses	
2. General Conditions	
Temporary Utilities	
Engineering Layout	
Temporary Construction/Dust Control	
General Clean Up/Trash Removal	
Project Manager/Supervision/Truck	
Rental Equipment	
3. Bonds and Insurance	
4. SITE WORK	
Demolition/Removal	
Site	
Building(s)	
Site Preparation	
General Brush and Tree Clearing	
Earthwork	
Site Improvements	
Termite/Weed Treatment	
AC Paving/Base/Striping	
Concrete Curb/Gutters	
Concrete Retaining Walls	
Concrete Paving	
Concrete Site Stairs	
Masonry Garden Walls	
Chain Link Fences/Gates	
Wrought Iron Fences/Gates	
Irrigation	
Planting	
Site Equipment (misc)	
Site Utilities	
Fire Hydrants	
Fire Lines	
Storm Drainage	
Site Water	
Site Gas	
Site Sewer	
Electrical Site Service/Lighting	

Item Description	Amount
Off-site Work	
AC Paving/Base	
Concrete Curb/Gutters	
Irrigation	
Planting	
Fire Hydrants	
Fire Lines	
Storm Drainage	
Site Water	
Site Gas	
Site Sewer	
Street Lights	
Other	
5. FOUNDATIONS	
Wall Foundations	
Column Foundations	
Special Foundations	
Other	
6. SUBSTRUCTURE	
Slab on Grade	
Trenches/pits/bases	
Basement Excavation/Walls	
Subgrade Moisture Protection	
Other	
7. SUPERSTRUCTURE	
Columns and Beams	
Concrete Columns/Beams	
Masonry Columns	
Steel Columns/Beams	
Wood Columns/Beams	
Glue Laminated Beams	
Structural Walls	
Concrete Walls	
Masonry Walls	
Wood Framed Walls	
Floor Construction	
Concrete Cast in Place	
Steel Deck/Framing	
Trusses	
Wood Framed Floors	
Roof Construction	
Concrete Cast in Place	
Steel Deck/Framing	
Trusses	
Wood Framed Roofs	
Stairs	
Other	

Item Description	Amount
8. EXTERIOR CLOSURE	
Exterior Walls/Soffits	
Sandblast Concrete Seal/Paint	
Sandblast Masonry Seal/Paint	
Glass Block	
Metal Studs	
Wood Studs	
Exterior Plaster	
Exterior Insulation	
Windows/Frames/Glazing	
Steel Windows/Glazing	
Aluminum Windows/Glazing	
Store Front/Glazing	
Doors	
Metal Doors/Frames	
Wood Doors/Frames	
Aluminum Doors/Frames/Glazing	
Sectional Doors/Frames	
Roll Up Doors/Frames	
Store Front	
Frames	
Hardware	
Insulation	
Thermal Wall	
Sound Wall	
Sealants/Caulking	
Other	
9. ROOFING	
Roof Coverings and Flashing	
Built Up Roofing	
Single Ply	
Preformed Metal	
Asphalt Shingle	
Clay/Concrete Tile	
Roof Walkway System	
Roof Insulation and Fill	
Lightweight Concrete	
Insulating Concrete Fill	
Rigid Insulation	
Flashing and Trim	
Roof Openings	
Roof Hatches	
Smoke Hatches	
Skylights	
Skyroofs/Walls	
Ladders to Roof	
Other	

Item Description	Amount
10. INTERIOR CONSTRUCTION	
Fixed Partitions	
Metal Studs	
Wood Studs	
Gypsum Board	
Interior Plaster	
Movable Partitions	
Compartments & Cubicles	
Toilet Partitions	
Interior Doors	
Wood Doors	
Metal Doors	
Aluminum Doors	
Roll Up Doors	
Special Doors	
Frames	
Interior Finishes	
Painting	
Walls	
Ceiling	
Vinyl Wall Coverings	
Ceramic Tile	
Fiberglass Reinforced Panels	
Concrete Sealer	
Vinyl Sheet/Tile	
Rubber Flooring	
Carpet	
Wood Flooring	
Suspended Acoustical Ceiling System	
Suspended Gypsum Ceiling System	
Specialties	
Chalkboard/Markerboard/Tackboards	
Cabinets	
Toilet Room Accessories	
Graphics and Signage	
Other	
11. CONVEYING SYSTEMS	
Elevators	
Moving Stairs and Walks	
Pneumatic Tube Systems	
Lifts, Hoists, and Cranes	
Wheel Chair Lift	
Dock Leveler/Bumpers	
Automotive Hoists (single)	
Two Post Hoist (twin)	
Other	

Item Description	Amount
12. EQUIPMENT	
Library	
Book Theft System	
Fixed Book Shelves	
Rolling Book Shelves	
Multipurpose/Stage	
Fireproof Curtain	
Projection Screen(s)	
Folding Tables/Benches	
Athletic	
Steel Athletic Lockers	
Basketball Backstops	
Bleachers	
Pool	
Classroom	
Window Coverings	
Book Lockers	
Food Service	
Kitchen Equipment	
Walk in Freezer/Refrigerator	
Other	
13. MECHANICAL	
Plumbing	
Supply Service	
Disposal Service	
Rainwater Service	
Gas Service	
Finish Fixtures	
Fire Protection	
Sprinklers	
Fire Extinguishers	
HVAC System	
Equipment	
Ductwork/Distribution	
System Controls	
Testing and Balancing	
Other	
14. ELECTRICAL	
Distribution	
Lighting and Power	
Special Systems	
Alarm System	
Communications	
Emergency System	
Other	

Item Description	Amount
15. SPECIAL CONSTRUCTION	
Miscellaneous Special Construction	
TOTAL COST	\$ _____

*The above categories may be subdivided and items added if the overall order remains the same and the subtotal cost for each category complies with the format as shown. Items not applicable to a particular job may be deleted from this list. Overhead and profit shall be a combined mark up and added proportionally to each line item.

SECTION 01 25 13

PRODUCT SUBSTITUTION PROCEDURES

1. PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Product options.
- B. Substitution procedures.

1.2 DEFINITIONS

- A. Requests for changes in products, materials, or equipment required by Contract Documents proposed by the Contractor prior to and after award of the Contract are considered requests for substitutions. The following are not considered substitutions:
 - 1. Revisions to Contract Documents requested by the Owner or Architect.
 - 2. Specified options of products, materials, and equipment included in Contract Documents.

1.3 PRODUCT OPTIONS

- A. Products Specified by Reference Standards or by Description Only: Any product meeting those standards or description.
- B. Products Specified by Naming One or More Manufacturers with Provision for Substitution: Products of manufacturers named and meeting specifications with substitution of products or manufacturer only when submitted under provisions of this section.
- C. Products Specified by Naming One or More Manufacturers without Provision for Substitution: No substitution allowed.

1.4 LIMITATIONS ON SUBSTITUTIONS SUBMITTED PRIOR TO THE RECEIPT OF BIDS

- A. The Bid shall be based upon the standards of quality established by those items of equipment and/or materials which are specifically identified in the Contract Documents.
- B. The opportunity to request a substitution is not for the convenience of the Bidder to request acceptance of equipment and/or materials which may be more familiar or have a lesser cost.
- C. Architect may consider requests for substitutions of specified equipment and/or materials only when requests are received by Architect prior to the date established for the receipt of bids as stipulated in Document 00 21 13 - Instructions to Bidders.
- D. Consideration by Architect of a substitution request will be made only if request is made in strict conformance with provisions of this section.
- E. Burden of proof of merit of requested substitution is the responsibility of the entity requesting the substitution.
- F. It is the sole responsibility of the entity requesting the substitution to establish proper content of submittal for requests for substitutions. Incomplete submittals will be rejected.
- G. Architect's decision on substitution requests are final and do not require documentation or justification.
- H. When substitution is not accepted, provide specified product.
- I. Substitute products shall not be included within the bid without written acceptance by Addendum.

1.5 LIMITATIONS ON SUBSTITUTIONS SUBMITTED AFTER THE AWARD OF THE CONTRACT

- A. The Contract is based upon the standards of quality established by those items of equipment and/or materials which are specifically identified in the Contract Documents.
- B. The opportunity to request a substitution is not for the convenience of the Contractor to request acceptance of equipment and/or materials which may be more familiar or have a lesser cost.
- C. Consideration by Architect of substitution requests received after the established date of the receipt of bids or contract award will only be made when one or more of the following conditions are met and documented:
 - 1. Specified item fails to comply with regulatory requirements.
 - 2. Specified item has been discontinued.
 - 3. Specified item, through no fault of the Contractor, is unavailable in the time frame required to meet project schedule.
 - 4. Specified item, through subsequent information disclosure, will not perform properly or fit in designated space.
 - 5. Manufacturer declares specified product to be unsuitable for use intended or refuses to warrant installation of product.
 - 6. Substitution would be, in the sole judgement of the Architect, a substantial benefit to the Owner in terms of cost, time, energy conservation, or other consideration of merit.
- D. Notwithstanding the provisions of Article 1.4 of this section and the above, the Architect may consider a substitution request after the date of the receipt of bids or contract award, if in the sole discretion of the Architect, there appears to be just cause for such a request. The acceptance of such a late request does not waive any other requirement as stated herein.
- E. Consideration by Architect of a substitution request will be made only if request is made in strict conformance with provisions of this section.
- F. Substitutions will not be considered when they are indicated or implied on shop drawings or product data submittals without separate written request as required by provisions of this section.
- G. Review of shop drawings does not constitute acceptance of substitutions indicated or implied on shop drawings.
- H. Substitutions will not be considered when requested or submitted directly by subcontractor or supplier.
- I. Substitutions will not be considered as a result of the failure to pursue the work promptly or coordinate activities properly.
- J. Burden of proof of merit of requested substitution is the responsibility of the Contractor.
- K. It is the sole responsibility of the Contractor to establish proper content of submittal for requests for substitutions. Incomplete submittals will be rejected.
- L. Owner shall receive full benefit of any cost reduction as a result of any request for substitution.
- M. Architect's decision on substitution requests is final and does not require documentation or justification.
- N. When substitution is not accepted, provide specified product.
- O. Substitute products shall not be ordered or installed without written acceptance.

1.6 REGULATORY REQUIREMENTS

- A. It shall be the responsibility of the entity requesting the substitution to obtain all regulatory approvals required for proposed substitutions.
- B. All regulatory approvals shall be obtained for proposed substitutions prior to submittal of substitution request to Architect.
- C. All costs incurred by the Owner in obtaining regulatory approvals for proposed substitutions to include the costs of the Architect and any authority having jurisdiction over the project shall be reimbursed to the Owner. Costs of these services shall be reimbursed regardless of final acceptance or rejection of substitution.
- D. Substitutions of materials or work procedures which affect the health, safety and welfare of the public shall have prior approval of the Division of the State Architect (DSA) field representative.

1.7 SUBSTITUTION REPRESENTATION

- A. In submitting a request for substitution, the entity requesting the substitution makes the representation that he or she:
 - 1. Has investigated the proposed substitution and has determined that it meets or exceeds the quality level of the specified product.
 - 2. Will provide the same warranty or guarantee for the substitution as for the specified product.
 - 3. Will coordinate installation and make changes to other work which may be required for the work to be completed with no additional cost to the Owner.
 - 4. Waives claims for additional cost or time extension which may subsequently become apparent.
 - 5. Will reimburse Owner for the cost of Architect's review or redesign services associated with substitution request.

1.8 SUBMITTAL PROCEDURE

- A. Submit each Substitution Request in conformance with the requirements of this section.
- B. Assemble complete Substitution Request into a single bookmarked Portable Document Format (PDF) file.
- C. Transit electronic PDF files via Architect's Project Collaboration Site address or designated email address.
- D. Submit request with Architect's Substitution Request Form. Form may be obtained at the office of the Architect. Substitution requests received without request form will be returned unreviewed.
- E. Limit each request to one proposed substitution.
- F. Request to include sufficient data so that direct comparison of proposed substitution can be made.
- G. Provide complete documentation for each request. Documentation shall include the following information, as appropriate, as a minimum:
 - 1. Statement of cause for substitution request.
 - 2. Identify product by specification section and article number.
 - 3. Provide manufacturer's name, address, and phone number. List fabricators, suppliers, and installers as appropriate.
 - 4. List similar projects where proposed substitution has been used, dates of installation and names of Architect and Owner.

5. List availability of maintenance services and replacement materials.
 6. Documented or confirmation of regulatory approval.
 7. Product data, including drawings and descriptions of products.
 8. Fabrication and installation procedures.
 9. Samples of proposed substitutions.
 10. Itemized comparison of significant qualities of the proposed substitution with those of the product specified. Significant qualities may include size, weight, durability, performance requirements and visual effects.
 11. Coordination information, including a list of changes or modifications needed to other items of work that will become necessary to accommodate proposed substitution.
 12. Statement on the substitutions effect on the construction schedule.
 13. Cost information including a proposal of the net change, if any, in the Contract sum if the substitution is submitted after the receipt of bids or contract award.
 14. Certification that the substitution is equal to or better in every respect to that required by the Contract Documents and that substitution will perform adequately in the application intended.
 15. Waiver of right to additional payment or time that may subsequently become necessary because of failure of substitution to perform adequately.
- H. Inadequate warranty, vagueness of submittal, failure to meet specified requirements, or submittal of insufficient data will be cause for rejection of substitution request.

1.9 ARCHITECT'S REVIEW

- A. Within 14 days of receipt of request for substitution, the Architect will accept or reject proposed substitution.
- B. If a decision on a substitution cannot be made within the time allocated, the product specified shall be used.
- C. There shall be no claim for additional time for review of proposed substitutions.
- D. Final acceptance of a substitution submitted prior to the date established for the receipt of bids will be in the form of an Addendum.
- E. Final acceptance of a substitution submitted after the award of the contract will be in the form of a Change Order.

2. PART 2 PRODUCTS

Not Used

3. PART 3 EXECUTION

Not Used

END OF SECTION

SECTION 01 31 00

PROJECT MANAGEMENT AND COORDINATION

1. PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Coordination.
- B. Preconstruction conference.
- C. Progress meetings.
- D. Request for Information (RFIs).
- E. Preinstallation conferences.
- F. Commissioning.
- G. Closeout conference.
- H. Post construction dedication.

1.2 DEFINITIONS

- A. RFI - Request from Contractor seeking additional information, interpretation or clarification of the Contract Documents.

1.3 COORDINATION

- A. Coordinate scheduling, submittals, and Work of the various Sections of Specifications to assure efficient and orderly sequence of installation of interdependent construction elements, with provisions for accommodating items installed later.
- B. Coordinate construction operations of the different Sections of the Specifications to ensure efficient and orderly installation of each part of the Work.
- C. Prior to commencement of a particular type or kind of work examine relevant information, contract documents and subsequent data issued to the project.
- D. Verify that utility requirement characteristics of operating equipment are compatible with building utilities. Coordinate work of various Sections having interdependent responsibilities for installing, connecting to, and placing in service, such equipment.
- E. Coordinate space requirements and installation of mechanical and electrical work which are indicated diagrammatically on Drawings. Follow routing shown for pipes, ducts, and conduit, as closely as practicable; place runs parallel with line of building. Utilize spaces efficiently to maximize accessibility for other installations, for maintenance, and for repairs.
- F. In finished areas except as otherwise indicated, conceal pipes, ducts, and wiring within the construction. Coordinate locations of fixtures and outlets with finish elements.
- G. In locations where several elements of mechanical and electrical work must be sequenced and positioned with precision in order to fit into available space, prepare coordination drawings showing the actual conditions required for the installation. Prepare coordination drawings prior to purchasing, fabricating or installing any of the elements required to be coordinated.
- H. Closing up of walls, partitions or furred spaces, backfilling and other covering up operations shall not proceed until all enclosed or covered work and inspections have been completed. Verify before proceeding.

- I. Coordinate completion and clean up of Work of separate sections in preparation for Substantial Completion and for portions of Work designated for Owners partial occupancy.
- J. After Owner occupancy of premises, coordinate access to site for correction of defective Work and Work not in accordance with Contract Documents, to minimize disruption of Owner's activities.
- K. Coordinate all utility company work in accordance with the General Conditions.
- L. Coordinate field engineering with the provisions of Section 01 73 00.

1.4 PRECONSTRUCTION CONFERENCE

- A. Architect will schedule a conference immediately after receipt of fully executed contract documents prior to project mobilization.
- B. Mandatory Attendance: Owner, Owner's Resident Inspector, Owner's Testing Laboratory Representative, Architect, Contractor, Contractor's Project Manager and Contractor's Job Superintendent.
- C. Optional Attendance: Architect's consultants, subcontractors and utility company representatives.
- D. Architect will preside at conference, record minutes and distribute copies.
- E. Agenda:
 - 1. Execution of Owner-Contractor Agreement.
 - 2. Issue Notice to Proceed.
 - 3. Submission of executed bonds and insurance certificates.
 - 4. Distribution of Contract Documents.
 - 5. Federal and State labor law requirements applicable to Contract.
 - 6. Submission of list of Subcontractors, list of Products, schedule of values, and progress schedule.
 - 7. Designation of responsible personnel representing the parties.
 - 8. Procedures and processing of RFIs, field decisions, submittals, substitutions, applications for payments, proposal requests, Change Orders and Contract closeout procedures.
 - 9. Procedures for testing and inspection.
 - 10. Temporary facilities and controls.
 - 11. Procedures for moisture and mold control.
 - 12. Procedures for disruptions and shutdowns.
 - 13. Scheduling.
 - 14. Critical work sequence and long lead items.
 - 15. Work restrictions and working hours.
 - 16. Progress meetings.
 - 17. Use of site and premises.
 - 18. Storage.

19. Authorities having jurisdiction over project.
20. Owner occupancy requirements.
21. Commissioning.
22. Construction waste management.
23. SWPPP requirements.
24. Preparation of Record Drawings.
25. Security.
26. Parking availability.
27. Progress cleaning.

1.5 PROGRESS MEETINGS

- A. Architect will schedule and administer meetings throughout progress of the Work at maximum twice a month intervals.
- B. Architect will make arrangements for meetings, prepare agenda, preside at meetings, record minutes (Field Reports), and distribute copies.
- C. Attendance Required: Job superintendent, major Subcontractors and suppliers, Owner, Owner's Inspector, and Architect, as appropriate to agenda topics for each meeting.
- D. Agenda:
 1. Review minutes of previous meetings. (Field Reports)
 2. Review of Work progress.
 3. Field observations, problems, and decisions.
 4. Identification of problems which impede planned progress.
 5. Review of submittals schedule and status of submittals.
 6. Requests For Information (RFIs).
 7. Status of Proposal Requests (PRs).
 8. Status of Change Order Requests (CORs).
 9. Status of Change Orders (Cos).
 10. Status of corrective or deficient items.
 11. Review of off-site fabrication and delivery schedules.
 12. Maintenance of construction schedule.
 13. Corrective measures to regain projected schedules.
 14. Planned progress during succeeding work period.
 15. Coordination of projected progress.

16. Maintenance of quality and work standards.
17. Effect of proposed changes on progress schedule and coordination.
18. Temporary facilities and controls.
19. Progress cleaning.
20. Other business relating to Work.

1.6 REQUEST FOR INFORMATION (RFI'S)

- A. Procedure: Immediately on discovery of the need for additional information, interpretation of the Contract Documents, and if not possible to request interpretation at Progress Meeting, prepare and submit an RFI in the form specified.
 1. RFIs shall originate with Contractor. RFIs submitted by entities other than Contractor will be returned with no response.
 2. Coordinate and submit RFIs in a prompt manner so as to avoid delays in Contractor's work or work of subcontractors.
 3. Each RFI shall address only one subject matter.
- B. Content of the RFI: Include a detailed, legible description of item needing interpretation and the following:
 1. Date.
 2. Project name.
 3. Owner's name.
 4. Name of Contractor.
 5. Name of Architect.
 6. RFI number, numbered sequentially.
 7. Specification Section number and title and related paragraphs, as appropriate.
 8. Drawing number and detail references, as appropriate.
 9. Field dimensions and conditions, as appropriate.
 10. Contractor's suggested solution(s). If Contractor's solution(s) impact the Contract Time or the Contract Sum, Contractor shall state impact in the RFI.
 11. Contractor's signature.
 12. Attachments: Include drawings, descriptions, measurements, photos, Product Data, Shop Drawings, and other information necessary to fully describe items needing interpretation. Supplementary drawings prepared by Contractor shall include dimensions, thicknesses, structural grid references, and details of affected materials, assemblies, and attachments.
- C. Hard-Copy RFIs: Identify each page of attachments with the RFI number and sequential page number.
- D. Software-Generated RFIs: Software-generated form with substantially the same content as indicated above. Attachments shall be electronic files in a format that will allow electronic editing by the Architect.

- E. Architect's Action: Architect will review each RFI, determine action required, and return it. Allow fifteen days for Architect's response for each RFI. RFIs received after 1:00 p.m. will be considered as received the following working day. If the RFI is required to be forwarded to a consultant, subconsultant, or Owner for a response, the response time will be twenty five days.

1. The following RFIs will be returned without action:
 - (a) Requests for approval of submittals.
 - (b) Requests for approval of substitutions.
 - (c) Requests for information already indicated in the Contract Documents.
 - (d) Requests for coordination information which is the responsibility of the Contractor.
 - (e) Requests for adjustments in the Contract Time or the Contract Sum.
 - (f) Requests for interpretation of Architect's actions on submittals and substitutions.
 - (g) Incomplete RFIs or RFIs with numerous errors.
2. Architect's action may include a request for additional information, in which case Architect's allowable time for response will start again.
3. Architect's review of or response to RFIs shall not constitute an approval, direction, or procedure related to construction means, methods, techniques, sequences, or procedures of Contractor.
4. Architect's review of or response to RFIs shall not constitute an approval, direction, or procedure related to the construction site safety precautions, procedures or methodology of Contractor.
5. Architect's action on RFIs that may result in a change to the Contract Time or the Contract Sum may be eligible for Contractor to submit Change Order Request according to Division 01 Section 01 20 00 - Price and Payment Procedures.
 - (a) If Contractor believes the RFI response warrants change in the Contract Time or the Contract Sum, notify Architect in writing within five days of receipt of the RFI response.
 - (b) Under no circumstances is the Architect's review of or response to RFIs to be considered an authorization to depart from the Contract Documents or an authorization to perform extra work.

F. On receipt of Architect's action immediately distribute the RFI response to affected parties.

G. Review response and notify Architect within three days if Contractor disagrees with response.

1.7 PREINSTALLATION CONFERENCES

- A. When required in individual specification Section, convene a preinstallation conference prior to commencing work of the Section. Refer to individual specification section for timing requirements of conference.
- B. Require attendance of parties directly affecting, or affected by, work of the specific Section.
- C. Notify Architect a minimum of seven days in advance of meeting date.
- D. Preinstallation conference to coincide with regularly scheduled progress meeting.
- E. Prepare agenda, preside at conference, record minutes, and distribute copies within two days after conference to participants.
- F. Agenda:
 1. Review of Contract Documents.

2. Manufacturer's recommendations.
3. Status of submittals.
4. Related RFIs.
5. Related Change Orders.
6. Schedule of work activities.
7. Deliveries of materials and equipment.
8. Sequence of operation.
9. Acceptable substrates.
10. Interface requirements.
11. Possible conflicts.
12. Access.
13. Site utilization.
14. Tests and inspections.
15. Review of Mockups.
16. Temporary facilities and controls.
17. Quality and work standards.
18. Weather limitations.

G. Preinstallation Schedule:

1. Section 01 57 23 - Storm Water Pollution Prevention Plan
2. Section 01 74 19 - Construction Waste Management and Disposal
3. Section 03 30 00 - Cast-in-Place Concrete
4. Section 04 20 00 - Reinforced Unit Masonry System
5. Section 05 12 13 - Architecturally Exposed Structural Framing
6. Section 07 13 53 - Elastomeric Sheet Waterproofing
7. Section 07 42 13 - Aluminum Metal Plate Wall Panels
8. Section 07 54 23 - Thermoplastic-Polyolefin Roofing
9. Section 09 24 00 - Cement Plastering
10. Section 09 54 90 - Linear Plank Metal Ceiling System
11. Section 14 21 23 - Electric Traction Elevators - Passenger
12. Section 31 63 26 - Drilled Caissons

1.8 PROJECT CLOSEOUT CONFERENCE

- A. Architect will schedule a project closeout conference, at a time convenient to Owner and Contractor, but no later than 90 days prior to the scheduled date of Substantial Completion.
- B. Mandatory Attendance: Owner, Owner's Resident Inspector, Owner's Testing Laboratory, Architect, and Contractor.
- C. Architect will preside at conference, record minutes, and distribute copies.
- D. Refer to Section 01 77 00 for additional closeout requirements.
- E. Agenda: Discuss items of significance that could affect or delay Project closeout, including the following:
 - 1. Submittal procedures for closeout documents.
 - 2. Preparation of Record Documents.
 - 3. Procedures required prior to review for Substantial Completion and for final review for acceptance.
 - 4. Submittal of written warranties.
 - 5. Procedures for completing the Commissioning process.
 - 6. Requirements for preparing operations and maintenance data.
 - 7. Requirements for delivery of material samples, attic stock, and spare parts.
 - 8. Requirements for demonstration and training.
 - 9. Preparation of Contractor's punch list.
 - 10. Procedures for processing Applications for Payment at Substantial Completion and for final payment.
 - 11. Coordination of separate contracts.
 - 12. Owner's partial occupancy requirements.
 - 13. Installation of Owner's furniture, fixtures, and equipment.
 - 14. Responsibility for removing temporary facilities and controls.
 - 15. DSA closeout and certification process.

1.9 POST CONSTRUCTION DEDICATION

- A. Attendance Required: Project superintendent, project manager, major subcontractors, Owner and Architect.
- B. Preparation prior to Dedication:
 - 1. Assist Owner in operation of mechanical systems.
 - 2. Verify operation and adjust controls for communication systems.
 - 3. Assist Owner in operation of lighting systems.

2. PART 2 PRODUCTS

Not Used

3. PART 3 EXECUTION

Not Used

END OF SECTION

SECTION 01 32 16

CONSTRUCTION SCHEDULE - NETWORK ANALYSIS

1. PART 1 GENERAL

1.1 SECTION INCLUDES

- A. References.
- B. Performance requirements.
- C. Quality assurance.
- D. Qualifications.
- E. Project record documents.
- F. Submittals.
- G. Review and evaluation.
- H. Format.
- I. Cost and schedule reports.
- J. Early work schedule.
- K. Construction schedule.
- L. Short interval schedule.
- M. Requested time adjustment schedule.
- N. Recovery schedule.
- O. Updating schedules.
- P. Distribution.

1.2 REFERENCES

- A. Construction Planning and Scheduling Manual - A Manual for General Contractors and the Construction Industry, The Associated General Contractors of America (AGC).
- B. CSI - Construction Specifications Institute MP-2-1 Master Format.
- C. National Weather Service - Local Climatological Data.

1.3 PERFORMANCE REQUIREMENTS

- A. Ensure adequate scheduling during construction activities so work may be prosecuted in an orderly and expeditious manner within stipulated Contract Time.
- B. Ensure coordination of Contractor and subcontractors at all levels.
- C. Ensure coordination of submittals, fabrication, delivery, erection, installation, and testing of materials and equipment.
- D. Ensure on-time delivery of Owner furnished materials and equipment.

- E. Ensure coordination of jurisdictional reviews.
- F. Assist in preparation and evaluation of applications for payment.
- G. Assist in monitoring progress of work.
- H. Assist in evaluation of proposed changes to Contract Time.
- I. Assist in evaluation of proposed changes to Construction Schedule.
- J. Assist in detection of schedule delays and identification of corrective actions.

1.4 QUALITY ASSURANCE

- A. Perform work in accordance with Construction Planning and Scheduling Manual published by the AGC.
- B. Maintain one copy of document on site.
- C. In the event of discrepancy between the AGC publication and this section, provisions of this section shall govern.

1.5 QUALIFICATIONS

- A. Scheduler: Personnel or specialist consultant with 5 years minimum experience in scheduling construction work of a complexity and size comparable to this Project.
- B. Administrative Personnel: 5 years minimum experience in using and monitoring schedules on comparable projects.

1.6 PROJECT RECORD DOCUMENTS

- A. Submit record documents under provisions of Section 01 77 00.
- B. Submit one electronic file and three copies of final Record Construction Schedule which reflects actual construction of this Project.
- C. Record schedule shall be certified for compliance with actual way project was constructed.
- D. Receipt of Record Construction Schedule shall be a condition precedent to any retainage release or final payment.

1.7 SUBMITTALS

- A. Submit under provisions of Section 01 33 00.
- B. Within 7 days from the Notice of Award submit proposed Early Work Schedule and preliminary Cost Report defining activities for first 60 days of Work.
- C. Within 45 days from Notice of Award submit proposed Construction Schedule and final Cost Report.
- D. Submit updated Construction Schedule at least 10 days prior to each Application for Payment.
- E. Submit Short Interval Schedule at each Construction Progress Meeting.
- F. Submit Time Adjustment Schedule within 10 days of commencement of a claimed delay.
- G. Submit Recovery Schedules as required by completion of work.
- H. Submit one electronic file and three copies of each schedule and cost report.

1.8 REVIEW AND EVALUATION

- A. Early Work Schedule shall be reviewed during Preconstruction Conference with Owner and Architect.
- B. Within 5 days of receipt of Owner and Architect's comments provide satisfactory revision to Early Work Schedule or adequate justification for activities in question.
- C. Acceptance by Owner of corrected Early Work Schedule shall be a condition precedent to making any progress payments for first 60 days of Contract.
- D. Cost loaded values of Early Work Schedule shall be basis for determining progress payments during first 60 days of Contract.
- E. Participate in joint review of Construction Schedule and Reports with Owner and Architect.
- F. Within 7 days of receipt of Owner and Architect's comments provide satisfactory revision to Construction Schedule or adequate justification for activities in question.
- G. In the event that an activity or element of work is not detected by Owner or Architect review, such omission or error shall be corrected by next scheduled update and shall not affect Contract Time.
- H. Acceptance by Owner of corrected Construction Schedule shall be a condition precedent to making any progress payments after first 60 days of Contract.
- I. Cost-loaded values of Construction Schedule shall be basis for determining progress payments.
- J. Review and acceptance by Owner and Architect of Early Work Schedule or Construction Schedule does not constitute responsibility whatsoever for accuracy or feasibility of schedules nor does such acceptance expressly or impliedly warrant, acknowledge or admit reasonableness of activities, logic, duration, manpower, cost or equipment loading stated or implied on schedules.

1.9 FORMAT

- A. Prepare diagrams and supporting mathematical analyses using Precedence Diagramming Method, under concepts and methods outlined in AGC Construction Planning and Scheduling Manual.
- B. Listings: Reading from left to right, in ascending order for each activity.
- C. Diagram Size: 42 inches maximum height x width required.
- D. Scale and Spacing: To allow for legible notations and revisions.
- E. Illustrate order and interdependence of activities and sequence of work.
- F. Illustrate complete sequence of construction by activity.
- G. Provide legend of symbols and abbreviations used.

1.10 COST AND SCHEDULE REPORTS

- A. Activity Analysis: Tabulate each activity of network diagram and identify for each activity:
 - 1. Description.
 - 2. Interface with outside contractors or agencies.
 - 3. Number.
 - 4. Preceding and following number.
 - 5. Duration.

6. Earliest start date.
7. Earliest finish date.
8. Actual start date.
9. Actual finish date.
10. Latest start date.
11. Latest finish date.
12. Total and free float.
13. Identification of critical path activity.
14. Monetary value keyed to Schedule of Values.
15. Manpower requirements.
16. Responsibility.
17. Percentage complete.
18. Variance positive or negative.

B. Cost Report: Tabulate each activity of network diagram and identify for each activity:

1. Description.
2. Number.
3. Total cost.
4. Percentage complete.
5. Value prior to current period.
6. Value this period.
7. Value to date.

C. Required Sorts: List activities in sorts or groups:

1. By activity number.
2. By amount of float time in order of early start.
3. By responsibility in order of earliest start date.
4. In order of latest start dates.
5. In order of latest finish dates.
6. Application for payment sorted by Schedule of Values.
7. Listing of activities on critical path.
8. Listing of basic input data which generates schedule.

1.11 EARLY WORK SCHEDULE

- A. Shall establish scope of work to be performed during first 60 days of Contract.
- B. Shall designate critical path or paths.
- C. Shall contain the following phases and activities:
 - 1. Procurement activities to include mobilization, shop drawings and sample submittals.
 - 2. Identification of key and long-lead elements and realistic delivery dates.
 - 3. Construction activities in units of whole days limited to 14 days for each activity except non-construction activities for procurement and delivery.
 - 4. Approximate cost and duration of each activity.
- D. Shall contain seasonal weather considerations. Seasonal rainfall shall be 10 year average for the month as evidenced by Local Climatological Data obtained from U.S. National Weather Service.
- E. Activities shall be incorporated into Construction Schedule.
- F. No application for payment will be evaluated or processed until Early Work Schedule has been submitted and reviewed.
- G. Shall be updated on a monthly basis while Construction Schedule is being developed.
- H. Failure to submit an adequate or accurate Early Work Schedule or failure to submit on established dates will be considered a substantial breach of Contract.

1.12 CONSTRUCTION SCHEDULE

- A. Include Early Work Schedule as first 60 days of Construction Schedule.
- B. Shall be a computer generated time scaled network diagram of activities.
- C. Indicate a completion date for project that is no later than required completion date subject to any time extensions processed as part of a change order.
- D. Conform to mandatory dates specified in the Contract Documents.
- E. Should schedule indicate a completion date earlier than any required completion date, Owner or Architect shall not be liable for any costs should project be unable to be completed by such date.
- F. Seasonal weather shall be considered in planning and scheduling of all work. Seasonal rainfall shall be 10 year average for the month as evidenced by Local Climatological Data obtained from U.S. National Weather Service.
- G. Level of detail shall correspond to complexity of work involved.
- H. Indicate procurement activities, delivery, and installation of Owner furnished material and equipment.
- I. Designate critical path or paths.
- J. Subcontractor work at all levels shall be included in schedule.
- K. As developed shall show sequence and interdependence of activities required for complete performance of Work.
- L. Shall be logical and show a coordinated plan of Work.

- M. Show order of activities and major points of interface, including specific dates of completion.
- N. Duration of activities shall be coordinated with subcontractors and suppliers and shall be best estimate of time required.
- O. Shall show description, duration and float for each activity.
- P. Failure to include any activity shall not be an excuse for completing all work by required completion date.
- Q. No activity shall have a duration longer than 14 days or a value over \$20,000.00 except non-construction activities for procurement and delivery.
- R. An activity shall meet the following criteria:
 - 1. Any portion or element of work, action, or reaction that is precisely described, readily identifiable, and is a function of a logical sequential process.
 - 2. Descriptions shall be clear and concise. Beginning and end shall be readily verifiable. Starts and finishes shall be scheduled by logical restraints.
 - 3. Responsibility shall be identified with a single performing entity.
 - 4. Additional codes shall identify building, floor, bid item and CSI classification.
 - 5. Assigned dollar value (cost-loading) of each activity shall cumulatively equal total contract amount. Mobilization, bond and insurance costs shall be separate. General requirement costs, overhead, profit, shall be prorated throughout all activities. Activity costs shall correlate with Schedule of Values.
 - 6. Each activity shall have manpower-loading assigned.
 - 7. Major construction equipment shall be assigned to each activity.
 - 8. Activities labeled start, continue or completion are not allowed.
- S. For major equipment and materials show a sequence of activities including:
 - 1. Preparation of shop drawings and sample submissions.
 - 2. Review of shop drawings and samples.
 - 3. Finish and color selection.
 - 4. Fabrication and delivery.
 - 5. Erection or installation.
 - 6. Testing.
- T. Include a minimum of 15 days prior to completion date for punch lists and clean up. No other activities shall be scheduled during this period.

1.13 SHORT INTERVAL SCHEDULE

- A. Shall be fully developed horizontal bar-chart-type schedule directly derived from Construction Schedule.
- B. Prepare schedule on sheet of sufficient width to clearly show data.
- C. Provide continuous heavy vertical line identifying first day of week.
- D. Provide continuous subordinate vertical line identifying each day of week.

- E. Identify activities by same activity number and description as Construction Schedule.
- F. Show each activity in proper sequence.
- G. Indicate graphically sequences necessary for related activities.
- H. Indicate activities completed or in progress for previous 2 week period.
- I. Indicate activities scheduled for succeeding 2 week period.
- J. Further detail may be added if necessary to monitor schedule.

1.14 REQUESTED TIME ADJUSTMENT SCHEDULE

- A. Updated Construction Schedule shall not show a completion date later than the Contract Time, subject to any time extensions processed as part of a Change Order.
- B. If an extension of time is requested, a separate schedule entitled "Requested Time Adjustment Schedule" shall be submitted to Owner and Architect.
- C. Indicate requested adjustments in Contract Time which are due to changes or delays in completion of work.
- D. Extension request shall include forecast of project completion date and actual achievement of any dates listed in Agreement.
- E. To the extent that any requests are pending at time of any Construction Schedule update, Time Adjustment Schedule shall also be updated.
- F. Schedule shall be a time-scaled network analysis.
- G. Accompany schedule with formal written time extension request and detailed impact analysis justifying extension.
- H. Time impact analysis shall demonstrate time impact based upon date of delay, and status of construction at that time and event time computation of all affected activities. Event times shall be those as shown in latest Construction Schedule.
- I. Activity delays shall not automatically constitute an extension of Contract Time.
- J. Failure of subcontractors shall not be justification for an extension of time.
- K. Float is not for the exclusive use or benefit of any single party. Float time shall be apportioned according to needs of project.
- L. Float suppression techniques such as preferential sequencing, special lead/lag logic restraints, extended activity durations, or imposed dates shall be apportioned according to benefit of project.
- M. Extensions will be granted only to extent that time adjustments to activities exceed total positive float of the critical path and extends Contract completion date.
- N. Owner shall not have an obligation to consider any time extension request unless requirements of Contract Documents, and specifically, but not limited to these requirements are complied with.
- O. Owner shall not be responsible or liable for any construction acceleration due to failure of Owner to grant time extensions under Contract Documents should requested adjustments in Contract Time not substantially comply with submission and justification requirements of Contract for time extension requests.
- P. In the event a Requested Time Adjustment Schedule and Time Impact Analysis are not submitted within 10 days after commencement of a delay it is mutually agreed that delay does not require a Contract time extension.

1.15 RECOVERY SCHEDULE

- A. When activities are behind Construction Schedule a supplementary Recovery Schedule shall be submitted.
- B. Form and detail shall be sufficient to explain and display how activities will be rescheduled to regain compliance with Construction Schedule.
- C. Maximum duration shall be one month and shall coincide with payment period.
- D. Ten days prior to expiration of Recovery Schedule verification to determine if activities have regained compliance with Construction Schedule will be made. Based upon this verification the following will occur:
 - 1. Supplemental Recovery Schedule will be submitted to address subsequent payment period.
 - 2. Construction Schedule will be resumed.

1.16 UPDATING SCHEDULES

- A. Review and update schedule at least 10 days prior to submitting an Application for Payment.
- B. Maintain schedule to record actual prosecution and progress.
- C. Approved change orders which affect schedule shall be identified as separate new activities.
- D. Change orders of less than \$20,000.00 value or less than 3 days duration need not be shown unless critical path is affected.
- E. No other revisions shall be made to schedule unless authorized by Owner.
- F. Provide narrative Progress Report at time of schedule update which details the following:
 - 1. Activities or portions of activities completed during previous reporting period.
 - 2. Actual start dates for activities currently in progress.
 - 3. Deviations from critical path in days ahead or behind.
 - 4. List of major construction equipment used during reporting period and any equipment idle.
 - 5. Number of personnel by craft engaged on Work during reporting period.
 - 6. Progress analysis describing problem areas.
 - 7. Current and anticipated delay factors and their impact.
 - 8. Proposed corrective actions and logic revisions for Recovery Schedule.
 - 9. Proposed modifications, additions, deletions and changes in logic of Construction Schedule.
- G. Schedule update will form basis upon which progress payments will be made.
- H. Owner will not be obligated to review or process Application for Payment until schedule and Progress Report have been submitted.

1.17 DISTRIBUTION

- A. Following joint review and acceptance of updated schedules distribute copies to Owner, Architect, and all other concerned parties.
- B. Instruct recipients to promptly report in writing any problem anticipated by projections shown in schedule.

2. PART 2 PRODUCTS

Not Used

3. PART 3 EXECUTION

Not Used

END OF SECTION

SECTION 01 33 00

SUBMITTAL PROCEDURES

1. PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Related submittals.
- B. Architect's digital data files.
- C. Proposed products list.
- D. Processing time.
- E. Submittal review.
- F. Submittal procedures - electronic submittals.
- G. Shop drawings - electronic submittals.
- H. Product data.
- I. Samples.
- J. Manufacturers' instructions.
- K. Manufacturers' certificates.
- L. Deferred approval requirements.
- M. Submittal schedule.

1.2 RELATED SUBMITTALS

- A. Progress Payments: Section 01 20 00 - Price and Payment Procedures.
- B. Schedule of Values: Section 01 20 00 - Price and Payment Procedures.
- C. Substitutions: Section 01 25 13 – Product Substitution Procedures.
- D. Coordination Drawings: Section 01 31 00 - Project Management and Coordination.
- E. Construction Schedule: Section 01 32 16 - Construction Schedule - Network Analysis.
- F. Tests and Inspections: Section 01 45 29 – Testing Laboratory Services.
- G. Certified Final Property Survey: Section 01 73 00 – Execution Requirements.
- H. Waste Reduction Progress Reports: Section 01 74 19 - Construction Waste Management and Disposal.
- I. Closeout Procedures: Section 01 77 00 – Closeout Procedures.
- J. Commissioning Submittals: Section 01 91 13 - General Commissioning Requirements.
- K. The General Conditions set forth additional requirements for submittals.

1.3 ARCHITECT'S DIGITAL DATA FILES

- A. Upon written request, Architect's electronic CAD files will be provided for use in connection with preparation of shop drawings subject to the acceptance of the Architect's standard terms and conditions for electronic file transfer. A service fee of \$50.00 per drawing shall be remitted to Architect prior to release of electronic files.

1.4 PROPOSED PRODUCTS LIST

- A. Within fourteen days after date of Notice to Proceed, submit complete list of major products proposed for use, with name of manufacturer, trade name, model number, and designated specification section of each product.
- B. For products specified only by reference standards, give manufacturer, trade name, model or catalog designation, and reference standards.

1.5 PROCESSING TIME

- A. Time period for review of submittals will commence upon receipt of submittal by Architect.
- B. Initial Review: Allow ten working days for each submittal.
- C. Resubmittal Review: Allow ten working days for each resubmittal.
- D. Sequential Review: Allow fifteen working days for initial and resubmittal review of each submittal where review is required by Architect's consultant's, Owner or other parties indicated.
- E. Deferred Approval Review: Allow a minimum of ninety calendar days for each submittal and any subsequent resubmittal review by the Division of The State Architect.

1.6 SUBMITTAL REVIEW

- A. The Architect's review is only for general conformance with design concept and Contract requirements. Contractor is responsible for compliance with Contract Documents, dimensions, quantities, fit and coordination with other Work. Review does not authorize substitutions, exclusions and limitations to Contract requirements unless specifically requested by Contractor and acknowledged by Architect.
- B. Definitions for submittal review:
 - 1. Review Completed - Do Not Resubmit: The Work covered by the submittal has been reviewed by the Architect and may proceed provided it complies with the Contract Documents. Final acceptance will depend on that compliance.
 - 2. Revise as Noted - Do Not Resubmit: The Work covered by the submittal has been reviewed by the Architect and may proceed provided it complies both with Architect's notations and corrections on the submittal and the Contract Documents. Final acceptance will depend on that compliance.
 - 3. Revise as Noted - Resubmit for Record: The Work covered by the submittal has been reviewed by the Architect and the submittal is to be revised according to the Architect's notations and corrections and a new submittal is to be made. Do not proceed with the Work covered by the submittal. Once the revised submittal is received it will be reviewed again by the Architect and retained as the record submittal. Once reviewed, the Work may proceed provided it complies with the Contract Documents. Final acceptance will depend on that compliance.
 - 4. Not Acceptable - Make New Submittal: Do not proceed with the Work covered by the submittal. Prepare a new submittal that complies with the Contract Documents. Once the revised submittal is received it will be reviewed again by the Architect. Once reviewed, the Work may proceed provided it complies with the Contract Documents. Final acceptance will depend on that compliance.
 - 5. Comment Box / Line: This line is for the Architect to take other action as may be appropriate for the actual submittal made. Notations may include a request for additional items or a statement regarding the submittal. This area can also be used in conjunction with other boxes that have been marked.

1.7 SUBMITTAL PROCEDURES - PAPER SUBMITTALS

- A. Transmit each submittal in conformance with requirements of this section.
- B. Sequentially number the transmittal forms. Resubmittals to have original number with an alphanumeric suffix.
- C. Identify Project and Architect's project number, Contractor, Subcontractor or supplier; pertinent Drawing and detail number(s), and specification Section number, as appropriate.
- D. Apply Contractor's stamp, signed or initialed certifying that review, verification of Products required, field dimensions, adjacent construction Work, and coordination of information is in accordance with the requirements of the Work and Contract Documents. Submittals without Contractor's stamp and signature will be returned without review.
- E. Schedule submittals to expedite the Project, and deliver to Architect at 8163 Rochester Avenue, Suite 100, Rancho Cucamonga, CA 91730. Coordinate submission of related items.
- F. Make submittals in groups containing associated and related items to make sure that information is available for checking each item when it is received.
- G. Submittals for all items requiring color selection must be received before any will be selected.
- H. Architect reserves the right to withhold action on a submittal requiring coordination with other submittals until all related submittals are received.
- I. Make submittals in advance of scheduled dates for installation to allow specified time for review, revisions, and resubmission prior to final review and subsequent placement of orders.
- J. No extension of Contract Time will be authorized because of failure to transmit submittals to the Architect sufficiently in advance of the Work to permit proper processing.
- K. Identify variations from Contract Documents and Product or system limitations which may be detrimental to successful performance of the completed Work.
- L. Provide space for Contractor and Architect review stamps.
- M. Revise and resubmit submittals as required, identify all changes made since previous submittal.
- N. Distribute copies of reviewed submittals to concerned parties. Instruct parties to promptly report any inability to comply with provisions.
- O. Partial submittals will be considered non responsive and will be returned without review.
- P. Submittals not requested will not be recognized or processed. Submittals not requested will be returned without review.
- Q. Architect will not review submittals that contain material safety data sheets (MSDS) and will return them for resubmittal.
- R. Substitutions will not be considered when they are indicated or implied on submittals without separate written request as required by provisions of Section 01 25 13 - Product Substitution Procedures.

1.8 SUBMITTAL PROCEDURES - ELECTRONIC SUBMITTALS

- A. Transmit each electronic submittal in conformance with requirements of this section.
- B. Submittals for all items requiring color selections will not be accepted as an electronic submittal.
- C. Assemble complete submittal package into a single indexed Portable Document Format (PDF) file. File format licensed by Adobe Systems.

- D. Transmit electronic submittals as PDF files via Architect's Project Collaboration Site address or designated email address.
- E. Transmittal form for submittals shall be an electronic form acceptable to the Architect which identifies the Project, the Architect's project number, the Contractor, the Subcontractor or material supplier; pertinent Drawing and detail number(s), and specification Sections, as appropriate.
- F. Provide links enabling navigation to each item of submittal package.
- G. Name electronic submittal file with consistent project identifier composed of Architect's project number, Architect's alpha numeric file designation, and specification section number followed by sequential number. (e.g., 1930700-56-SUB - 064116-01.pdf)
- H. Resubmittals shall include an alphabetic suffix after initial point number. (e.g., 1930700-56-SUB – 064116-01-A.pdf)
- I. Resubmittals shall identify all changes made since previous submittal.
- J. Insert Contractor's review stamp to permanently record Contractor's action.
- K. Contractor's stamp shall be signed or initialed certifying that review, verification of Products required, field dimensions, adjacent work, and coordination of information is in accordance with the requirements of the Work and Contract Documents.
- L. Submittals without Contractor's stamp and signature will be returned without review.
- M. Provide space for Architect's electronic review stamp.
- N. Architect reserves the right to withhold action on a submittal requiring coordination with other submittals until all related submittals are received.
- O. Make submittals in advance of scheduled dates for installation to allow specified time for review, revisions, and resubmission prior to final review and subsequent placement of orders.
- P. No extension of Contract Time will be authorized because of failure to transmit submittals to the Architect sufficiently in advance of the Work to permit proper processing.
- Q. Identify variations from Contract Documents and Product or system limitations which may be detrimental to successful performance of the completed Work.
- R. Contractor shall reproduce and distribute copies of reviewed submittals to concerned parties. Instruct parties to promptly report any inability to comply with provisions.
- S. Partial submittals will be considered non responsive and will be returned without review.
- T. Submittals not requested will not be recognized or processed. Submittals not requested will be returned without review.
- U. Architect will not review submittals that contain material data safety sheets (MSDS) and will return them for resubmittal.
- V. Substitutions will not be considered when they are indicated or implied on submittals without separate written request as required by provisions of Section 01 25 13 - Product Substitution Procedures.

1.9 SHOP DRAWINGS - ELECTRONIC SUBMITTALS

- A. Submit electronic copy of shop drawings in PDF format as specified in this section.
- B. Review comments will be indicated on reviewed document.
- C. After review, distribute in accordance with article on procedures stated above and provide copies for Record Documents described in Section 01 77 00 - Closeout Procedures.

- D. Do not reproduce Contract Documents or copy standard information and submit as shop drawings.
- E. Standard information prepared without specific reference to project requirements will not be considered a shop drawing.
- F. Do not use or allow others to use shop drawings which have been submitted and have been rejected.

1.10 PRODUCT DATA

- A. When specified in individual specification sections, submit copies of data for each product which Contractor requires.
- B. Electronic submittals for product data will comply with Article for electronic submittal procedures stated in this section.
- C. Mark each copy to identify applicable products, models, options, and other data. Supplement manufacturer's standard data to provide information unique to this Project.
- D. Manufacturer's standard product data or catalogs that do not indicate materials or products that are specific to project will be returned without review.
- E. After review, distribute in accordance with article on procedures stated above and provide copies for Record Documents described in Section 01 77 00 - Closeout Procedures.

1.11 SAMPLES

- A. Submit samples to illustrate functional and aesthetic characteristics of the Product, with integral parts and attachment devices. Coordinate sample submittals for interfacing work.
- B. Include identification on each sample, with full Project information.
- C. Submit the number of samples which Contractor requires, plus two which will be retained by Architect.
- D. Reviewed samples which may be used in the Work are indicated in individual specification Sections.
- E. Submittals for all items requiring color selection must be received before any will be selected.
- F. If a variation in color, pattern, texture or other characteristic is inherent within the material or product submitted, sample shall approximate limits of variation.

1.12 MANUFACTURER'S INSTRUCTIONS

- A. When specified in individual specification Sections, submit manufacturer's printed instructions for delivery, storage, assembly, installation, start-up, adjusting, and finishing, in quantities specified for Product Data.
- B. Identify conflicts between manufacturer's instructions and Contract Documents.

1.13 MANUFACTURER'S CERTIFICATES

- A. When specified in individual specification Sections, submit manufacturer's certificate to Architect for review, in quantities specified for Product Data.
- B. Indicate material or Product conforms to or exceeds specified requirements. Submit supporting reference date, affidavits, and certifications as appropriate.
- C. Certificates may be recent or previous test results on material or Product, but must be acceptable to Architect.

1.14 DEFERRED APPROVAL REQUIREMENTS

- A. Installation of deferred approval items shall not be started until detailed plans, specifications, and engineering calculations have been accepted and signed by the Architect or Engineer in general responsible charge of design and signed by a California registered Architect or professional engineer who has been delegated responsibility covering the work shown on a particular plan or specification and approved by the Division of the State Architect. Deferred approval items for this project are the following items:
 - 1. Telescopic Bleachers - Section 12 66 13.
 - 2. Gymnasium Equipment - Section 11 66 23.
 - 3. Open Web Steel Joists.
 - 4. Elevator Guide Rails.
- B. Deferred approval drawings and specifications become part of the approved documents for the project when they are submitted to and approved by the Division of the State Architect.
- C. Deferred approval items shall be submitted no later than 60 days after Notice to Proceed.
- D. Submit four prints of each drawing.
- E. Submit four copies of calculations, product data and test reports.
- F. Identify and specify all supports, fasteners, spacing, penetrations, etc., for each of the deferred approval items, including calculations for each and all fasteners.
- G. Submit documents to Architect for review.
- H. Documents shall bear the stamp and signature of the Structural, Mechanical, or Electrical Engineer licensed in the State of California who is responsible for the work shown on the documents.
- I. Architect will forward submittal to project Structural, Mechanical, and Electrical Engineer.
- J. Review of project Architect, Structural, Mechanical, and Electrical Engineer is only for conformance with design concept shown on the documents.
- K. After review by Architect/Engineer, Architect will forward two copies of submittal to the Division of the State Architect for approval.
- L. Respond to review comments made by the Division of the State Architect and revise and resubmit submittal for final approval.
- M. Architect will forward two copies of final revised submittal to the Division of the State Architect for approval.
- N. The Division of the State Architect will return one copy of final submittal to the Architect.
- O. Architect will forward one copy of evidence of submittal approval by the Division of the State Architect for final distribution by the Contractor.

2. PART 2 PRODUCTS

Not Used

3. PART 3 EXECUTION

- 3.1 Provide submittals as indicated in individual specification sections.

END OF SECTION

SECTION 01 42 19

REFERENCE STANDARDS

1. PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Definitions.
- B. Specification format and content.
- C. Industry standards.
- D. Codes and standards.
- E. Governing regulations/authorities.

1.2 DEFINITIONS

- A. General: Basic contract definitions are included in the General Conditions.
- B. Regulations: Includes laws, ordinances, statutes, and lawful orders issued by authorities having jurisdiction, as well as rules, conventions, and agreements within the construction industry that control performance of the work.

1.3 SPECIFICATION FORMAT AND CONTENT

- A. Specifications are organized into Divisions and Sections based on the Construction Specifications Institute's 50-Division Master Format 2018 numbering system.
- B. The sections are placed in the Project Manual in numeric sequence; however, this sequence is not complete and the Table of Contents of the specifications must be consulted to determine the total listing of sections.
- C. The section title is not intended to limit the meaning or content of the section, nor to be fully descriptive of the requirements specified therein.
- D. The organization of the specifications shall not control the division of the work among subcontractors or establish the extent of work to be performed by any trade.
- E. Specifications use certain conventions regarding style of language and the intended meaning of certain terms, words, and phrases when used in particular situations or circumstances. These conventions are:
 - 1. Language used in Specifications and other Contract Documents is abbreviated. Words and meanings shall be interpreted as appropriate. Words that are implied, but not stated, shall be interpolated as the sense requires. Singular words shall be interpreted as plural and plural words interpreted as singular where applicable to maintain the context of the Contract Document indicated.
 - 2. Imperative and streamlined language is generally used in the Specifications. Requirements expressed in the imperative mood are to be performed by the Contractor. Subjective language is used for clarity to describe responsibilities that must be fulfilled indirectly by the Contractor, or by others when so noted.
 - 3. The words "shall be" are implied wherever a colon (:) is used within a sentence or phrase.

1.4 INDUSTRY STANDARDS

- A. Except where Contract Documents include more stringent requirements, applicable construction industry standards shall apply as if bound into the Contract Documents to the extent referenced. Such standards are made part of Contract Documents by reference.
- B. Conform to reference standard by date of issue current on date for receiving bids except when a specific date is indicated.
- C. Where compliance with 2 or more standards is specified and where standards may establish different or conflicting requirements for quantities or quality levels, the more stringent, higher quality and greater quantity of work shall apply.
- D. The quantity or quality level shown or specified shall be the minimum provided or performed. Indicated numeric values are minimum or maximum, as appropriate, for the context of the requirements.
- E. Each entity engaged in construction of the work is required to be familiar with industry standards applicable to its construction activity.
- F. Copies of applicable standards are not bound with the Contract Documents. Where copies of standards are needed to perform a required activity, Contractor shall obtain copies directly from publication source.
- G. Trade associations names and titles of general standards are frequently abbreviated. Where such abbreviations are used in the Specifications or other Contract Documents, they shall mean the recognized trade association, standards-generating organization, authority having jurisdiction, or other entity applicable to the content of the text provision. Refer to the "Encyclopedia of Associations", published by Gale Research Co., available in most libraries.
- H. Refer to individual specification sections and related drawings for names and abbreviations of trade associations and standards applicable to specific portions of the work. In particular, refer to Division 23 for names and abbreviations applicable to mechanical work, and refer to Division 26 for names and abbreviations applicable to electrical work.
- I. The contractual relationship of the parties to the Contract shall not be altered from the Contract Documents by mention or inference otherwise in any reference document.

1.5 CODES AND STANDARDS

- A. Latest edition of pertaining ordinances, laws, rules, codes, regulations, standards, and others of public agencies having jurisdiction of the work are intended wherever reference is made in either the singular or plural to Code or Building Code except as otherwise specified, including but not limited to latest edition of those in the following listing.
 - 1. 2016 California Building Standards Administrative Code (CBSAC), California Code of Regulations (CCR), Title 24, Part 1
 - 2. 2016 California Building Code (CBC) California Code of Regulations (CCR) Title 24, Part 2 (2015 International Building Code (IBC) with California amendments)
 - 3. 2016 California Electrical Code (CEC) California Code of Regulations (CCR) Title 24, Part 3 (2014 National Electric Code (NEC) with California amendments)
 - 4. 2016 California Mechanical Code (CMC) California Code of Regulations (CCR) Title 24, Part 4 (2015 Uniform Mechanical Code (UMC) with California amendments)
 - 5. 2016 California Plumbing Code (CPC) California Code of Regulations (CCR) Title 24, Part 5 (2015 Uniform Plumbing Code (UPC) with California amendments)
 - 6. 2016 California Energy Code, California Code of Regulations (CCR) Title 24, Part 6

7. 2016 California Fire Code (CFC) California Code of Regulations (CCR) Title 24, Part 9 (2015 International Fire Code (IFC) with California Amendments)
8. 1990 State Fire Marshal Regulations California Code of Regulations (CCR) Title 19 (As amended to date)
9. 2016 State Referenced Standards Code (CRSC) California Code of Regulations (CCR) Title 24, Part 12
10. California Elevator Safety Code, California Code of Regulations (CCR) Title 8. (As amended to date)
11. 2010 Americans with Disabilities Act (ADA) Standards for Accessible Design. (ADAS)

1.6 GOVERNING REGULATIONS/AUTHORITIES

- A. Authorities having jurisdiction have been contacted where necessary to obtain information for preparation of Contract Documents. Contact authorities having jurisdiction directly for information having a bearing on the work.
- B. Comply with all federal, state and local laws, ordinances, rules and regulations indicated and which bear on the conduct of the work.

2. PART 2 PRODUCTS

Not Used

3. PART 3 EXECUTION

Not Used

END OF SECTION

SECTION 01 43 00

QUALITY ASSURANCE

1. PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Interpretation of requirements.
- B. Quality assurance and control of installation.
- C. Tolerances.
- D. Field samples.
- E. Mock-up.
- F. Manufacturers' field services and reports.

1.2 INTERPRETATION OF REQUIREMENTS

- A. If compliance with two or more standards is specified and the standards establish different or conflicting requirements for minimum quantities or quality levels, comply with the most stringent requirement.
- B. The quantity or quality level shown or specified shall be the minimum provided or performed. The actual installation shall comply exactly with the minimum quantity or quality specified, or it may exceed the minimum within reasonable limits.
- C. Where codes or specified standards indicate higher standards, more stringent tolerances or more precise workmanship than levels shown or specified, comply with most stringent requirements.
- D. Refer uncertainties and requirements that are different, but apparently equal, to Architect for a decision before proceeding.

1.3 QUALITY ASSURANCE/CONTROL OF INSTALLATION

- A. Installer Qualifications: A firm or individual experienced in installing, erecting, or assembling work similar in material, design, and extent to that indicated for this project, whose work has resulted in construction with a record of successful in-service performance.
- B. Manufacturer Qualifications: A firm experienced in manufacturing products or systems similar to those indicated for this project and with a record of successful in-service performance, as well as sufficient production capacity to produce required units.
- C. Fabricator Qualifications: A firm experienced in producing products similar to those indicated for this project and with a record of successful in-service performance, as well as sufficient production capacity to produce required units.
- D. Coordination: Coordinate sequence of activities to accommodate required quality-assurance and - control services with a minimum of delay and to avoid necessity of removing and replacing construction to accommodate testing and inspecting.
- E. Monitor quality control over suppliers, manufacturers, products, services, site conditions, and workmanship, to produce Work of specified quality.
- F. Comply fully with manufacturers' instructions, including each step in sequence.
- G. Should manufacturers' instructions conflict with Contract Documents, request clarification from Architect before proceeding.

- H. Secure Products in place with positive anchorage devices designed and sized to withstand stresses, vibration, physical distortion or disfigurement.

1.4 TOLERANCES

- A. Monitor tolerance control of installed products to produce acceptable Work. Do not permit tolerances to accumulate.
- B. Comply with manufacturer's tolerances. Should manufacturer's tolerance conflict with Contract Documents, request clarification from Architect before proceeding.
- C. Adjust products to appropriate dimensions; position before securing products in place.

1.5 FIELD SAMPLES

- A. Install field samples at the site as required by individual specifications sections for review.
- B. Acceptable samples represent a quality level for the Work.
- C. Where field sample is specified in individual sections to be removed, clear area after field sample has been reviewed by Architect.

1.6 MOCK-UP

- A. Mock-up will be performed under provisions identified in this section and identified in the respective product specification sections.
- B. Assemble and erect specified items, with specified attachment and anchorage devices, flashings, seals and finishes.
- C. Maintain mockups during construction in an undisturbed condition as a standard for judging the completed Work.
- D. Where mock-up is specified in individual Sections to be removed, clear area after mock-up has been reviewed by Architect.

1.7 MANUFACTURERS' FIELD SERVICES AND REPORTS

- A. When specified in individual specification sections, require material or product suppliers or manufacturers to provide qualified staff personnel to observe site conditions, conditions of surfaces and installation, quality of workmanship, start-up of equipment, test, adjust, and balance of equipment and other field services as applicable, and to initiate instructions when necessary.
- B. Individuals to report observations and site decisions or instructions given to applicators or installers that are supplemental or contrary to manufacturers' written instructions.
- C. Submit report in duplicate within 15 days of observation to Architect for review.

2. PART 2 PRODUCTS

Not Used

3. PART 3 EXECUTION

3.1 GENERAL INSTALLATION

- A. Comply with requirements specified in Section 01 73 00.

3.2 EXAMINATION

- A. Verify that existing site conditions and substrate surfaces are acceptable for subsequent Work. Beginning new Work means acceptance of existing conditions.

- B. Verify that existing substrate is capable of structural support or attachment of new Work being applied or attached.
- C. Examine and verify specific conditions described in individual specification sections.
- D. Verify that utility services are available, of the correct characteristics, and in the correct locations.

3.3 PREPARATION

- A. Clean substrate surfaces prior to applying next material or substance.
- B. Seal cracks or openings of substrate prior to applying next material or substance.
- C. Apply manufacturer required or recommended substrate primer, sealer, or conditioner prior to applying any new material or substance in contact or bond.

END OF SECTION

SECTION 01 45 29

TESTING LABORATORY SERVICES

1. PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Selection and payment.
- B. Contractor submittals.
- C. Laboratory responsibilities.
- D. Laboratory reports.
- E. Limits on testing laboratory authority.
- F. Contractor responsibilities.
- G. Schedule of inspections and tests.
- H. Test and inspection form.

1.2 REFERENCES

- A. ASTM C140 - Standard Test Methods for Sampling and Testing Concrete Masonry Units and Related Units.
- B. ASTM D3740 - Practice for Evaluation of Agencies Engaged in Testing and/or Inspection of Soil and Rock as Used in Engineering Design and Construction.
- C. ASTM E329 - Recommended Practice for Inspection and Testing Agencies for Concrete, Steel, and Bituminous Materials as Used in Construction.
- D. CBC - California Building Code, Title 24, Part 2 of the California Code of Regulations (CCR).
- E. DSA - Division of the State Architect, Office of Regulation Services, Structural Safety Section.
- F. IR - Interpretation of Regulation Documents, Division of the State Architect.

1.3 SELECTION AND PAYMENT

- A. Owner will employ and pay for services of an independent testing laboratory to perform specified inspection and testing as specified by Owner's testing laboratory.
- B. Owner will pay cost of testing and inspection except the following for which the Contractor shall reimburse the Owner through deductive change order:
 - 1. Any retesting and sampling required due to failure of original test.
 - 2. Any testing and inspection required to be performed that requires testing laboratory or agency to perform services outside the state of California.
 - 3. Concrete design mix.
 - 4. Additional testing expenses caused by failure of the Contractor to adhere to construction schedule or caused by failure of the Contractor to give proper advanced notice or caused by Contractor delay.
- C. Contractor shall employ and pay for services required to perform specified inspection and testing specified as Contractor responsibility.

- D. Employment of testing laboratory shall in no way relieve Contractor of obligation to perform work in accordance with requirements of Contract Documents.

1.4 QUALITY ASSURANCE

- A. Comply with requirements of ASTM E329 and ASTM D3740.
- B. Laboratory Staff: Maintain a full time registered engineer on staff to review services.
- C. Testing Equipment: Capable of performing tests required calibrated at reasonable intervals with devices acceptable to the National Bureau of Standards.
- D. All testing agency management, laboratory, and field supervisory personnel shall have at least five years experience in the inspection and testing of work and materials of construction.
- E. Testing laboratory shall maintain a current letter of acceptance issued by the Division of the State Architect (DSA) demonstrating that it has met the criteria established by the Division of the State Architect for performance of inspection work and testing of materials. Laboratory to furnish copy of acceptance letter upon request.

1.5 OWNER'S TESTING LABORATORY RESPONSIBILITIES

- A. Test samples of mixes submitted by Inspector.
- B. Provide qualified personnel at site. Cooperate with Architect and Contractor in performance of services.
- C. Perform specified inspection, sampling, and testing of products in accordance with specified standards.
- D. Ascertain compliance of materials and mixes with requirements of Contract Documents.
- E. Promptly notify Architect and Contractor of observed irregularities or non-conformance of Work or products.
- F. Perform additional inspections and tests required by Architect.
- G. Attend preconstruction conferences and progress meetings when requested by Architect.

1.6 LABORATORY REPORTS

- A. After each inspection and test, promptly submit within no more than 14 days of the date of the inspection or test one copy of laboratory report to Architect, Engineer, Owner's Resident Inspector, Division of the State Architect and to Contractor. Reports of test results of materials and inspections found not to be in compliance with the requirements of the Contract Documents shall be forwarded immediately to the Architect, Engineer, Owner's Resident Inspector, Division of the State Architect and the Contractor.
- B. Include:
 - 1. Date issued.
 - 2. Project title and number.
 - 3. Name of inspector.
 - 4. Date and time of sampling or inspection.
 - 5. Identification of product and Specifications section.
 - 6. Location in the Project.
 - 7. Type of inspection or test.
 - 8. Date of test.

9. Ambient conditions at time of test or sample-taking.
10. Results of tests and interpretation of test results.
11. Professional opinion as to whether tested work is in conformance with Contract Documents.
12. Recommendations on retesting.

- C. Verification of Test Reports: Each testing agency shall submit to the Architect and the Division of the State Architect a verified report in duplicate covering all of the tests which were required to be made by that agency during the progress of the project. Such report shall be furnished each time that work on the project is suspended, covering the tests up to that time and at the completion of the project, covering all tests.

1.7 LIMITS ON TESTING LABORATORY AUTHORITY

- A. Laboratory may not release, revoke, alter, or enlarge on requirements of Contract Documents.
- B. Laboratory may not approve or accept any portion of the Work.
- C. Laboratory may not assume any duties of Contractor.
- D. Laboratory has no authority to stop the Work.

1.8 CONTRACTOR RESPONSIBILITIES

- A. Submit proposed mix designs to Architect for review in accordance with Section 03 30 00.
- B. Cooperate with laboratory personnel, and provide access to the Work and to manufacturer's facilities.
- C. Notify Architect, Owner's Resident Inspector and testing laboratory 48 hours prior to expected time for operations requiring inspection and testing services.
 1. When tests or inspections cannot be performed after such notice, reimburse Owner for laboratory personnel and travel expenses incurred due to the Contractor's negligence.
 2. The Contractor shall notify the Owner's representative a sufficient time in advance of the manufacture of material to be supplied by him under the Contract Documents, which must by terms of the Contract be tested, in order that the Owner may arrange for the testing of same at the source of supply.
 3. Any material shipped by the Contractor from the source of supply prior to having satisfactorily passed such testing and inspection or prior to the receipt of notice from said representative that such testing and inspection will not be required shall not be incorporated in the job.
- D. Employ and pay for services of Owner's testing laboratory to perform additional inspections, sampling and testing required when initial tests indicate work does not comply with contract documents.

1.9 SCHEDULE OF INSPECTIONS AND TESTS BY OWNER'S TESTING LABORATORY

- A. Perform tests and inspections for the following in conformance with the (CBC) California Building Code (International Building Code with State of California Amendments), Title 24, Part 2, of the California Code of Regulations (CCR).
 1. Structural Tests and Special Inspections
 - (a) General - 1701A
 - (b) Approvals - 1703A
 - (c) Special Inspections - 1704A
 - (1) Structural Steel - 1705A.2 and Table 1705A.2.1

- (2) Welding - 1705A.2.5 and Table 1705A.2.1.
- (3) High Strength Fasteners - 1705A.2.6 and Table 1705A.2.1
- (4) Concrete - 1705A.3 Table 1705A.3 and 1910A
- (5) Masonry - 1705A.4, TMS 402 and TMS 602 Table 3 and 4
- (6) Wood - 1705A.5
- (7) Soils - 1705A.6 and Table 1705A.6
- (8) Pile Foundation - 1705A.7 and Table 1705A.7
- (9) Pier Foundation - 1705A.8 and Table 1705A.8
- (10) Exterior Insulation and Finish Systems - 1705A.16
- (11) Water-Resistive Barrier - 1705A.16.1
- (12) Penetration Fire Stops and Joints - 1705A.17
- (13) Smoke Control Systems - 1705A.18
- (d) Special Inspections for Seismic Resistance - Section 1705A.12
 - (1) Structural Steel - Continuous Inspection, Welding - 1705A.12.1, 1705A.2.1, 1705A.2.5
 - (2) Cold-Formed Steel Framing - Periodic Inspection- 1705A.11.2 and 1705A.12.3
 - (3) Storage Racks and Access Floors - Periodic Inspection - 1705A.12.7
 - (4) Architectural Components - Periodic Inspection - 1705A.12.5
 - (5) Mechanical and Electrical Components - Periodic Inspection - 1705A.12.6
 - (6) Designated Seismic Systems - Verification - 1705A.13.3
- 2. Foundations (Chapter 18A)
 - (a) Earth fill compaction - 1803A.5.8
 - (b) Observation of Driven Pile Installation - 1705A.7.1
 - (c) Observation of Caissons - Table 1705A.8
- 3. Concrete (Chapter 19A)
 - (a) Concrete Inspection
 - (1) Portland Cement Tests - 1910A.1
 - (2) Reinforcing Bars Table - 1705A.2.1, 1910A.2
 - (3) Batch Plant Inspection - 1705A.3.3
 - (4) Frequency of Tests for Concrete - 1905A.1.15
 - (b) Concrete Quality
 - (1) Proportions of Concrete - 1903A, 1904A, 1905A

- (c) Job Site Inspection
 - (1) Site Placement Inspection - 1705A.3.5
- (d) Anchors in Concrete
 - (1) Drilled-In-Expansion Bolts or Epoxy-Type Anchors in Concrete - 1910A.5
- 4. Masonry (Chapter 21A)
 - (a) Materials
 - (1) Masonry Units - 2103A.1
 - (2) Mortar - 2103A.2
 - (3) Grout - 2103A.3
 - (4) Grout Aggregates - 2103A.3.1
 - (5) Reinforcing Bars - 2103A.4
 - (b) Masonry Tests
 - (1) General - 2105A.1, 1705A.4, TMS 402 and TMS 602, Table 3 and 4
 - (2) Masonry Tests - 2105A.2
 - (3) Mortar and Grout - 2105A.3
 - (4) Masonry Core Tests - 2105A.4
 - (5) Mason Prism Test - 2105A.5
 - (6) Unit Strength Test - 2105A.6
- 5. Structural Steel (Chapter 22A)
 - (a) Materials
 - (1) Material Identification - 2202A
 - a) Anchor Bolt - DSA IR 17-11
 - (2) Inspection and Tests of Structural Steel 1705A.2
 - (3) Tests of H.S. Bolts, Nuts, Washers - 2213A.1
 - (4) Tests of End Welded Studs - 2213A.2
 - (5) Steel Joist Tests - 1705A.2.3 and Table 1705A.2.3
 - (6) Shop Fabrication Inspection - 1704A.2.5
 - (7) High Strength Bolt Inspection - 1705A.2.6 - Table 1705A2.1, 2213A.1
 - (8) Welding Inspection - 1705A.2.5 and Table 1705A.2.1
 - (9) Nelson Stud Welding - 2213A.2
 - (10) Non-Destructive Weld Testing - DSA IR 17-2

6. Wood (Chapter 23)
 - (a) Materials
 - (1) Lumber and Plywood Grading - 2303
 - (2) Fire-Retardant Treated Wood - 2303.2
7. Aluminum (Chapter 20)
 - (a) Materials
 - (1) General - 2002.1
 - (b) Inspection
 - (1) Testing and Inspection - 2003.1
8. Remotely Fabricated Construction Elements
 - (a) Testing and Inspection - DSA IR A-15
- B. Perform tests and inspections for the following in conformance with the California Building Code (CBC), Title 24, Part 2 of the California Code of Regulations (CCR).
 1. Foundations - Chapter 18:
 - (a) Earth Fill Compaction - 1803.5.8, ASTM D1556, ASTM D 1557
 2. Concrete - Chapter 19:
 - (a) Tests - 1903.1
 3. Concrete Quality - Chapter 19:
 - (a) Proportions of Concrete - 1904.1

NOTE: Strength tests are not required for equipment pads, pipe and conduit cover and minor non-structural concrete.

4. Unit Masonry - Chapter 21:
 - (a) Material Test - 2105.1
5. Steel - Chapter 22:
 - (a) Welding - 2203.1
 - (b) Welding - 2204.1
 - (c) Bolts - 2204.2
- C. Special Inspection - 1704 - As indicated on the drawings.
- D. Perform additional test required by individual Specification Sections.

1.10 SCHEDULE OF INSPECTIONS AND TESTS BY CONTRACTOR

- A. Contractor Responsibility:
 1. Statement of Responsibility - 1704A.4 Refer to listed special inspections under Article 1.9.

- B. Planting and Irrigation:
 - 1. Testing as specified in Division 32 including, but not limited to; soils analysis and irrigation pressure testing.
- C. Plumbing:
 - 1. Testing as specified in Division 22 including, but not limited to: Sterilization, soil waste and vent, water piping, source of water, gas piping, downspouts and storm drains.
- D. Automatic Fire Sprinklers:
 - 1. Testing as specified in Division 21 shall include, but not be limited to: hydrostatic pressure.
- E. Heating, Ventilating and Air Conditioning:
 - 1. Testing as specified in Division 21 shall include, but not be limited to: Ductwork tests, cooling tower tests, boiler tests, controls testing, piping tests, water and air systems, and test and balance of heating and air conditioning systems.
- F. Electrical
 - 1. Testing as specified in Division 26 including, but not limited to: Equipment testing, all electrical system operations, grounding system and checking insulation after cable is pulled.

1.11 INSPECTION BY THE OWNER

- A. An Inspector employed by the Owner in accordance with the requirements of the California Code of Regulations Title 24, Part 1 will be assigned to the work. His duties are specifically defined in Section 4-342 of Title 24, Part 1.
- B. The Owner and his representatives shall at all times have access for the purpose of inspection to all parts of the work and to the shops wherein the work is in preparation, and the Contractor shall at all times maintain proper facilities and provide safe access for such inspection.
- C. The work of construction in all stages of progress shall be subject to the personal continuous observation of the Inspector. He shall have free access to any or all parts of the work at any time. The Contractor shall furnish the Inspector reasonable facilities for obtaining such information as may be necessary to keep him fully informed respecting the progress and manner of the work and the character of the materials. Inspection of the work shall not relieve the Contractor from any obligation to fulfill this Contract. The presence of an Inspector shall in no way change, mitigate or alleviate the responsibility of the Contractor.
- D. The Inspector is not authorized to change, revoke, alter, enlarge or decrease in any way any requirement of the Contract Documents, drawings, specifications or subsequent change orders.
- E. Whenever there is insufficient evidence of compliance with any of the provisions of Title 24, Part 2 of the California Code of Regulations or evidence that any material or construction does not conform to the requirements of Title 24, Part 2 of the California Code of Regulations, the Division of the State Architect may require tests as proof of compliance. Test methods shall be as specified herein or by other recognized and accepted test methods determined by the Division of the State Architect. All tests shall be performed by a testing laboratory accepted by the Division of the State Architect.

2. PART 2 PRODUCTS

Not Used

3. PART 3 EXECUTION

3.1 STRUCTURAL TEST AND INSPECTION FORM

- A. Form DSA 103 attached.

END OF SECTION

SECTION 01 50 00

TEMPORARY FACILITIES AND CONTROLS

1. PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Temporary Utilities: Electricity, lighting, heat, ventilation, telephone service, communication service, water, and sanitary facilities.
- B. Temporary Controls: Barriers, enclosures and fencing. Water, erosion, pollution, noise and fire protection control.
- C. Construction Facilities: Access roads, parking, progress cleaning, project signage, and temporary buildings.

1.2 SUBMITTALS

A. Moisture-Protection Plan:

- 1. Submit Moisture - Protection Plan under provisions of Section 01 33 00.
- 2. Describe procedures and controls for protecting materials and construction from moisture absorption and damage, including delivery, handling, and storage provisions for materials subject to moisture absorption or moisture damage, discarding moisture-damaged materials, protocols for mitigating moisture intrusion into completed Work, and replacing moisture damaged Work.
- 3. Indicate sequencing of work that requires water, such as sprayed fire-resistive materials, plastering, sawing and grinding, and describe plans for dealing with water and moisture from these operations.
- 4. Show procedures for verifying that wet construction has dried sufficiently to permit installation of finish materials.

1.3 TEMPORARY ELECTRICITY

- A. Provide and pay for power service required from Utility source.
- B. Provide power outlets for construction operations, with branch wiring and distribution boxes. Provide flexible power cords as required.
- C. Provide main service disconnect and over current protection at convenient location.
- D. Comply with NECA, NEMA, and UL standards and regulations for temporary electric service.

1.4 TEMPORARY LIGHTING

- A. Provide and maintain lighting for construction operations, observations, inspections, and traffic conditions.
- B. Provide and maintain lighting to exterior staging and storage areas after dark for security purposes.
- C. Provide branch wiring from power source to distribution boxes with lighting conductors, pigtails, and lamps as required.
- D. Maintain lighting and provide routine repairs.
- E. Permanent building lighting may be utilized during construction.

1.5 TEMPORARY HEATING/COOLING

- A. Provide and pay for devices as required to maintain specified thermal conditions for construction operations.

- B. Only electric or indirect fired combustion heaters shall be used. No direct fired space heaters will be allowed.
- C. Heaters will be equipped with controls to automatically turn off heater if airflow is interrupted or internal temperature exceeds design temperature.
- D. Do not use permanent equipment for temporary purposes.
- E. Maintain minimum ambient temperature of 50 degrees F and maximum ambient temperature of 80 degrees F in areas where construction is in progress, unless indicated otherwise in specifications.
- F. Maintain temperature above dew point of enclosed space based upon relative humidity of enclosed area.
- G. Continuously monitor temperature of enclosed space(s) using an electronic monitoring device (s). Place devices in locations that will record average temperature of building(s). Provide print out to Architect upon request.

1.6 TEMPORARY VENTILATION

- A. Ventilate enclosed areas to assist cure of materials and to prevent accumulation of dust, fumes, vapors, or gases.
- B. Do not use permanent equipment for temporary ventilation purposes.
- C. Ventilate enclosed spaces to dissipate humidity. Maintain a maximum relative humidity level of less than 60 percent. Avoid pockets of high humidity.
- D. Continuously monitor humidity of enclosed space(s) using an electronic monitoring device(s). Place devices in locations that will record average humidity of building(s). Provide print out to Architect upon request.

1.7 TEMPORARY HUMIDITY CONTROL

- A. Provide temporary ventilation during construction activities to protect installed construction from adverse effects of high humidity and moisture.
- B. Select equipment that will not have a harmful effect on completed installations or elements being installed.
- C. Coordinate ventilation requirements to produce ambient condition required and minimize energy consumption.
- D. Provide dehumidification systems when required to reduce substrate moisture levels to level required to allow installation or application of finishes.
- E. Measure moisture content of materials that have been exposed to moisture during construction operations or after installation. Record daily readings over a forty-eight hour period. Identify materials containing moisture levels higher than allowed. Report findings in writing to Architect.

1.8 TELEPHONE SERVICE

- A. Provide, maintain and pay for telephone service to field office and Owner's/Inspector's field office at time of project mobilization. Inspector's office to have separate telephone line.
- B. Provide mobile telephone service for project superintendent for use when away from field office.
- C. Provide, maintain and pay for Facsimile machine in field office. Provide separate dedicated telephone line for machine.

1.9 ELECTRONIC COMMUNICATION SERVICE

- A. Provide minimum DSL electronic communication service, including electronic mail, in primary field office.

1.10 TEMPORARY WATER SERVICE

- A. Provide, maintain and pay for suitable quality water service required for construction operations. Contractor may obtain water from existing fire hydrant if appropriate clearances are acquired and fees paid.
- B. Extend branch piping with outlets located so water is available by hoses with threaded connections.

1.11 TEMPORARY SANITARY FACILITIES

- A. Provide temporary chemical type toilet facilities and enclosures.
- B. Maintain temporary toilet facilities in a sanitary manner.
- C. Existing facilities shall not be used.
- D. Facilities shall comply with the accessibility requirements of the CBC - California Building Code, (CCR) California Code of Regulations, Title 24, Part 2, Section 11B-201.4.

1.12 BARRIERS

- A. Provide barriers to prevent unauthorized entry to construction areas and to protect existing facilities and adjacent properties from damage from construction operations.
- B. Provide barricades and covered walkways required by governing authorities for public rights-of-way.
- C. Provide protection for plant life and trees designated to remain and for soft and hardscape areas adjacent to work, replace damaged materials in kind.
- D. Protect non-owned vehicular traffic, stored materials, site and structures from damage.

1.13 FENCING

- A. Construction: Commercial grade chain link fence.
- B. Provide 6 foot high fence around construction site; equip with vehicular and pedestrian gates with locks. Post fences and gates with no trespassing signs.

1.14 WATER CONTROL

- A. Grade site to drain. Maintain excavations free of water. Provide, operate, and maintain pumping equipment.
- B. Provide water barriers as required to protect site from running water.

1.15 EROSION AND SEDIMENT CONTROL

- A. Conform to Best Management Practices for erosion and sediment control and non-storm water management as defined in Sections 3 and 4 of the Construction Activity Handbook published by the Storm Water Quality Association.
- B. Plan and execute construction by methods to control surface drainage from cuts and fills, from borrow and waste disposal areas. Prevent erosion and sedimentation.
- C. Minimize amount of bare soil exposed at one time.
- D. Provide temporary measures such as berms, dikes, and drains, to prevent water flow.
- E. Construct fill and waste areas by selective placement to avoid erosive surface silts or clays.
- F. Coordinate construction activities with control procedures established in the Storm Water Pollution Prevention Plan (SWPPP).

1.16 TEMPORARY FIRE PROTECTION

- A. Maintain temporary fire protection facilities of the types needed until permanent facilities are installed.
- B. Comply with NFPA 10 "Standard for Portable Fire Extinguishers" and NFPA 241 "Standard for Safeguarding Construction, Alterations, and Demolition Operations".
- C. Fire safety during construction shall comply with CFC - California Fire Code (CCR) California Code of Regulations, Title 24, Part 9, Chapter 33.
- D. Store combustible materials in containers in fire-safe locations.
- E. Maintain unobstructed access to fire extinguishers, fire hydrants, temporary fire-protection facilities, stairways, and other access routes.
- F. Provide supervision of welding operations, combustion-type temporary heating units, and similar sources of fire ignition.

1.17 NOISE CONTROL

- A. Provide methods, means, and facilities to minimize noise produced by construction operations.

1.18 POLLUTION CONTROL

- A. Provide methods, means, and facilities to prevent contamination of soil, water, and atmosphere from discharge of noxious, toxic substances, and pollutants produced by construction operations.
- B. Conform to Best Management Practices for waste management and material controls as defined in Section 4 of the Construction Activity Handbook published by the Storm Water Quality Association.
- C. Coordinate construction activities with control procedures established in the Storm Water Pollution Prevention Plan (SWPPP).

1.19 EXTERIOR ENCLOSURES

- A. Provide temporary weather-tight closure of exterior openings to accommodate acceptable working conditions and protection for materials, to allow for temporary heating and maintenance of required ambient temperatures identified in individual specification Sections, and to prevent entry of unauthorized persons.
- B. Provide access doors with self-closing hardware and locks.

1.20 SECURITY

- A. Provide security and facilities to protect Work from unauthorized entry, vandalism, or theft.

1.21 ACCESS ROADS

- A. Construct and maintain temporary roads accessing public thoroughfares to serve construction area. Extend and relocate as Work progress requires. Provide detours necessary for unimpeded traffic flow.
- B. Stabilize temporary vehicle transportation routes and construction entrances to prevent erosion and control dust immediately after grading in accordance with best management practice techniques defined in Section 3 of the Construction Activity Handbook published by the Storm Water Quality Association.
- C. Maintain stabilization techniques as work progresses.
- D. Provide and maintain access to fire hydrants, free of obstructions.

1.22 PARKING

- A. Construct temporary gravel surface parking areas to accommodate construction personnel.

- B. Stabilize temporary surface parking areas immediately after grading to prevent erosion and control dust in accordance with Best Management practice techniques defined in Section 3 of the Construction Activity Handbook published by the storm Water Quality Association.
- C. Maintain stabilization techniques as work progresses.

1.23 TRAFFIC CONTROL

- A. Comply with requirements of authorities having jurisdiction.
- B. Obtain all permits, provide all materials and maintain controls as required of authorities having jurisdiction.
- C. Maintain access for fire-fighting equipment and access to hydrants.

1.24 PROGRESS CLEANING

- A. Remove debris and rubbish from pipe chases, plenums, attics, crawl spaces, and other closed or remote spaces, prior to enclosing the space.
- B. Broom and vacuum clean interior areas prior to start of surface finishing, and continue cleaning to eliminate dust.
- C. Provide walk-off mats at each building entry.

1.25 WASTE DISPOSAL

- A. Provide waste collection containers in sizes adequate to handle waste from construction operations.
- B. Maintain building areas free of waste materials, debris, and rubbish.
- C. Remove waste materials, debris, and rubbish from site periodically and legally dispose of off site.
- D. Maintain site area in a clean and orderly condition.

1.26 PROJECT IDENTIFICATION

- A. Provide 8 x 4 foot project sign of exterior grade plywood and wood frame construction, painted, with exhibit lettering by professional sign painter to Architect's design and colors.
- B. List title of Project, names of Owner, Architect and Contractor.
- C. List funding source for project in minimum 3 inch high upper and lower case lettering. Funding source statement to contain the following language:

This construction project was funded by the State Allocation Board from Proposition 51 state bond funds.
- D. Erect on site at location established by Architect.
- E. Sign to remain in place through construction period and shall be removed only after dedication of the project.
- F. Provide temporary directional signs for construction personnel and visitors.
- G. No other signs are allowed except those required by law.

1.27 FIELD OFFICES

- A. Office: Weather-tight, with lighting, electrical outlets, heating, cooling and ventilating equipment, and equipped with sturdy furniture drawing rack and drawing display table.
- B. Maintain daily janitorial service for offices. Maintain approach to office free of mud and water.

- C. Provide space for Project meetings, with table and chairs to accommodate 8 persons with 6 feet social distancing between persons.
- D. Provide separate private office, minimum of 120 sq. ft., similarly equipped and furnished, for use of Resident Inspector.
- E. Permanent facilities shall not be used for field offices.
- F. Facilities shall comply with the accessibility requirements of the CBC - California Building Code, (CCR) California Code of Regulations, Title 24, Part 2, Section 11B-201.4.

1.28 STORAGE AREAS AND SHEDS

- A. Size to storage requirements for products of individual Sections. Allow for access and orderly provision for maintenance and for inspection of products.

1.29 REMOVAL OF UTILITIES, FACILITIES, AND CONTROLS

- A. Maintain temporary equipment, facilities and controls until Substantial Completion or when use is no longer required.
- B. Remove temporary above grade or buried utilities, equipment, facilities, materials, prior to Substantial Completion review.
- C. Remove underground installations to a minimum depth of 2 feet. Grade site as indicated.
- D. Clean and repair damage caused by installation or use of temporary work.
- E. Materials and facilities that constitute temporary facilities are property of the Contractor.
- F. Restore existing facilities used during construction to original condition.
- G. Restore permanent facilities used during construction to specified condition.
- H. Replace construction that cannot be satisfactorily restored.

2. PART 2 PRODUCTS

Not Used

3. PART 3 EXECUTION

Not Used

END OF SECTION

SECTION 01 57 23

STORM WATER POLLUTION PREVENTION PLAN

1. PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Assistance in filing the Notice of Intent (NOI) in the Stormwater Multi-Application and Reporting System (SMARTS) website.
- B. Preparation and implementation of the Storm Water Pollution Prevention Plan (SWPPP).
- C. Plan administration, maintenance and updates.
- D. Placement of erosion/pollution control devices.
- E. Maintenance and monitoring of control devices.
- F. Non-storm water management.
- G. Related work necessary for plan compliance.
- H. Reports and certificates.
- I. Filing the Notice of Termination (NOT) in the Stormwater Multi-Application and Reporting System (SMARTS) website.

1.2 REFERENCES

- A. Stormwater Best Management Practice Handbook (BMP Handbook), Construction Edition, as published by the California Storm Water Quality Association. Available at www.casqa.org.

1.3 SUBMITTALS

- A. Submit SWPPP under provisions of Section 01 33 00.
- B. Submit SWPPP for review within two weeks after Contract award.
- C. Submit manufacturer's installation instructions for all products.

1.4 QUALITY ASSURANCE

- A. Storm Water Pollution Prevention Plan (SWPPP) shall be prepared by a Qualified SWPPP Developer (QSD).
- B. Permit Registration Documents (PRDs) shall be prepared by a Qualified SWPPP Developer (QSD).
- C. Implementation and monitoring of the SWPPP shall be accomplished by a Qualified Storm Water Practitioner (QSP).
- D. Perform work in accordance with Storm Water Pollution Prevention Plan.
- E. Maintain one copy of document on site.

1.5 REGULATORY REQUIREMENT

- A. Prior to the beginning of construction on this site the Owner will file with the State of California, State Water Resources Control Board a Notice of Intent (N.O.I.) that this project will comply with the terms of the State Water Resources Control Board's Order No. 2012-0006 - DWQ and the National Pollutant Discharge Elimination System (NPDES) General Permit No. CAS0000002, General Permit for Storm Water Discharges Associated with Construction and Land Disturbance Activities.
- B. Assist Owner with entering any necessary data, information or Permit Registration Documents into the Stormwater Multi-Application and Reporting System (SMARTS) website.
- C. Comply with requirements of the State's General Permit with regard to the implementation and maintenance of the SWPPP.
- D. Coordinate the SWPPP with the requirements of the Owner's Storm Water Management Plan (SWMP). A copy of the SWMP may be obtained from the Owner upon request.

1.6 PRE-INSTALLATION CONFERENCE

- A. Convene a conference two weeks prior to commencing work at the site, under provisions of Section 01 31 00.
- B. Require attendance of parties directly affecting the work of this Section.
- C. Review requirements of the SWPPP.

1.7 PERFORMANCE REQUIREMENTS

- A. Risk level shall be determined and submitted to the State Water Resources Control Board as part of the Permit Registration Documents (PRDs).
- B. The Storm Water Pollution Prevention Plan is a minimum requirement. Revisions and modifications to the SWPPP are acceptable only if they maintain levels of protection equal to or greater than originally specified.
- C. All modifications to the SWPPP shall be made by a Qualified Storm Water Practitioner (QSP).
- D. Read and be thoroughly familiar with all of the requirements of the SWPPP
- E. Inspect and monitor all work and storage areas for compliance with the SWPPP prior to any anticipated rain.
- F. A Qualified Storm Water Practitioner (QSP) shall develop Rain Event Action Plans (REAPs) during construction.
- G. Complete any and all corrective measures as may be directed by the regulatory agency.
- H. Penalties: Pay any fees and be liable for any other penalties that may be imposed by the regulatory agency for non-compliance with SWPPP during the course of work.
- I. Costs: Pay all costs associated with the implementation of the requirements of the SWPPP in order to maintain compliance with the Permit. This includes installation of all Housekeeping BMPs, General Site and Material Management BMPs, Bi-weekly Inspection requirements, maintenance requirements, monitoring requirements, and all other requirements specified in the SWPPP.

2. PART 2 PRODUCTS

2.1 MATERIALS

- A. All temporary and permanent storm water pollution prevention facilities, equipment, and materials as required by or as necessary to comply with the SWPPP as described in the BMP Handbook.
- B. Substitutions: Under provisions of Section 01 25 13.

3. PART 3 EXECUTION

3.1 PREPARATION AND APPROVAL

- A. Prepare Storm Water Pollution Prevention Plan (SWPPP) as required to comply with storm water pollution regulations.
- B. Prepare SWPPP by following the format in Appendix G of the Stormwater Best Management Practice Handbook (BMP Handbook), January 2015 edition, published by the Storm Water Quality Association.
- C. Prepare and submit all additional Permit Registration Documents (PRDs) required by the State Water Resources Control Board.

3.2 GENERAL IMPLEMENTATION REQUIREMENTS

- A. Obtain a Waste Discharger Identification (WDID) number from the State Water Resources Control Board (SWRCB).
- B. All measures required by the SWPPP shall be implemented concurrent with the commencement of construction. Pollution practices and devices shall be followed or installed as early in the construction schedule as possible with frequent upgrading of devices as construction progresses.
- C. Conduct an inspection of all erosion control and pollution prevention devices prior to any anticipated storm event to verify all SWPPP measures are in place and to identify and mitigate any new potential pollution sources brought by the ongoing construction.
- D. Conduct monitoring to assess compliance with Numeric Action Levels (NALs) or Numeric Effluent Limitations (NELs) as appropriate to the project.
- E. After storm events, conduct an inspection of the project site to verify the performance of the erosion control and pollution prevention devices in reducing pollutant loading of the discharged storm water associated with the construction activity.
- F. Eliminate or reduce to the extent feasible the discharge of materials other than storm water to the storm drain system and/or receiving waters as dictated by the State General Permit and SWPPP

3.3 IMPLEMENTATION REQUIREMENTS DURING THE NON-RAINY SEASON

- A. The non-rainy season in the State of California is between April 1 and September 30.
- B. All requirements of the SWPPP shall apply during the non-rainy season without exception.

3.4 IMPLEMENTATION REQUIREMENTS DURING THE RAINY SEASON

- A. The rainy season in the State of California is between October 1 and March 31.
- B. All requirements of the SWPPP shall apply during the rainy season without exception.

3.5 REPORTING

- A. Prepare all inspection records for each inspection done prior to and just after all storm events as required by the SWPPP with two copies forwarded to the Owner and the Architect.
- B. Prepare the overall certification based upon the inspection reports for Owner's use in the certifying the project site's compliance with the SWPPP and the State's General Permit.

3.6 COMPLETION OF WORK

- A. Clean-up shall be performed as each portion of the work progresses. All refuse, excess material, and possible pollutants shall be disposed of in a legal manner off-site and all temporary and permanent SWPPP devices shall be in place and maintained in good condition.
- B. At completion of work, inspect installed SWPPP devices, and present the currently implemented SWPPP with all backup records to the Owner.
- C. Assist the Owner in submitting a Notice of Termination (NOT) into the SMARTS system when construction is complete and conditions of termination listed in the NOT have been satisfied.
- D. Leave storm water pollution prevention controls in place that are needed for post-construction storm water management. Remove those that are not needed. Post-construction controls will be maintained by the Owner.
- E. Provide Site Monitoring Reports, SWPPP revisions, Compliance Certificates, and related documents to the Owner. Post-construction controls mentioned in the Compliance Certificate are considered to be in place at the end of the Construction Contract.

3.7 EROSION CONTROL PLAN

- A. Refer to Erosion Control Plan that is included in the Contract Documents as a guide for site erosion and sediment control.
- B. Include Erosion Control Plan as a part of the final SWPPP.

END OF SECTION

SECTION 01 61 00

PRODUCT REQUIREMENTS

1. PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Products.
- B. Transportation and handling.
- C. Storage and protection.
- D. Damage and restoration.

1.2 PRODUCTS

- A. Products: Means new material, machinery, components, equipment, fixtures, and systems forming the Work. Does not include machinery and equipment used for preparation, fabrication, conveying and erection of the Work.
- B. Products specified or recycled from other projects are not considered new products.
- C. Provide interchangeable components of the same manufacturer, for similar components.
- D. Provide products that comply with the Contract Documents, that are undamaged and are unused at the time of installation.
- E. Provide products complete with all accessories, trim, finish, safety guards and other devices and detail needed for a complete installation and for the intended use and effect.
- F. Where a specific manufacturer's product is specified as the basis of design, the designation shall establish the qualities relating to type, function, dimension, in-service performance, physical properties, appearance and other characteristics for comparable products of other named manufacturers.
- G. Where products are specified by name or by manufacturer provide the product or manufacturer specified. No substitutions will be permitted unless made under the provisions of Section 01 25 13.
- H. Where specifications only describe a product or assembly by listing exact characteristics required, provide a product or assembly that provides the characteristics.
- I. Where specifications only require compliance with performance requirements, provide products that comply with those requirements.
- J. Where the specifications only require compliance with an imposed code, standard or regulation, provide a product that complies with the standards, codes or regulations specified.
- K. Where specifications require review and acceptance of a sample, the Architect's decision will be final on whether a proposed product sample is acceptable or not.
- L. Provide materials and products specified in the full range of color, texture and pattern for selection by Architect. Range shall include standard stocked color/texture/pattern as advertised in product data and brochures. Unless otherwise indicated in individual specification sections, Architect may select from any color range at no additional cost to Owner.

1.3 TRANSPORTATION AND HANDLING

- A. Transport and handle products in accordance with manufacturer's instructions.
- B. Schedule delivery to minimize long-term storage at site to prevent overcrowding of construction spaces.

- C. Coordinate delivery with installation time to ensure minimum holding time for items that are flammable, hazardous, easily damaged, or sensitive to deterioration, theft and other losses.
- D. Deliver products in manufacturer's original sealed container or packaging system, complete with labels and instructions for handling, storing, unpacking, protecting, and installing.
- E. Promptly inspect shipments to assure that products comply with requirements, quantities are correct, and products are undamaged.
- F. Provide equipment and personnel to handle products by methods to prevent soiling, disfigurement, or damage.

1.4 STORAGE

- A. Store products in accordance with manufacturer's instructions, with seals and labels intact and legible.
- B. Store sensitive products in weather-tight, climate controlled enclosures.
- C. Store products in a manner that will not damage or overload project structure.
- D. For exterior storage of fabricated products, place on sloped supports, above ground.
- E. Provide off-site storage when site does not permit on-site storage .
- F. Cover products subject to deterioration with impervious sheet covering. Provide ventilation to avoid condensation.
- G. Store loose granular materials on solid flat surfaces in a well-drained area. Prevent mixing with foreign matter.
- H. Provide equipment and personnel to store products by methods to prevent soiling, disfigurement, or damage.
- I. Arrange storage of products to permit access for inspection. Periodically inspect to assure products are undamaged and are maintained under specified conditions.
- J. Prevent the discharge of pollutants to storm water from storage of materials on-site using best management practice techniques defined in Chapter 4 of the Construction Activity Handbook published by the Storm Water Quality Task Force.

1.5 PROTECTION

- A. Protect installed Work and provide special protection where specified in individual specification Sections.
- B. Provide temporary and removable protection for installed Products. Control activity in immediate work area to minimize damage.
- C. Provide protective coverings at walls, projections, jambs, sills, and soffits of openings.
- D. Protect finished floors, stairs, and other surfaces from traffic, dirt, wear, damage, or movement of heavy objects.
- E. Prohibit traffic or storage upon waterproofed or roofed surfaces. If traffic or activity is necessary, obtain recommendations for protection from waterproofing or roofing material manufacturer.
- F. Provide humidity and temperature control for installed products as recommended by materials manufacturer.
- G. Prohibit traffic from landscaped areas.

1.6 DAMAGE AND RESTORATIONS

- A. Damage to existing or new work whether accidental or not shall be restored or replaced as specified or directed by Architect.
- B. Restoration shall be equal to structural performance of original work.
- C. Finish shall match appearance of existing adjacent work.
- D. Work not properly restored or where not capable of being restored shall be removed and replaced.

2. PART 2 PRODUCTS

Not Used

3. PART 3 EXECUTION

Not Used

END OF SECTION

SECTION 01 73 00

EXECUTION REQUIREMENTS

1. PART 1 GENERAL

1.1 SECTION INCLUDES

- A. General procedural requirements governing execution of the Work.
 - 1. Construction layout.
 - 2. Field engineering and surveying.
 - 3. General installation of products.

1.2 SUBMITTALS

- A. Certificates: Submit certificate signed by land surveyor certifying that location and elevation of improvements comply with requirements.
- B. Certified Surveys: Submit two copies signed by land surveyor.
- C. Final Property Survey: Submit 2 copies showing the Work performed and record survey data.

2. PART 2 PRODUCTS

Not Used

3. PART 3 EXECUTION

3.1 EXAMINATION

- A. Existing Conditions: Existence and location of site improvements and other construction indicated as existing are not guaranteed. Before beginning work, investigate and verify existence and location of construction affecting the Work.
- B. Existing Utilities: Existence and location of underground and other utilities indicated as existing are not guaranteed. Before beginning work, investigate and verify existence and location of underground utilities affecting the Work.
 - 1. Before construction, verify location and invert elevation at points of connection of sanitary sewer, storm sewer, and water-service piping; and electrical services.
 - 2. Furnish location data for work related to Project that must be performed by public utilities serving Project site.
- C. Acceptance of Conditions: Examine substrates, areas, and conditions, with Installer or Applicator present for compliance with requirements for installation tolerances and other conditions affecting performance. Record observations.
 - 1. Written Report: Where conditions detrimental to performance of the Work are encountered, provide a written report listing the following:
 - (a) Description of the Work.
 - (b) List of detrimental conditions, including substrates.
 - (c) List of unacceptable installation tolerances.
 - (d) Recommended corrections.

2. Verify compatibility with and suitability of substrates, including compatibility of existing finishes or primers.
3. Examine roughing-in for mechanical and electrical systems to verify actual locations of connections before equipment and fixture installation.
4. Examine walls, floors, and roofs for suitable conditions where products and systems are to be installed.
5. Proceed with installation only after unsatisfactory conditions have been corrected. Proceeding with the Work indicates acceptance of surfaces and conditions.

3.2 PREPARATION

- A. Existing Utility Information: Furnish information to Owner that is necessary to adjust, move, or relocate existing utility structures, utility poles, lines, services, or other utility appurtenances located in or affected by construction. Coordinate with authorities having jurisdiction.
- B. Field Measurements: Take field measurements as required to fit the Work properly. Recheck measurements before installing each product. Where portions of the Work are indicated to fit to other construction, verify dimensions of other construction by field measurements before fabrication. Coordinate fabrication schedule with construction progress to avoid delaying the Work.
- C. Space Requirements: Verify space requirements and dimensions of items shown diagrammatically on Drawings.
- D. Review of Contract Documents and Field Conditions: Immediately on discovery of need for clarification of Contract Documents, submit a Request For Information (RFI) to Architect. Include a detailed description of problem encountered, together with recommendations for resolution of the item discovered.

3.3 CONSTRUCTION LAYOUT

- A. Verification: Before proceeding to lay out the Work, verify layout information shown on Drawings, in relation to the property survey and existing benchmarks. If discrepancies are discovered, notify Architect promptly.
- B. General: Engage a land surveyor, registered in the state of California to lay out the Work using accepted surveying practices.
 1. Establish benchmarks and control points to set lines and levels at each story of construction and elsewhere as needed to locate each element of Project.
 2. Establish dimensions within tolerances indicated. Do not scale Drawings to obtain required dimensions.
 3. Inform installers of lines and levels to which they must comply.
 4. Check the location, level and plumb, of every major element as the Work progresses.
 5. Notify Architect when deviations from required lines and levels exceed allowable tolerances.
 6. Close site surveys with an error of closure equal to or less than the standard established by authorities having jurisdiction.
- C. Site Improvements: Locate and lay out site improvements, including pavements, grading, fill and topsoil placement, utility slopes, and invert elevations.
- D. Building Lines and Levels: Locate and lay out control lines and levels for structures, building foundations, column grids, and floor levels, including those required for mechanical and electrical work. Transfer survey markings and elevations for use with control lines and levels. Level foundations and piers from two or more locations.

- E. Record Log: Maintain a log of layout control work. Record deviations from required lines and levels. Include beginning and ending dates and times of surveys, weather conditions, name and duty of each survey party member, and types of instruments and tapes used. Make the log available for reference by Architect.

3.4 FIELD ENGINEERING

- A. Identification: Control datum for survey is that established by Owner provided survey.
- B. Reference Points: Locate existing permanent benchmarks, control points, and similar reference points before beginning the Work. Preserve and protect permanent benchmarks and control points during construction operations.
 - 1. Do not change or relocate existing benchmarks or control points without prior written approval of Architect. Report lost or destroyed permanent benchmarks or control points promptly. Report the need to relocate permanent benchmarks or control points to Architect before proceeding.
 - 2. Replace lost or destroyed permanent benchmarks and control points promptly. Base replacements on the original survey control points.
- C. Benchmarks: Establish and maintain a minimum of two permanent benchmarks on Project site, referenced to data established by survey control points.
 - 1. Record benchmark locations, with horizontal and vertical data, on Project Record Documents.
 - 2. Where the actual location or elevation of layout points cannot be marked, provide temporary reference points sufficient to locate the Work.
 - 3. Remove temporary reference points when no longer needed. Restore marked construction to its original condition.
- D. Certified Survey: On completion of foundation walls, major site improvements, and other work requiring field-engineering services, prepare a certified survey showing dimensions, locations, angles, and elevations of construction and sitework.
- E. Final Property Survey: Prepare a final property survey showing significant features (real property) for Project. Include on the survey a certification, signed by land surveyor that principal metes, bounds, lines, and levels of Project are accurately positioned as shown on the survey.
 - 1. Show boundary lines, monuments, streets, site improvements and utilities, existing improvements and significant vegetation, adjoining properties, acreage, grade contours, and the distance and bearing from a site corner to a legal point.

3.5 INSTALLATION

- A. General: Locate the Work and components of the Work accurately, in correct alignment and elevation, as indicated.
 - 1. Make vertical work plumb and make horizontal work level.
 - 2. Where space is limited, install components to maximize space available for maintenance and ease of removal for replacement.
 - 3. Conceal pipes, ducts, and wiring in finished areas, unless otherwise indicated.
 - 4. Maintain maximum headroom clearance in spaces without a suspended ceiling.
- B. Comply with manufacturer's written instructions and recommendations for installing products in applications indicated.
- C. Install products at the time and under conditions that will ensure the best possible results. Maintain conditions required for product performance until Substantial Completion.

- D. Conduct construction operations so no part of the Work is subjected to damaging operations or loading in excess of that expected during normal conditions of occupancy.
- E. Tools and Equipment: Do not use tools or equipment that produce harmful noise levels.
- F. Templates: Obtain and distribute to the parties involved templates for work specified to be factory prepared and field installed. Check Shop Drawings of other work to confirm that adequate provisions are made for locating and installing products to comply with indicated requirements.
- G. Anchors and Fasteners: Provide anchors and fasteners as required to anchor each component securely in place, accurately located and aligned with other portions of the Work.
 - 1. Mounting Heights: Where mounting heights are not indicated, mount components at heights directed by Architect.
 - 2. Allow for building movement, including thermal expansion and contraction.
 - 3. Coordinate installation of anchorages. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors, that are to be embedded in concrete or masonry. Deliver such items to Project site in time for installation.
- H. Joints: Make joints of uniform width. Where joint locations in exposed work are not indicated, arrange joints for the best visual effect. Fit exposed connections together to form hairline joints.
- I. Hazardous Materials: Use products, cleaners, and installation materials that are not considered hazardous.

END OF SECTION

SECTION 01 74 19

CONSTRUCTION WASTE MANAGEMENT AND DISPOSAL

1. PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Administrative and procedural requirements for the following:
 - 1. Salvaging nonhazardous construction waste.
 - 2. Recycling nonhazardous construction waste.
 - 3. Disposing of nonhazardous construction waste.

1.2 DEFINITIONS

- A. Construction Waste: Building and site improvement materials and other solid waste resulting from construction operations. Construction waste includes packaging.
- B. Disposal: Removal off-site of demolition and construction waste and subsequent sale, recycling, reuse, or deposit in landfill or incinerator acceptable to authorities having jurisdiction.
- C. Recycle: Recovery of demolition or construction waste for subsequent processing in preparation for reuse.
- D. Salvage: Recovery of demolition or construction waste and subsequent sale or reuse in another facility.
- E. Salvage and Reuse: Recovery of demolition or construction waste and subsequent incorporation into the Work.

1.3 PERFORMANCE REQUIREMENTS

- A. General: Develop waste management plan that results in end-of-Project rates for salvage/recycling of 65 percent by weight of total waste generated by the Work.
- B. Salvage/Recycle Goals: Salvage and recycle as much nonhazardous construction waste as possible. Owner has established a minimum goal of 65 percent by weight of total waste generated by the Work for the following materials:
 - 1. Construction Waste:
 - (a) Site-clearing waste.
 - (b) Masonry and CMU.
 - (c) Lumber.
 - (d) Wood sheet materials.
 - (e) Wood trim.
 - (f) Metals.
 - (g) Roofing.
 - (h) Insulation.
 - (i) Carpet and pad.
 - (j) Gypsum board.
 - (k) Piping.
 - (l) Electrical conduit.
 - (m) Packaging: Regardless of salvage/recycle goal indicated above, salvage or recycle 100 percent of the following uncontaminated packaging materials:
 - (1) Paper.
 - (2) Cardboard.
 - (3) Boxes.
 - (4) Plastic sheet and film.
 - (5) Polystyrene packaging.
 - (6) Wood crates.
 - (7) Plastic pails.

1.4 SUBMITTALS

- A. Submit waste management plan and progress reports under the provisions of Section 01 33 00.
- B. Waste Management Plan: Submit plan within 14 days of date established for the Notice of Award.
- C. Waste Reduction Progress Reports: Concurrent with each Application for Payment, submit reports. Include separate reports for demolition and construction waste. Include the following information:
 - 1. Material category.
 - 2. Generation point of waste.
 - 3. Total quantity of waste in tons.
 - 4. Quantity of waste salvaged, both estimated and actual in tons.
 - 5. Quantity of waste recycled, both estimated and actual in tons.
 - 6. Total quantity of waste recovered (salvaged plus recycled) in tons.
 - 7. Total quantity of waste recovered (salvaged plus recycled) as a percentage of total waste.
- D. Forms: Prepare waste reduction progress reports on forms included at end of Part 3.
- E. Waste Reduction Calculations: Before request for Substantial Completion, submit calculated end-of-Project rates for salvage, recycling, and disposal as a percentage of total waste generated by the Work.
- F. Records of Donations: Indicate receipt and acceptance of salvageable waste donated to individuals and organizations. Indicate whether organization is tax exempt.
- G. Records of Sales: Indicate receipt and acceptance of salvageable waste sold to individuals and organizations. Indicate whether organization is tax exempt.
- H. Recycling and Processing Facility Records: Indicate receipt and acceptance of recyclable waste by recycling and processing facilities licensed to accept them. Include manifests, weight tickets, receipts, and invoices.
- I. Landfill and Incinerator Disposal Records: Indicate receipt and acceptance of waste by landfills and incinerator facilities licensed to accept them. Include manifests, weight tickets, receipts, and invoices.
- J. Qualification Data: For Waste Management Coordinator.

1.5 QUALITY ASSURANCE

- A. Waste Management Coordinator Qualifications: LEED Accredited Professional with a specialty designation in Building Design and Construction, BD+C. Waste management coordinator may also serve as LEED coordinator.
- B. Regulatory Requirements: Comply with hauling and disposal regulations of authorities having jurisdiction.
- C. Waste Management Conference: Conduct conference at Project site to comply with requirements in Division 01 Section 01 31 00 - Project Management and Coordination. Review methods and procedures related to waste management including, but not limited to, the following:
 - 1. Review and discuss waste management plan including responsibilities of Waste Management Coordinator.
 - 2. Review requirements for documenting quantities of each type of waste and its disposition.
 - 3. Review and finalize procedures for materials separation and verify availability of containers and bins needed to avoid delays.
 - 4. Review procedures for periodic waste collection and transportation to recycling and disposal facilities.
 - 5. Review waste management requirements for each trade.

1.6 WASTE MANAGEMENT PLAN

- A. General: Develop plan consisting of waste identification, waste reduction work plan, and cost/revenue analysis. Indicate quantities by weight or volume, but use same units of measure throughout waste management plan.
- B. Waste Identification: Indicate anticipated types and quantities of site-clearing and construction waste generated by the Work. Include estimated quantities and assumptions for estimates.
- C. Waste Reduction Work Plan: List each type of waste and whether it will be salvaged, recycled, or disposed of in landfill or incinerator. Include points of waste generation, total quantity of each type of waste, quantity for each means of recovery, and handling and transportation procedures.
 - 1. Salvaged Materials for Reuse: For materials that will be salvaged and reused in this Project, describe methods for preparing salvaged materials before incorporation into the Work.
 - 2. Salvaged Materials for Sale: For materials that will be sold to individuals and organizations, include list of their names, addresses, and telephone numbers.
 - 3. Salvaged Materials for Donation: For materials that will be donated to individuals and organizations, include list of their names, addresses, and telephone numbers.
 - 4. Recycled Materials: Include list of local receivers and processors and type of recycled materials each will accept. Include names, addresses, and telephone numbers.
 - 5. Disposed Materials: Indicate how and where materials will be disposed of. Include name, address, and telephone number of each landfill and incinerator facility.
 - 6. Handling and Transportation Procedures: Include method that will be used for separating recyclable waste including sizes of containers, container labeling, and designated location on Project site where materials separation will be located.
- D. Cost/Revenue Analysis: Indicate total cost of waste disposal as if there was no waste management plan and net additional cost or net savings resulting from implementing waste management plan. Include the following:
 - 1. Total quantity of waste.
 - 2. Estimated cost of disposal (cost per unit). Include hauling and tipping fees and cost of collection containers for each type of waste.
 - 3. Total cost of disposal (with no waste management).
 - 4. Revenue from salvaged materials.
 - 5. Revenue from recycled materials.
 - 6. Savings in hauling and tipping fees by donating materials.
 - 7. Savings in hauling and tipping fees that are avoided.
 - 8. Handling and transportation costs. Include cost of collection containers for each type of waste.
 - 9. Net additional cost or net savings from waste management plan.
- E. Forms: Prepare waste management plan on forms included at end of Part 3.

2. PART 2 PRODUCTS

(NOT USED)

3. PART 3 EXECUTION

3.1 PLAN IMPLEMENTATION

- A. General: Provide handling, containers, storage, signage, transportation, and other items as required to implement waste management plan during the entire duration of the Contract.
- B. Waste Management Coordinator: Waste management coordinator to be responsible for implementing, monitoring, and reporting status of waste management work plan. Coordinator shall be present at Project site full time for duration of Project.

- C. Training: Train workers, subcontractors, and suppliers on proper waste management procedures, as appropriate for the Work occurring at Project site.
 - 1. Distribute waste management plan to everyone concerned within 3 days of submittal return.
 - 2. Distribute waste management plan to entities when they first begin work on-site. Review plan procedures and locations established for salvage, recycling, and disposal.
- D. Site Access and Temporary Controls: Conduct waste management operations to ensure minimum interference with roads, streets, walks, walkways, and other adjacent occupied and used facilities.
 - 1. Designate and label specific areas on Project site necessary for separating materials that are to be salvaged, recycled, reused, donated, and sold.
 - 2. Comply with Division 01 Section 01 50 00 - Temporary Facilities and Controls, for controlling dust and dirt, environmental protection, and noise control.

3.2 RECYCLING CONSTRUCTION WASTE, GENERAL

- A. General: Recycle paper and beverage containers used by on-site workers.
- B. Recycling Receivers and Processors: Licensed entity normally engaged in the business of receiving, recycling, and processing waste materials with a minimum of 5 years of documented experience with the types of waste products to be processed under the provisions of this section.
- C. Recycling Incentives: Revenues, savings, rebates, tax credits, and other incentives received for recycling waste materials shall be shared equally by Owner and Contractor.
- D. Procedures: Separate recyclable waste from other waste materials, trash, and debris. Separate recyclable waste by type at Project site to the maximum extent practical.
 - 1. Provide appropriately marked containers or bins for controlling recyclable waste until they are removed from Project site. Include list of acceptable and unacceptable materials at each container and bin.
 - 2. Inspect containers and bins for contamination and remove contaminated materials if found.
 - 3. Stockpile processed materials on-site without intermixing with other materials. Place, grade, and shape stockpiles to drain surface water. Cover to prevent windblown dust.
 - 4. Stockpile materials away from construction area. Do not store within drip line of remaining trees.
 - 5. Store components off the ground and protect from the weather.
 - 6. Remove recyclable waste off Owner's property and transport to recycling receiver or processor.

3.3 RECYCLING CONSTRUCTION WASTE

- A. Packaging:
 - 1. Cardboard and Boxes: Break down packaging into flat sheets. Bundle and store in a dry location.
 - 2. Polystyrene Packaging: Separate and bag materials.
 - 3. Pallets: As much as possible, require deliveries using pallets to remove pallets from Project site. For pallets that remain on-site, break down pallets into component wood pieces and comply with requirements for recycling wood.
 - 4. Crates: Break down crates into component wood pieces and comply with requirements for recycling wood.
- B. Site-Clearing Wastes: Chip brush, branches, and trees on-site.
 - 1. Comply with requirements in Division 32 Section 32 90 00 - Planting for use of chipped organic waste as organic mulch. A minimum of 100 percent of site clearing waste to be recycled.
- C. Wood Materials:
 - 1. Clean Cut-Offs of Lumber: Grind or chip into small pieces.

2. Clean Sawdust: Bag sawdust that does not contain painted or treated wood.
 - (a) Comply with requirements in Division 32 Section 32 90 00 - Planting for use of clean sawdust as organic mulch.
- D. Gypsum Board: Stack large clean pieces on wood pallets and store in a dry location.
 1. Clean Gypsum Board: Grind scraps of clean gypsum board using small mobile chipper or hammer mill. Screen out paper after grinding.
 - (a) Comply with requirements in Division 32 Section 32 90 00 - Planting for use of clean ground gypsum board as inorganic soil amendment.

3.4 DISPOSAL OF WASTE

- A. General: Except for items or materials to be salvaged, recycled, or otherwise reused, remove waste materials from Project site and legally dispose of them in a landfill or incinerator acceptable to authorities having jurisdiction.
- B. Do not allow waste materials that are to be disposed of accumulate on-site. Remove and transport debris in a manner that will prevent spillage on adjacent surfaces and areas.
- C. Burning: Do not burn waste materials.
- D. Disposal: Transport waste materials off Owner's property and legally dispose of them.

3.5 FORMS

- A. Waste Management Plan Forms Attached:
 1. Construction Waste Reduction Progress Report.
 2. Construction Waste Identification.
 3. Construction Waste Reduction Work Plan.
 4. Cost/Revenue Analysis of Construction Waste Reduction Work Plan.

END OF SECTION

CONSTRUCTION WASTE REDUCTION PROGRESS REPORT								
MATERIAL CATEGORY	GENERATION POINT	TOTAL QUANTITY OF WASTE TONS (A)	QUANTITY OF WASTE SALVAGED		QUANTITY OF WASTE RECYCLED		TOTAL QUANTITY OF WASTE RECOVERED TONS (D = B + C)	TOTAL QUANTITY OF WASTE RECOVERED % (D/Ax100)
			ESTIMATED TONS	ACTUAL TONS (B)	ESTIMATED TONS	ACTUAL TONS (C)		
Packaging: Cardboard								
Packaging: Boxes								
Packaging: Plastic Sheet or Film								
Packaging: Polystyrene								
Packaging: Pallets or Skids								
Packaging: Crates								
Packaging: Paint Cans								
Packaging: Plastic Pails								
Site-Clearing Waste								
Masonry or CMU								
Lumber: Cut-Offs								
Lumber: Warped Pieces								
Plywood or OSB (scraps)								
Wood Forms								
Wood Waste Chutes								
Wood Trim (cut-offs)								
Metals								
Insulation								
Roofing								
Joint Sealant Tubes								
Gypsum Board (scraps)								
Carpet and Pad (scraps)								
Piping								
Electrical Conduit								
Other:								

CONSTRUCTION WASTE IDENTIFICATION							
MATERIAL CATEGORY	GENERATION POINT	EST. QUANTITY OF MATERIALS RECEIVED (A)	EST. WASTE - % (B)	TOTAL EST. QUANTITY OF WASTE* (C=AxB)	EST. VOLUME CY	EST. WEIGHT TONS	REMARKS AND ASSUMPTIONS
Packaging: Cardboard							
Packaging: Boxes							
Packaging: Plastic Sheet or Film							
Packaging: Polystyrene							
Packaging: Pallets or Skids							
Packaging: Crates							
Packaging: Paint Cans							
Packaging: Plastic Pails							
Site-Clearing Waste							
Masonry or CMU							
Lumber: Cut-Offs							
Lumber: Warped Pieces							
Plywood or OSB (scraps)							
Wood Forms							
Wood Waste Chutes							
Wood Trim (cut-offs)							
Metals							
Insulation							
Roofing							
Joint Sealant Tubes							
Gypsum Board (scraps)							
Carpet and Pad (scraps)							
Piping							
Electrical Conduit							
Other:							

* Insert units of measure.

CONSTRUCTION WASTE REDUCTION WORK PLAN						
MATERIAL CATEGORY	GENERATION POINT	TOTAL EST. QUANTITY OF WASTE TONS	DISPOSAL METHOD AND QUANTITY			HANDLING AND TRANSPORTATION PROCEDURES
			EST. AMOUNT SALVAGED TONS	EST. AMOUNT RECYCLED TONS	EST. AMOUNT DISPOSED TO LANDFILL TONS	
Packaging: Cardboard						
Packaging: Boxes						
Packaging: Plastic Sheet or Film						
Packaging: Polystyrene						
Packaging: Pallets or Skids						
Packaging: Crates						
Packaging: Paint Cans						
Packaging: Plastic Pails						
Site-Clearing Waste						
Masonry or CMU						
Lumber: Cut-Offs						
Lumber: Warped Pieces						
Plywood or OSB (scraps)						
Wood Forms						
Wood Waste Chutes						
Wood Trim (cut-offs)						
Metals						
Insulation						
Roofing						
Joint Sealant Tubes						
Gypsum Board (scraps)						
Carpet and Pad (scraps)						
Piping						
Electrical Conduit						
Other:						

COST/REVENUE ANALYSIS OF CONSTRUCTION WASTE REDUCTION WORK PLAN								
MATERIALS	TOTAL QUANTITY OF MATERIALS (VOL. OR WEIGHT) (A)	EST. COST OF DISPOSAL (B)	TOTAL EST. COST OF DISPOSAL (C = A x B)	REVENUE FROM SALVAGED MATERIALS (D)	REVENUE FROM RECYCLED MATERIALS (E)	LANDFILL TIPPING FEES AVOIDED (F)	HANDLING AND TRANSPORTATION COSTS AVOIDED (G)	NET COST SAVINGS OF WORK PLAN (H = D+E+F+G)
Packaging: Cardboard								
Packaging: Boxes								
Packaging: Plastic Sheet or Film								
Packaging: Polystyrene								
Packaging: Pallets or Skids								
Packaging: Crates								
Packaging: Paint Cans								
Packaging: Plastic Pails								
Site-Clearing Waste								
Masonry or CMU								
Lumber: Cut-Offs								
Lumber: Warped Pieces or OSB								
Wood Forms								
Wood Waste Chutes								
Wood Trim (cut-offs)								
Metals								
Insulation								
Roofing								
Joint Sealant Tubes								
Gypsum Board (scraps)								
Carpet and Pad (scraps)								
Piping								
Electrical Conduit								
Other:								

SECTION 01 77 00

CLOSEOUT PROCEDURES

1. PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Closeout Procedures.
- B. Final Cleaning.
- C. Pest Control.
- D. Adjusting.
- E. Demonstration and Instructions.
- F. Project Record Documents.
- G. Operation and Maintenance Data.
- H. Warranties.
- I. Spare Parts and Maintenance Materials.
- J. Commissioning.
- K. DVBE Participation Report.

1.2 PROJECT CLOSEOUT CONFERENCE

- A. As specified under Section 01 31 00.

1.3 CLOSEOUT PROCEDURES

- A. Submit written certification that Contract Documents have been reviewed, Work has been inspected, and that Work is complete in accordance with Contract Documents and ready for Architect's review.
- B. Prepare and submit to Architect a list of items to be completed or corrected, the value of the items on the list, and reasons why the Work is not complete.
- C. Submit written request to Architect for review of Work.
- D. Submit warranties, bonds, service agreements, certifications, record documents, maintenance manuals, receipt of spare parts and similar closeout documents.
- E. Make final changeover of permanent locks and deliver keys to Owner.
- F. Terminate and remove temporary facilities from Project site.
- G. Advise Owner of change over in heat and other utilities.
- H. Submit final Application for Payment identifying total adjusted Contract Sum, previous payments, and sum remaining due.
- I. Submit affidavit of payment of debts and claims, AIA Document G706.
- J. Submit affidavit of release of liens, AIA Document G706A.
- K. Submit consent of contractors surety to final payment, AIA Document G707.

- L. Owner will occupy all portions of the building as specified in Section 01 11 00.

1.4 REGULATORY REQUIREMENTS

- A. Provide final verified reports required by Section 39151 and 81141 of the Education Code in the manner prescribed by Title 24, Part 1, Section 4-336 and 4-343 in compliance with DSA Procedure: Project Certification Process PR 13-02.

1.5 FINAL CLEANING

- A. Execute final cleaning prior to final review by Architect.
- B. Employ experienced professional cleaners for final cleaning.
- C. Clean interior and exterior glass and surfaces exposed to view; remove temporary labels, stains and foreign substances, polish transparent and glossy surfaces.
- D. Vacuum carpeted and soft surfaces. Shampoo if visible stains exist.
- E. Clean equipment and plumbing fixtures to a sanitary condition.
- F. Clean exposed surfaces of grilles, registers and diffusers.
- G. Replace filters of operating mechanical equipment.
- H. Clean debris from roofs, gutters, downspouts, and drainage systems.
- I. Clean site; sweep paved areas, rake clean landscaped surfaces.
- J. Remove waste and surplus materials, rubbish, and construction facilities from the site.
- K. Clean light fixtures.
- L. Relamp all lamps and bulbs in lighting fixtures. Offer removed bulbs to Owner.
- M. Replace defective and noisy ballasts and starters in fluorescent fixtures.
- N. Leave project clean and ready for occupancy by Owner.

1.6 PEST CONTROL

- A. Engage an experienced, licensed exterminator to make final inspection and rid Project of rodents, insects, and other pests. Submit final report to Architect.

1.7 ADJUSTING

- A. Adjust operating Products and equipment to ensure smooth and unhindered operation.

1.8 DEMONSTRATION AND INSTRUCTIONS

- A. Demonstrate operation and maintenance of products, systems, and equipment to Owner's personnel two weeks prior to date of final review.
- B. For each demonstration submit list of participants in attendance.
- C. Provide two copies of video tape of each demonstration and instructions session.
- D. For equipment or systems requiring seasonal operation, perform demonstration for other season within six months.

- E. Utilize operation and maintenance manuals as basis for instruction. Review contents of manual with Owner's personnel in detail to explain all aspects of operation and maintenance.
- F. Demonstrate start-up, operation, control, adjustment, trouble-shooting, servicing, maintenance, and shutdown of each item of equipment at agreed-upon times, at equipment location.
- G. Prepare and insert additional data in operations and maintenance manuals when need for additional data becomes apparent during instruction.

1.9 PROJECT RECORD DOCUMENTS

- A. Maintain on site, one set of the following record documents; record actual revisions to the Work in contrasting color.
 - 1. Contract Drawings.
 - 2. Specifications.
 - 3. Addenda.
 - 4. Change Orders and other Modifications to the Contract.
 - 5. Reviewed shop drawings, product data, and samples.
- B. Store Record Documents separate from documents used for construction.
- C. Record information concurrent with construction progress.
- D. Specifications: Legibly mark and record at each Product Section in contrasting color ink, description of actual Products installed, including the following:
 - 1. Manufacturer's name and product model and number.
 - 2. Supplier and installer's name and contact information.
 - 3. Changes made by Addenda and Modifications.
- E. Contract Drawings and Shop Drawings: Legibly mark each item in contrasting color ink to record actual construction including:
 - 1. Measured horizontal and vertical locations of underground utilities and appurtenances, referenced to permanent surface improvements.
 - 2. Measured locations of internal utilities and appurtenances concealed in construction, referenced to visible and accessible features of the Work.
 - 3. Field changes of dimension and detail.
 - 4. Details not on original Contract Drawings.
 - 5. Revisions to electrical circuitry and locations of electrical devices and equipment.
 - 6. Note change orders, alternate numbers, and similar information, where applicable.
 - 7. Identify each record drawing with the written designation of "RECORD DRAWING" located in prominent location.

- F. Record Digital Data Files: Immediately before inspection for Substantial Completion, review marked-up record prints with Architect. When authorized, prepare a full set of corrected digital data files of the Contract Drawings, as follows:
1. Format: Annotated PDF electronic file with comment function enabled.
 2. Incorporate changes and additional information previously marked on record prints. Delete, redraw, and add details and notations where applicable.
 3. Refer instances of uncertainty to Architect for resolution.
 4. Architect will furnish Contractor one set of digital data files of the Contract Drawings for use in recording information.
 - (a) Refer to Section 01 33 00 "Submittal Procedures" for requirements related to use of Architect's digital data files.
 - (b) Architect will provide data file layer information. Record markups in separate layers.
- G. Final Property Survey: Under the provisions of Section 01 73 00.
- H. Record Construction Schedule: Under the provisions of Section 01 32 16.
- I. Submit documents to Architect at time of Substantial Completion.

1.10 OPERATION AND MAINTENANCE DATA

- A. Summary:
1. Organize operation and maintenance data with directory.
 2. Provide operation and maintenance manuals for products, systems, subsystems, and equipment.
 3. Refer to Divisions 02 thru 49 for specific operation and maintenance manual requirements for the Work in those Divisions.
- B. Submit two sets prior to final review, bound in 8-1/2 inch x 11 inch, three ring D size binders with durable vinyl covers.
- C. Prepare binder covers with printed title "OPERATION AND MAINTENANCE INSTRUCTIONS", title of project, and subject matter of binder when multiple binders are required.
- D. Internally subdivide the binder contents with permanent page dividers, logically organized as described below; with laminated plastic tabs.
- E. Part 1: Directory, listing names, addresses, and telephone numbers of Architect, Engineers, Contractor, subcontractors, and major equipment suppliers and manufacturers.
- F. Part 2: Operation and maintenance instructions, arranged by specification section. For each category, identify names, addresses, and telephone numbers of Subcontractors and suppliers. Identify the following:
1. Performance and design criteria.
 2. List of equipment.
 3. Parts list for each component.
 4. Start-up procedures.
 5. Shutdown instructions.
 6. Normal operating instructions.

7. Wiring diagrams.
 8. Control diagrams.
 9. Maintenance instructions for equipment and systems.
 10. Maintenance instructions for finishes, including recommended cleaning methods and materials.
- G. Part 3: Project documents and certificates, including the following:
1. Shop drawings and product data.
 2. Air and water balance reports.
 3. Certificates.
 4. Warranties.
- H. Refer to Section 01 91 13 - General Commissioning Requirements, for additional requirements.

1.11 WARRANTIES

- A. Commencement of warranties shall be date of Substantial Completion.
- B. For items of Work delayed beyond date of Substantial Completion, provide updated submittal within ten days after acceptance, listing date of acceptance as start of warranty period.
- C. Provide duplicate notarized copies in operation and maintenance manuals.
- D. Execute and assemble documents from subcontractors, suppliers, and manufacturers.
- E. Provide Table of Contents and assemble in binder with durable plastic cover.
- F. Submit prior to final Application for Payment.
- G. Manufacturer's disclaimers and limitations on product warranties do not relieve Contractor of warranty on the work that incorporates the products.
- H. Manufacturer's disclaimer and limitations on product warranties do not relieve suppliers, manufacturer's, and subcontractors required to countersign special warranties with Contractor.
- I. When correcting failed or damaged warranted construction, remove and replace construction that has been damaged as a result of such failure or must be removed and replaced to provide access for correction of warranted construction.
- J. When work covered by warranty has failed and has been corrected, reinstate warranty by written endorsement. Reinstated warranty shall be equal to original warranty with equitable adjustment for depreciation.
- K. Upon determination that Work covered by warranty has failed, replace or repair Work to an acceptable condition complying with requirements of the Contract Documents.

1.12 SPARE PARTS AND MAINTENANCE MATERIALS

- A. Provide products, spare parts, maintenance and extra materials in quantities specified in individual specification Sections.
- B. Deliver to Project site and place in location as directed.
- C. Obtain signed receipt for delivery of materials and submit prior to request for final review by Architect.

1.13 DISABLED VETERAN BUSINESS ENTERPRISE ("DBVE") PARTICIPATION

- A. Submit DVBE Participation Report as stipulated by Document 00 65 73.
- B. Provide supplemental report to substantiate non-compliance with District goal of three percent (3%) participation if required.

2. PART 2 PRODUCTS

Not Used

3. PART 3 EXECUTION

Not Used

END OF SECTION

SECTION 01 91 13

GENERAL COMMISSIONING REQUIREMENTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings, Agreement, Part 0, Special Conditions and Forms, and Division 01 Specifications Sections, apply to this Section.
- B. Owner's Project requirements and Basis of Design (BOD) documents – for information only.
- C. Project Commissioning Plan – for information only.
- D. Related Sections include the following:
 - 1. Section 22 08 00 - Commissioning of Plumbing.
 - 2. Section 23 08 00 - Commissioning of HVAC.
 - 3. Section 26 08 00 - Commissioning of Electrical Systems
 - 4. Individual Division 22, 23, and 26 Sections contain requirements related to the commissioning process.

1.2 SUMMARY

- A. An independent commissioning agent (CA) has been retained to implement and coordinate the commissioning process for this project. The objectives of the commissioning process are to:
 - 1. Achieve, verify and document that the performance of facilities, systems, and assemblies meet defined objectives and criteria.
 - 2. Verify that O&M documentation left on site is complete.
 - 3. Verify that the Owner's operating personnel are adequately trained.
- B. The commissioning process includes specific tasks to be conducted during each phase in order to verify that design, construction, operation and occupancy meet the Owner's project requirements.

- C. This section defines the members of the commissioning team (CxT) and outlines the responsibilities of each member of the CxT. All CxT members work together to fulfill their contracted responsibilities and meet the objectives of the contract documents.
- D. The commissioning process does not take away from or reduce the responsibility of the system designers or installing contractors to provide a finished and fully functioning product.
- E. The commissioning process does not include the Title 24 Acceptance Test requirements. All envelope, mechanical and covered process acceptance testing, and associated certificate of acceptance documentation, must be completed by the installing contractor. All indoor and outdoor lighting acceptance tests, and associated certification of acceptance documentation, must be completed by a certified lighting control acceptance test technician (CLCATT).
- F. Participating CxT entities shall each include the cost to complete their work of the commissioning process in their proposal.

1.3 COMMISSIONED SYSTEMS

- A. Refer to Section 22 08 00 for listing of plumbing equipment/systems to be commissioned.
- B. Refer to Section 23 08 00 for listing of HVAC equipment/systems to be commissioned.
- C. Refer to Section 26 08 00 for listing of electrical equipment/systems to be commissioned.
- D. New electrical supply equipment associated with above systems.

1.4 DEFINITIONS

- A. Acceptance: A formal action, taken by a person with appropriate authority (which may or may not be contractually defined) to declare that some aspect of the project meets defined requirements, thus permitting subsequent activities to proceed.
- B. Basis of Design: A document that records the concepts, calculations, decisions, and product selections used to meet the Owner's Project requirements and to satisfy applicable regulatory requirements, standards, and guidelines. The document includes both narrative descriptions and lists of individual items that support the design process.
- C. Checklists: Verification checklists that are developed and used during all phases of the commissioning process to verify that the Owner's Project requirements are being achieved. This includes checklists for general verification, plus testing, training, and other specific requirements.
- D. Commissioning or Commissioning Process: A quality-focused process for enhancing the delivery of a Project. The process focuses on verifying and documenting that the facility and all of its systems and assemblies are planned, designed, installed, tested, operated, and maintained to meet the Owner's Project requirements.

- E. Commissioning Process Activities: Components of the commissioning process.
- F. Commissioning Agent: The entity identified by the Owner who plans, schedules, and coordinates the commissioning team to implement the commissioning process.
- G. Commissioning Plan: A document that provides the organization, schedule, and coordination planning for the commissioning process.
- H. Commissioning Process Progress Report: A written document that details activities completed as part of the commissioning process and significant findings from those activities, which is continuously updated during the course of a Project.
- I. Commissioning Request for Information (RFI): Form used by the CA to request information from the design and construction team.
- J. Commissioning Team: The individuals who through coordinated actions are responsible for implementing the commissioning process.
- K. Coordination Drawings: Drawings showing the work of all trades to illustrate that equipment can be installed in the space allocated without compromising equipment function or access for maintenance and replacement. These drawings graphically illustrate and dimension manufacturers' recommended maintenance clearances.
- L. Deferred Performance Tests (DPTs): Performance tests that are performed, at the discretion of the CA, after Substantial Completion, due to partial occupancy, equipment, seasonal requirements, design, or other site conditions that do not allow the test to be performed.
- M. Deficiency: A condition in the installation or function of a component, piece of equipment, or system that is not in compliance with the contract documents.
- N. Document Request Log: A log maintained by the CA to list and track documents requested from the design and construction team.
- O. Factory Testing: Testing of equipment on-site or at the factory, by factory personnel, with or without an Owner's Representative present.
- P. Functional Performance Test: A written protocol that defines methods, personnel, and expectations, for tests conducted on components, equipment assemblies, systems, and interfaces among systems.
- Q. Integrated System Testing: A written protocol that defines methods, personnel and expectations for tests conducted to verify proper interface and interaction between HVAC, building automation, electrical, security and fire systems. In addition to testing the response of these systems to a building power outage and restoration, HVAC equipment is tested to verify that modules of capacity are brought on automatically in response to added heat load.

- R. Issues Log: A formal and ongoing record of problems or concerns - and their resolution - that have been raised by members of the commissioning team during the course of the commissioning process.
- S. Non-Compliance: See Deficiency.
- T. Non-Conformance: See Deficiency.
- U. Owner's Project Requirements: A written protocol that details the functional requirements of a Project and the expectations of how it will be used and operated. This includes project and design goals, measurable performance criteria, and supporting information.
- V. Phased Commissioning: Commissioning that is completed in phases as required by the phasing plan as approved for the Project and other scheduling issues.
- W. Pre-Functional/Start-Up Checklist: A form used by the Contractor to verify that appropriate components are on-site, ready for installation, correctly installed, and functional.
- X. Seasonal Performance Tests: Performance tests that are deferred until the system(s) will experience conditions closer to their design conditions based on weather conditions.
- Y. Training Plan: A written document that details the expectations, schedule, budget, and deliverables of commissioning process activities related to training of project operating and maintenance personnel, users, and occupants.
- Z. Verification: The process by which specific documents, components, equipment, assemblies, systems, and interfaces among systems are confirmed to comply with the criteria described in the Owner's Project requirements.

1.5 SUBMITTALS

- A. The CA will provide the Contractor with a specific request for the type of submittal documentation the CA requires facilitating the commissioning work. These requests will be integrated into the normal submittal process and protocol of the construction project. All documentation requested by the CA will be included by the Contractor in the O&M manual.
- B. The CA will review submittals related to the commissioning of equipment for conformance to the contract documents as it relates to the commissioning process, to the performance of the equipment and adequacy for developing test procedures. This review is intended primarily to aid in the development of performance test procedures and only secondly to verify compliance with equipment specifications. The CA will follow communications protocol to notify those required of items missing or areas that are not in conformance with contract documents and which require submission.
- C. CA shall receive submittals concurrent to Architect / Engineer. CA will provide comments, when required, to Architect / Engineer for inclusion in their comments to contractors.

D. Shop Drawings:

1. Include a complete bill of material of equipment used indicating quantity, manufacturer and model number and other relevant technical data.
2. Include manufacturer's description and technical data, such as performance curves, performance test procedures, product specification sheets, schedules, settings and installation, operation and maintenance instructions, and detailed startup procedures.
3. Submittals shall contain outline dimensions, layout details, operating and maintenance clearances and sufficient engineering data to indicate compliance with the specifications.
4. Scale and Measurements: Make Shop Drawings accurately to a scale sufficiently large to show all pertinent aspects of the item and its method of connection to the work.
5. Each piece of equipment shall be identified by the number shown in the schedules and specification article number pertaining to the item. Shop Drawings shall, at a minimum, be 1/4 inch equal 1'-0" scale and shall be newly prepared by the Contractor and not reproduced from the Architect / Engineer's Drawings.
6. When manufacturer's cut sheets apply to a product series rather than a specific product, the data specifically applicable to the Project will be highlighted or clearly indicated by other means. General catalogs will not be accepted as cut sheets to fulfill submittal requirements.

E. The CA may request additional submittals/information not listed above and design narrative from the Architect / Engineer, Contractor, and/or equipment suppliers, etc.

F. Submittals to the CA do not constitute compliance for O&M manual documentation. The O&M manuals are the responsibility of the Contractor, through the CA will review and approve them.

1.6 COMMISSIONING TEAM

A. Members appointed by Contractor: Individuals, each having expertise and authority to act on behalf of the entity he or she represents, explicitly organized to implement the commissioning process through coordinated actions. The commissioning team shall consist of, but not be limited to, representatives of Contractor, including project superintendent and subcontractors, installers, suppliers, and specialists deemed appropriate by the CA.

B. Members appointed by Owner:

1. CA: An entity identified by the Owner who leads, plans, schedules, and coordinates the commissioning team to implement the commissioning process. Owner has engaged the CA under a separate contract.
2. Representatives of the facility user and operation and maintenance personnel.

3. Architect and engineering design professionals (A/E).

C. Members of the Commissioning Team, at minimum, to include:

1. Owner's Representative.
2. Owner Operations Staff Representative.
3. Architect / Engineer (A/E).
4. General Contractor.
5. Mechanical Sub-contractor.
6. Plumbing Sub-contractor.
7. Major HVAC, Plumbing Equipment Suppliers.
8. Electrical Sub-contractor.
9. Lighting Controls Equipment Supplier.
10. Major Electrical Systems Suppliers.
11. Test and Balance Sub-contractor.
12. Commissioning Agent.

1.7 RESPONSIBILITIES

A. All CxT Members:

1. Follow the commissioning plan.
2. Attend preconstruction commissioning meeting and additional commissioning meetings as necessary.
3. Cooperate with all CxT members to carry out commissioning process.
4. Include the price of commissioning responsibilities/tasks in each CxT member's proposal.

B. Commissioning Agent (CA):

1. Develops a commissioning plan outlining the organization, schedule, allocation of resources, and documentation requirements of the commissioning process. CA oversees implementation of commissioning plan.
2. Coordinates and directs the commissioning activities in a logical, sequential and efficient manner using consistent protocols and forms, centralized documentation, clear and regular communications and consultations with all necessary parties, updated timelines and schedules and technical expertise.
3. The CA shall develop specific commissioning documentation. This commissioning documentation shall be kept in three ring binders. All pages shall be numbered and a table of contents page(s) shall be provided. The CA developed commissioning documentation shall include, but not be limited to, the following:
 - a. Commissioning plan.
 - b. Commissioning schedule.
 - c. Commissioning RFIs.
 - d. Issues log.
 - e. Pre-functional/startup checklists.
 - f. Functional performance test procedures.
 - g. Commissioning progress reports.
 - h. Commissioning team meeting minutes.
 - i. Final commissioning report.
4. Additional documentation required of the commissioning process that the CA shall verify is in place and review (when contracted to do so), includes the following:
 - a. Owner's Project requirements document.
 - b. Basis of design document.
 - c. Shop Drawing submittals.

- d. Installation, operation and maintenance (O&M) manuals
 - e. Training materials, agenda and training schedules for Owner's operating personnel.
 - f. As-built documentation.
 - g. Warranties for equipment, systems and Project.
 - h. Test and balance reports.
 - i. Results of factory tests specified in Division 23 and 26 Sections of this specification for construction.
 - j. Results of tests specified in Division 23 and 26 Sections of this specification for construction.
 - k. Commissioned systems resource manual.
- 5. Provides Contractor training with regards to testing process, forms used, approval process, and scheduling.
 - 6. The CA may assist with problem solving, non-conformance or deficiencies, but ultimately that responsibility resides with the Contractor and the Architect / Engineer.
 - 7. The CA is not responsible for the design concept, design criteria, compliance with codes, review or approval of change orders, design or construction scheduling or cost estimating.
 - 8. The CA coordinates the commissioning work and, with the Contractor, ensures that commissioning activities are being incorporated into the construction schedule maintained by the Contractor.
 - 9. Makes revisions to the commissioning plan as required.
 - 10. Plans and conducts a pre-construction commissioning meeting and other commissioning meetings.
 - a. Prepares meeting agendas, meeting minutes and distributes to the commissioning team.
 - 11. Requests and reviews additional information required to perform commissioning tasks, including O&M materials and Contractor pre-functional/startup checkout procedures.
 - 12. Reviews normal Contractor submittals applicable to systems being commissioned for compliance with commissioning needs, concurrent with the Architect / Engineer's reviews.

13. Develops a startup, checkout, Contractor directed test, CA witnessed test and integrated system test plan with Contractor.
14. Attends selected planning and job-site meetings to obtain information on construction progress. Reviews construction meeting minutes for revisions/substitutions relating to the commissioning process. Assists in resolving any discrepancies.
15. Conducts periodic construction observations, as contracted, to verify that systems and equipment are installed consistently with Owner's Project requirements, basis of design and contract documents. Documents deficiencies in the issues log and distributes to the CxT. (Note: The CA is responsible for identifying deficiencies but is not responsible for ensuring that deficiencies are corrected. Also note that CA observations are not intended to take the place of design team observations.)
16. Approves pre-functional checklist/startup completion by reviewing checklist reports and by selected site observation.
17. With necessary assistance and review from the Architect / Engineer and Contractor, writes the functional test procedures and integrated systems test procedures for equipment and systems.
18. Reviews the control sequences and interlocks and works with Contractor and Architect / Engineer until sufficient clarity has been obtained, in writing, to be able to write detailed testing procedures.
19. Reviews and approves completed Contractor directed functional performance test forms.
20. Directs functional performance tests (CA witnessed) after "Contractor directed" functional testing has been completed and Contractor directed functional performance test forms have been filled out, submitted to and approved by CA.
21. Coordinates retesting as necessary until satisfactory performance is achieved.
22. Analyzes any performance trend logs and monitoring data to verify performance.
23. Reviews test and balance reports along with Architect / Engineer.
24. Recommends acceptance of the individual systems and assemblies to the Owner.
25. Maintains a master issues log and a separate testing record. Provides the Owner, Architect / Engineer, and Contractor with written progress reports and test results with recommended actions.
26. Verifies the training of the Owner's operating personnel has been completed.

27. Reviews equipment warranties to ensure that the Owner's responsibilities are clearly defined.
28. Compiles and maintains commissioning documents.
29. Coordinates and supervises required seasonal or deferred testing and deficiency corrections.

C. Owner:

1. Defines the Owner's Project requirements (OPR), provides interpretations and clarifications to the OPR, and provides OPR document to CA and Contractor for information and use.
2. Manages the contract of the Architect / Engineer (A/E) and Contractor.
3. Facilitates the coordination of the commissioning work by the CA, and, with the Contractor and CA, ensures that commissioning activities are being scheduled into the construction schedule.
4. Assigns operations and maintenance personnel and arranges for them to participate in the various meetings and observations/inspections as follows:
 - a. Design/construction phase coordination meetings.
 - b. Procedure meetings for testing systems.
 - c. Pre-functional/startup checkouts.
 - d. Functional testing.
 - e. Systems testing.
5. Assists with gathering of documents requested of CxT members.
6. Provides the basis of design documents, approved by Owner, to the CA and Contractor.
7. Reviews, comments and approves the commissioning plan.
8. Reviews, comments and approves the construction documents.
9. Performs review of Contractor submittals.
10. Coordinates site visits and meetings with the CA.

11. Attends commissioning meetings, pre-functional/startup procedures, and functional testing.
12. Reviews, comments and approves the CA's functional test reports.
13. Provides access to areas of the facility in a timely manner for commissioning team to perform its work.
14. Reviews commissioning progress reports and issues log.
15. Coordinates the resolution of non-compliance and design deficiencies identified in all phases of commissioning.
16. Develops final punchlist for the construction project.
17. Reviews and accepts the CA's final commissioning report and provides final approval for the completion of the commissioning work.
18. Ensures that any seasonal or deferred testing and any deficiency issues are addressed.
19. Participates in warranty review activities 10 months into 12-month warranty period with other members of the CxT.

D. Architect / Engineer (A/E):

1. Provides documentation of design intent/basis of design based on Owner's Project requirements.
2. Prepares construction contract documents.
3. Specifies and verifies adequate maintenance access for each piece of equipment in design, Shop Drawings, and actual installation.
4. Provides system design parameters to Owner and obtains approval.
5. Provides any design narrative documentation requested by the CA. This includes clarifying the operation and control of commissioned equipment in areas where the specifications, control drawings or equipment documentation is not sufficient for writing detailed testing procedures.
6. Notifies the CA of substantive changes to the contract documents.
7. Reviews and comments on pre-functional/startup checklists and functional performance test procedures submitted by the CA.

8. Reviews and approves submittals.
9. Provides periodic site observations as contracted.
10. Witnesses testing of selected equipment and systems.
11. Reviews and comments on CA's commissioning progress reports and issues logs.
12. Reviews and approves O&M data and training plan.
13. Reviews and/or prepares as-built documents from Contractor record documents as contracted.
14. Prepares punchlists.
15. Prepares final basis of design document.
16. Reviews and approves test and balance plan and reports.
17. Provides designer's intent training for Owner's operating personnel, if included in Architect / Engineer contract.
18. Coordinates the resolution of system deficiencies identified during commissioning.
19. Coordinates resolution of design non-conformance and deficiencies identified during warranty period commissioning.
20. Recommends final acceptance of the systems to the Owner.
21. Reviews and comments on the final commissioning report.

E. Contractor:

1. The Contractor is responsible for his commissioning activities and coordinating all commissioning activities of his sub-contractors and equipment suppliers.
2. Facilitates the coordination of commissioning work by the CA and ensures that the Contractor, his sub-contractors, and all other CxT member commissioning tasks/activities are incorporated into the construction schedule.
3. Furnishes a copy of all construction documents, addenda, change orders, requests for information, and approved submittals and Shop Drawings related to commissioned equipment/systems to CA.

4. Includes requirements for submittal data, O&M data, commissioning tasks and training in each purchase order or subcontract written.
5. Performs review of submittals.
6. Ensures that all sub-contractors execute their commissioning responsibilities according to the contract documents and schedule.
7. Attends Contractor training conducted by CA concerning commissioning process, forms to be used, testing requirements, commissioning process deliverables and scheduling.
8. Attends CxT meetings.
9. Provides functional and seasonal testing plan in accordance with procedures supplied in this Section.
10. Responds to (in writing) and addresses items documented in the issues log.
11. Notifies the CA six weeks in advance of all equipment startup, Contractor directed testing, and tests required by contract documents.
12. Contractor to certify that equipment/systems have been installed per manufacturer's instructions.
13. Reviews and makes comment on the pre-functional/startup checklists and functional performance test procedures developed by CA.
14. Submits test results for tests required by the contract documents, including (but not limited to) duct leakage tests, plumbing system disinfection certification, fire alarm tests, etc.
15. Completes pre-functional/startup checkout forms to CA for review and approval.
16. Completes Contractor directed functional performance testing. This testing mandates the participation of Contractor and all sub-contractors involved with systems integration, such as, mechanical, electrical, and controls sub-contractors. Submits completed Contractor directed functional test forms to CA for review and approval.
17. Notifies the CA when systems and assemblies are ready for CA witnessed testing.
18. Remedies any deficiencies identified in the pre-functional/startup checklists and Contractor directed functional performance testing and notifies CA (in writing) that deficiencies have been addressed.
19. Coordinates and facilitates the resolution of non-compliance, deficiencies and discrepancies identified in all phases of commissioning.

20. Notifies the CA four weeks in advance when test and balancing activities are to start and when their activities have been completed.
21. Provides qualified personnel for performing all test procedures, including functional performance testing witnessed by CA.
22. Performs functional performance testing of assemblies and systems witnessed by the CA.
23. Coordinates training of Owner personnel. Develops training agenda, training materials, conducts training sessions. Schedules sub-contractors, equipment suppliers, etc. to participate in training the Owner's personnel. Coordinates with Owner schedule for training Owner operating personnel.
24. Provides training agenda and schedules to CA for review and comment.
25. Prepares O&M manuals, according to the contract documents, including clarifying and updating the original sequences of operation to as-built conditions. Submits O&M manuals to CA for review prior to Owner operating personnel training. O&M manuals are to be used in training sessions.
26. Submits complete set of as-built records to CA for review.
27. Ensures that Contractor and sub-contractors execute seasonal and deferred functional performance testing, witnessed by the CA, according to the specifications.
28. Ensures that Contractor and sub-contractors correct deficiencies and make necessary adjustments to O&M manuals and as-built records for applicable issues identified in any seasonal or deferred testing.
29. Participates in warranty review activities coordinated by CA 10 months into 12-month warranty period.

F. Equipment Suppliers:

1. Provides all requested submittal data, including detailed start-up procedures and specific responsibilities of the Owner to keep warranties in force.
2. Assists in equipment testing per agreements with Contractor.
3. Includes all special tools and instruments (only available from equipment supplier, specific to a piece of equipment) required for testing equipment according to these contract documents.
4. Analyzes specified products and verifies that the Architect / Engineer has specified the newest, most updated equipment reasonable for this Project's scope.

5. Provides information requested by CA regarding equipment sequence of operation and testing procedures.
6. Reviews and approves test procedures for equipment installed by factory representatives.
7. Provides personnel, services, documents, tools, etc. for those responsibilities listed under Contractor that are applicable to equipment suppliers.

1.8 COORDINATION

- A. The CA shall receive a copy of all construction documents, addenda, change orders, and appropriate approved submittals and Shop Drawings related to commissioned system/equipment directly from the Contractor.
- B. The CA shall disseminate written information and documents to all responsible parties relative to the nature and extent of the communication.
- C. The CA is primarily responsible to the Owner and, as such, shall regularly apprise the Contractor and the Owner of progress, pending problems and/or disputes, and shall provide regular status reports on progress with each system. Any potential change in the contractual and/or financial obligations of the Owner (credits, change orders, schedule changes, etc.) shall be identified and quantified as soon as possible.
- D. The CA shall coordinate the schedule of commissioning activities with the construction schedule. It is possible that some procedures will be completed before the entire system is completed.

1.9 SCHEDULE

- A. Contractor schedules and scheduling is the responsibility of the Contractor. The CA shall provide commissioning scheduling information to the Contractor for review and planning activities. CA developed commissioning activities to be integrated into the construction schedule by the Contractor.
- B. The schedule shall incorporate sufficient time for the following commissioning process steps:
 1. Equipment/systems shall be installed per manufacturer's instructions.
 2. Pre-functional/startup checklists will be completed by the field personnel implementing the startup procedure, field personnel to sign the completed form, and submit signed checklist to CA for review and approval.

3. Contractor Directed Functional Testing: The Contractor shall perform functional performance testing of systems/equipment once pre-functional/startup checklists have been approved by CA. Personnel actually carrying out Contractor directed functional performance testing are to fill out test forms during the "Contractor Directed" testing and the appropriate contracting team personnel shall sign the completed forms. Submit signed, completed forms to CA for review and approval.
 4. CA Witnessed Functional Testing: The Contractor shall perform functional performance testing to be witnessed by the CA after step 3 above has been completed. The CA shall complete and sign functional performance test forms for those tests completed in this step.
- C. The Contractor will integrate all commissioning activities into the overall construction schedule. All parties will address scheduling problems and make necessary notifications in a timely manner in order to expedite the commissioning process.
 - D. Problems observed shall be addressed immediately, responsible parties notified, and actions taken to correct deficiencies coordinated in a timely manner.

PART 2 - PRODUCTS

2.1 TEST EQUIPMENT

- A. All industry standard test equipment, special tools, ladder/lifts, two-way radios and equipment required for performing the specified tests shall be provided by the Contractor and shall be approved by the CA. The Owner shall furnish necessary utilities for the commissioning process.
- B. Any portable or hand-held setup/calibration devices required to initialize the control system shall be provided by the control system sub-contractor and equipment supplier for testing.
- C. The instrumentation used in the commissioning process shall meet the following standards:
 1. Be sufficient quality and accuracy to test and/or measure system performance within the tolerances required.
 2. Be calibrated at the manufacturer's recommended intervals with calibration tags permanently affixed to the instrument.
 3. Be maintained in good repair and operating condition throughout the duration of use on this project.
 4. Be immediately recalibrated or repaired if dropped and/or damaged in any way during use on this project.

PART 3 - EXECUTION

3.1 COMMISSIONING PLAN

- A. The CA will develop a commissioning plan detailing the following information, at minimum, for the project:
 - 1. Contact directory of key commissioning team personnel
 - 2. Communications protocol for project
 - 3. Listing of equipment/systems to be commissioned
 - 4. Sampling strategy to be used for equipment and systems for applicable commissioning process.
 - 5. Responsibilities for each party involved with the commissioning process
 - 6. Commissioning milestone and schedule
 - 7. Listing of key deliverables associated with the commissioning process
 - 8. Note that the commissioning plan will be incorporated into the commissioning report so that one document will be used throughout the commissioning process and when the process is completed this document will be called the final commissioning report.
 - 9. Listing of exhibits to the commissioning plan/report.

3.2 MEETINGS

- A. The CA will schedule, plan and conduct an initial commissioning meeting with the Contractor. The Contractor and its responsible parties are required to attend.
- B. Other meetings will be planned and conducted by the CA as construction progresses. The meetings will cover coordination, deficiency resolution, and planning issues. These meetings will be held at least monthly, until the final three months of construction, when they may be held as frequently as one per week.

3.3 CONSTRUCTION OBSERVATION

- A. CA construction observation is an additional and separate activity from that provided by the design team. Construction observation is required as part of the commissioning and coordination process to be provided by the CA.

3.4 TEST AND BALANCE (TAB)

- A. Air and water test and balance shall be accomplished by a test and balance firm as specified by the Architect / Engineer.

3.5 PRE-FUNCTIONAL/STARTUP CHECKLISTS

- A. The following procedures apply to all equipment/systems to be commissioned.
- B. Pre-functional/startup checklists are important to verify that the equipment and systems are installed, fully connected and ready to operate in accordance with contract documents. It ensures that performance testing (in-depth system checkout) may proceed without unnecessary delays. The pre-functional/startup checklist for a given system must be successfully completed and approved prior to formal performance testing of equipment or subsystems of the given system.
- C. The CA will coordinate with Contractor and his sub-contractors for the commissioned equipment/system to create a pre-functional/Star-up checklist that is specific to the particular equipment/system. The intent of the pre-function/startup checklist is to incorporate the manufacturer's startup routines and CA's initial checkout and startup requirements.
- D. CA will approve the final content and documentation format for all pre-functional/startup checklists used for commissioned equipment/systems on this project.
- E. The Contractor shall determine which trade is responsible for executing and documenting each of the line item tasks and transmit the checklist to the responsible sub-contractors. Each form may have more than one trade responsible for its execution.
- F. The Contractor and his sub-contractors are to provide the services of personnel to implement the pre-functional/startup checklists.
- G. The Contractor is to provide access to contract plans, Shop Drawings, equipment cut sheets, as-built wiring schematics, sub-system interfaces and interlocks.
- H. Execution of Pre-functional/Startup Checklists:
 - 1. Six weeks prior to the scheduled startup, the Contractor shall coordinate startup and checkout with the Owner, Architect / Engineer and CA. **The execution of the pre-functional/startup checklists, startup, and checkout shall be directed and performed on 100% of the equipment/systems by the personnel of the Contractor, sub-contractors and/or equipment suppliers.** Signatures are required of personnel performing pre-functional/startup checklist tasks for verification of completion of their work.
 - 2. The Owner and Architect / Engineer, as necessary, shall observe the execution of pre-functional/startup checklists.

3. The CA will observe execution of pre-functional/startup checklists based on sampling strategy identified in the commissioning plan.
 4. The personnel of the Contractor, sub-contractors, and equipment suppliers shall execute startup and Contractor shall provide the CA, with a signed and dated copy of the completed pre-functional/startup checklists.
 5. Only personnel of the Contractor (technicians, engineers, tradesmen, equipment suppliers, etc.) who have direct knowledge and witnessed that a line item task on the pre-functional/startup checklist was actually preformed shall check off that item. It is not acceptable for witnessing supervisors to fill out these forms.
 6. CA will review and approve pre-functional/startup checklists submitted by Contractor.
- I. Pre-functional/startup checklists filled out by the appropriate personnel, signed and approved by the CA will be included in the commissioning report.

3.6 CONTRACTOR DIRECTED FUNCTIONAL PERFORMANCE TESTING

- A. Functional performance testing shall demonstrate that each system is operating according to the documented Owner's project requirements and basis of design and contract documents. Functional performance testing facilitates bringing the systems from a state of individual substantial completion to full dynamic operation.
- B. Functional performance test forms (FPTFs) shall be developed by the CA. The basis of the FPTFs shall be the control sequence of operation for the equipment/system.
- C. Control sequences of operation specified by the Architect / Engineer and provided by the Contractor shall include all operating modes, interlocks, control responses, and specific responses to abnormal or emergency conditions.
- D. Before test procedures are finalized, the Contractor shall provide to the Architect / Engineer and the CA all requested documentation and a current list of changes affecting equipment or systems, including an updated points list, program code, control sequences, and testing parameters. Using the testing parameters and requirements in the technical specifications, the CA shall update/develop specific test procedures and forms to verify and document proper operation of each piece of equipment and system. Contractor and his sub-contractors and equipment suppliers, as appropriate, shall provide assistance to the CA in developing the final procedures. Prior to finalization, the Owner and Architect / Engineer shall review and concur with the test procedure.
- E. Sample functional performance test procedure forms are made part of the project specifications and are found in an appendix of this specification section.

F. Execution of Contractor Directed Functional Performance Testing

1. Contractor directed FPT cannot proceed until pre-functional/startup checklist process is completed and checklists have been approved by the CA.
2. Air and water system balance shall be completed before performance testing of air or water-related equipment or systems.
3. Contractor shall coordinate with Owner, Architect / Engineer and CA the start of Contractor directed functional performance testing on the commissioning equipment/systems. Contractor directed testing will occur no sooner than 48 hours from approval from CA of pre-functional/startup checklists.
4. The Owner and Architect / Engineer, as necessary, shall observe the execution of Contractor directed functional performance testing.
5. The CA will not be present for Contractor directed functional performance testing.
6. The contracting team carrying out Contractor directed testing will include trades necessary to functionally test the equipment/system and its interaction with other equipment/systems. This generally includes mechanical, electrical, temperature control personnel and may also include equipment suppliers and test balance personnel.
7. The Contractor will coordinate so that all personnel required to carry out Contractor directed functional performance testing are present and are working together to complete the task.
8. Contractor directed functional performance testing will include the following, at minimum:
 - a. Set the system equipment (i.e. AHU's, etc.) into the operating mode to be tested (i.e. normal shut-down, normal auto position, normal manual position, unoccupied cycle, emergency power and alarm conditions, etc.)
 - b. Repeat test for each operating cycle that applies to the system being tested.
 - c. Perform operating checks of all safety cutouts, alarms, and interlocks with smoke control and life safety systems during all modes of operation of the mechanical/electrical systems.
9. The Contractor shall inspect and verify the position of each device and interlock identified in the test procedures. Each item shall be signed off as acceptable (yes) or failed (no).
10. Contractor directed functional performance testing shall be completed on 100% of the equipment/systems included in the commissioning process. Contractor directed functional testing is the contracting team's trouble-shooting phase of the testing process.

11. During Contractor directed functional performance testing, the contracting team completing the testing procedures is to fix problems as they appear and is required to fill out and sign the Contractor directed test procedure forms. Note that the test procedure forms are identical to that used during the CA witnessed testing.
 12. Once Contractor directed functional testing is complete, problems fixed and forms filled out and signed by the appropriate personnel, submit the forms to CA for review and approval.
 13. Only individuals of the Contractor (technicians, engineers, tradesmen, equipment suppliers, etc.) who have direct knowledge and witnessed that a line item task on the functional test procedure was actually performed shall check off that line item. It is not acceptable for witnessing supervisors to fill out these forms.
 14. Upon CA approval of the Contractor directed functional performance test forms, the equipment/system is ready for CA witnessed testing.
- G. Contractor directed functional performance test forms filled out by the appropriate personnel, signed and approved by the CA will be included in the final commissioning report.

3.7 CA WITNESSED FUNCTIONAL PERFORMANCE TESTING

- A. The identical test procedures and forms that the contracting team used for Contractor directed functional performance testing will be used for CA witnessed testing.
- B. The same contracting team that executed Contractor directed functional testing will again be onsite and execute functional performance testing to be witnessed by the CA.
- C. Execution of CA Witnessed Functional Performance Testing:
1. CA witnessed functional performance testing will not proceed until Contractor directed functional testing has been completed, forms completed and signed by the appropriate personnel and CA has reviewed and approved the test forms.
 2. CA shall coordinate with Owner and Architect / Engineer that Contractor directed testing has been approved by CA.
 3. Contractor shall notify contracting team the CA witness testing can proceed and that scheduling of CA witnessed testing should occur.
 4. CA witnessed testing shall occur no sooner than 48 hours from approval of CA approval of Contractor directed functional performance testing.

5. In some cases, multiple identical piece of equipment will be witness tested by CA using a sampling strategy. Significant application differences and significant sequence of operation differences in otherwise identical equipment invalidates the common identity. A small size or capacity difference alone does not constitute a difference.
6. CA witnessed testing will occur when enough equipment/systems have met CA approval of Contractor directed functional performance testing and can be grouped together to be efficient for CA to be onsite.
7. During CA witnessed testing the contracting team executing/performing the mechanical/integrated automations systems test will execute the functional performance test which includes, at minimum:
 - a. Set the system equipment (i.e. chiller, boiler, pumps, fan, etc.) into the operating mode to be tested (i.e. normal shut-down, normal auto position, normal manual position, unoccupied cycle, emergency power and alarm conditions etc.)
 - b. Repeat test for each operating cycle that applies to the system being tested.
 - c. Perform operating checks of all safety cutouts, alarms, and interlocks with smoke control and life safety systems during all modes of operation of the mechanical/electrical systems.
8. The CA shall inspect and verify the position of each device and interlock identified in the test procedure. Each item shall be sign off as acceptable (yes) or failed (no).
9. During CA witnessed functional testing, the CA will document results of the test on the functional performance test forms.
10. If during the test an operating deficiency is observed, appropriate comments will be added to the test procedure form and the issue log.
11. Corrections of minor deficiencies identified may be made during the tests at the discretion of the CA. In such cases the deficiency and resolution will be documented on the procedure form or an attached sheet.

D. Non-Conformance

1. As tests progress and a deficiency is identified, the CA shall discuss the issue with the commissioning team and the contractor.

2. When there is no dispute on the deficiency and the Contractor accepts responsibility to correct it:
 - a. The CA will document the deficiency and the Contractor's response and intentions. The CA will submit the noncompliance reports to the Owner. The Contractor corrects the deficiency, signs the statement of correction at the bottom of the non-compliance form certifying that the equipment is ready to be retested and sends it back to the CA.
 - b. The Contractor shall reschedule the test; and the test is repeated.
3. If there is a dispute about a deficiency, regarding whether or not it is a deficiency:
 - a. The dispute shall be documented on the non-compliance form with the Contractor's response.
 - b. Resolutions are made at the lowest management level possible. Other parties are brought into the discussions as needed. Final interpretive authority is with Architect / Engineer. Final acceptance authority is with the Owner.
 - c. The CA documents the resolution process.
 - d. Once the interpretation and resolution have been decided, the Contractor corrects the deficiency, signs the statement of correction on the non-compliance form and provides it to the CA. The Contractor shall reschedule the test and the test is repeated until satisfactory performance is achieved.
4. If a test is failed, **the cost of further retesting of a performance test shall be the responsibility of the Contractor including the CA billable time and expenses for re-witnessing the test.**
5. The Contractor shall submit in writing to the Owner and CA at least as often as commissioning meetings are being scheduled, the status of each outstanding discrepancy identified during commissioning. Discussion shall cover explanations of any disagreement and proposals for their resolutions.
 - a. The CA retains the original non-conformance forms until the end of the project.
 - b. Retesting shall not be considered a justified reason for a claim of delay or for a time extension by the Contractor.

- E. Failure Due to Manufacturing Defect: If 10% (or three, whichever is greater) of identical pieces of equipment fail to perform to the contract documents (mechanically or substantively) due to a manufacturing defect, not allowing it to meet its submitted performance specification, all identical units may be considered unacceptable by the Architect / Engineer or CA. In such case, the Contractor shall provide the Owner with the following:
1. Within one week of notification from the Owner, the Contractor or manufacturer's representative shall examine all other identical units making a record of the findings. The findings shall be provided to the Owner within two weeks of the original notice.
 2. Within two weeks of the original notification, the Contractor or manufacturer shall provide a signed and dated, written explanation of the problem, cause of failures, etc., and all proposed solutions. The proposed solutions shall not significantly exceed the specification requirements of the original installation.
 3. The Architect / Engineer will determine whether a replacement of all identical units or a repair is acceptable.
 4. Two examples, where applicable, of the proposed solution shall be installed by the Contractor and the Architect / Engineer shall be allowed to test the installations for up to one week, upon which the Architect / Engineer will decide whether to accept the solution.
 5. Upon acceptance, the Contractor and/or manufacturer shall replace or repair all identical items, at their expense. The replacement/repair work shall proceed with reasonable speed beginning within one week from when parts can be obtained.

3.8 SENSOR AND ACTUATOR CALIBRATION

- A. Calibrate all field-installed temperature, relative humidity, carbon monoxide, carbon dioxide, and pressure sensors and gages, and all actuators (dampers and valves) on this piece of equipment shall be calibrated. Sensors installed in the unit at the factory with calibration certification provided need not be field calibrated.
- B. Calibrate using the methods described below; alternate methods may be used, if approved by Commissioning Authority and Owner beforehand. See PART 2 for test instrument requirements. Record methods used on the relevant Prefunctional Checklist or other suitable forms, documenting initial, intermediate and final results.
- C. All Sensors:
1. Verify that sensor location is appropriate and away from potential causes of erratic operation.
 2. Verify that sensors with shielded cable are grounded only at one end.

3. For sensor pairs that are used to determine a temperature or pressure difference, for temperature make sure they are reading within 0.2 degree F (0.1 degree C) of each other, and for pressure, within tolerance equal to 2 percent of the reading, of each other.
4. Tolerances for critical applications may be tighter.

D. Sensors Without Transmitters - Standard Application:

1. Make a reading with a calibrated test instrument within 6 inches (150 mm) of the site sensor.
2. Verify that the sensor reading, via the permanent thermostat, gage or building automation system, is within the tolerances in the table below of the instrument-measured value.
3. If not, install offset, calibrate or replace sensor.

E. Sensors With Transmitters - Standard Application.

1. Disconnect sensor.
2. Connect a signal generator in place of sensor.
3. Connect ammeter in series between transmitter and building automation system control panel.
4. Using manufacturer's resistance-temperature data, simulate minimum desired temperature.
5. Adjust transmitter potentiometer zero until 4 mA is read by the ammeter.
6. Repeat for the maximum temperature matching 20 mA to the potentiometer span or maximum and verify at the building automation system.
7. Record all values and recalibrate controller as necessary to conform with specified control ramps, reset schedules, proportional relationship, reset relationship and P/I reaction.
8. Reconnect sensor.
9. Make a reading with a calibrated test instrument within 6 inches (150 mm) of the site sensor.
10. Verify that the sensor reading, via the permanent thermostat, gage or building automation system, is within the tolerances in the table below of the instrument-measured value.

11. If not, replace sensor and repeat.
 12. For pressure sensors, perform a similar process with a suitable signal generator.
- F. Sensor Tolerances for Standard Applications: Plus/minus the following maximums:
1. Watthour, Voltage, Amperage: 1 percent of design.
 2. Pressure, Air, Water, Gas: 3 percent of design.
 3. Air Temperatures (Outside Air, Space Air, Duct Air): 0.4 degrees F (0.2 degree C).
 4. Relative Humidity: 4 percent of design.
 5. Barometric Pressure: 0.1 inch of Hg (340 Pa).
 6. Flow Rate, Air: 10 percent of design.
 7. Flow Rate, Water: 4 percent of design.
 8. Flow Rate, Steam: 3 percent of design.
 9. AHU Wet Bulb and Dew Point: 2.0 degrees F (1.1 degrees C).
 10. Hot Water Coil and Boiler Water Temperature: 1.5 degrees F (0.8 degrees C).
 11. Cooling Coil, Chilled and Condenser Water Temperatures: 0.4 degrees F (0.2 degree C).
 12. Combustion Flue Temperature: 5.0 degrees F (2.8 degrees C).
 13. Oxygen and CO2 Monitors: 0.1 percentage points.
 14. CO Monitor: 0.01 percentage points.
 15. Natural Gas and Oil Flow Rate: 1 percent of design.
- G. Critical Applications: For some applications more rigorous calibration techniques may be required for selected sensors. Describe any such methods used on an attached sheet.
- H. Valve/Damper Stroke Setup and Check:
1. For all valve/damper actuator positions checked, verify the actual position against the control system readout.

2. Set pump/fan to normal operating mode.
 3. Command valve/damper closed; visually verify that valve/damper is closed and adjust output zero signal as required.
 4. Command valve/damper to open; verify position is full open and adjust output signal as required.
 5. Command valve/damper to a few intermediate positions.
 6. If actual valve/damper position does not reasonably correspond, replace actuator or add pilot positioner (for pneumatics).
- I. Isolation Valve or System Valve Leak Check: For valves not associated with coils.
 1. With full pressure in the system, command valve closed.
 2. Use an ultra-sonic flow meter to detect flow or leakage.

3.9 DEFERRED TESTING

- A. Unforeseen Deferred Tests: If any check or test cannot be completed due to the project completion level, required occupancy condition or other reason execution of checklists and performance testing may be delayed upon approval of the Owner and CA. These tests will be conducted in the same manner as the seasonal tests as soon as possible. Services of necessary parties will be negotiated.

3.10 OPERATIONS AND MAINTENANCE MANUALS

- A. Operations and maintenance data shall cover all systems, equipment, devices, materials and finishes described within these specifications and provided by Contractor under this Project.
- B. The CA shall review the draft form of the O&M manuals provided by the Division 22, 23, and 26 Contractors. The review process shall verify that O&M instructions meet specifications and are included for all commissioned equipment/systems provided by the Contractor, and that the information, instructions, and wiring diagrams are specific (edited where necessary) to the actual equipment provided for this Project.
- C. The O&M manual review and coordination efforts shall be completed prior to Owner training sessions, as these documents are to be utilized in the training sessions.
- D. The CA's review does not replace the Architect / Engineer's review of O&M manuals according to the Architect / Engineer's contract.

E. O&M Data Format:

1. O&M data shall be provided in neatly indexed, heavy duty, vinyl, 3-ring binders of manageable size. Binders shall be indexed by specification Section, with additional dividers provided under each specification section if multiple types of equipment and/or systems are defined within a single specification Section. Dividers shall be heavy paper with plastic covered tabs.
2. Fold all oversized sheets to neatly fit within binder. For sheets greater than 11" x 17" provide inserts for storage in binder.
3. Provide a table of contents in each binder. If more than one binder is used, clearly identify in the table of contents which information is contained in each.
4. Clearly label each manual with the title "OPERATION AND MAINTENANCE MANUAL - VOLUME _ OF _" and the Project name.

3.11 TRAINING OF OWNER'S OPERATING PERSONNEL

- A. The Contractor shall provide training coordination, scheduling of sub-contractors, and ensure that training is completed. All training shall be coordinated through the Owner.
- B. The Contractor shall ensure that each sub-contractor and equipment supplier (mechanical, plumbing, fire, electrical, specialty, etc) shall have the following responsibilities:
 1. Provide a training plan covering the following elements:
 - a. Equipment
 - b. Intended audience
 - c. Location of training
 - d. Objectives
 - e. Subjects covered (description, duration of discussion, special methods, etc)
 - f. Duration of training on each subject
 - g. Instructor for each subject
 - h. Methods (classroom lecture, manufacturer's quality video, site walk-through, actual operational demonstrations, written handouts, etc).

2. Provide designated Owner personnel with comprehensive orientation and training in the understanding of the systems and the operation and maintenance of each piece of equipment that makes up the system.
3. Training shall normally start with classroom sessions followed by hands-on demonstration/training on each piece of equipment.
4. During any demonstration, should the system fail to perform in accordance with the requirements of the O&M manual or sequence of operations, the system shall be repaired or adjusted as necessary and the demonstration repeated at another scheduled time, if necessary.
5. The appropriate trade or manufacturer's representative shall provide the instructions on each major piece of equipment. Practical building operating expertise as well as in-depth knowledge of all modes of operation of the specific piece of equipment are required. More than one party may be required to execute the training.
6. The controls sub-contractor shall attend sessions other than the controls training, as specified, to discuss the interaction of the controls system as it relates to the equipment being discussed.
7. The training sessions shall follow the outline in the table of contents of the O&M manual and illustrate whenever possible the use of the O&M manuals for reference.
8. Training shall include:
 - a. Use of the printed installation, operation and maintenance instruction material included in the O&M manual.
 - b. A review of the written O&M instructions emphasizing safe and proper operating requirements, preventative maintenance, special tools needed and spare parts inventory suggestions. The training shall include startup, operation in all modes possible, shutdown, seasonal changeover and any emergency procedures.
 - c. Discussion of relevant health and safety issues and concerns.
 - d. Discussion of warranties and guarantees.
 - e. Common troubleshooting problems and solutions.
 - f. Explanatory information included in the O&M manuals.
 - g. Discussion of any peculiarities of equipment installation or operation.

- h. Classroom sessions shall include the use of overhead projections, slides, video/audio-taped material as might be appropriate.
 - i. Hands-on training shall include startup, operation in all modes possible, including manual, shut-down, alarms, power failure and any emergency procedures, and preventative maintenance for all pieces of equipment.
 - 9. The Contractor shall fully explain the operation, function and overrides of any local packaged controls not controlled by the central control system.
- C. At the discretion of the CA, training may occur before performance testing is complete if required by the facility operators to assist the CA in the performance testing.

3.12 RECORD DOCUMENTS

- A. The Contractor shall maintain at the site one record copy of all drawings, specifications, addenda, approved Shop Drawings, change orders, and other modifications, in good order and marked to record all changes applicable to the work made during construction. All changes from design made during construction shall be recorded by the Contractor. Contractor shall be responsible for sufficient detail and accuracy of all changes made.
- B. Contractor record documents will be periodically reviewed and verified during construction by the CA. Discrepancies in the record documents will be documented in site visit reports and the Contractor shall be responsible to verify and correct the record documents against the installed system for specified and all similar problems noted.
- C. Contractor shall supply draft copy of complete record documents to the Architect / Engineer and Owner prior to initial training session.

3.13 WARRANTIES

- A. Contractor shall supply a complete copy of all warranties applicable to the Project, the terms of maintenance for each warranty, and the inception and expiration dates for each warranty. This information will become part of the O&M data.
- B. Within 10 months of Substantial Completion, the CA shall conduct a review of the operations and condition of the facility with Owner operating personnel with respect to warranty related issues. CA shall supply Contractor, Architect / Engineer and Owner with a detailed report listing the issues identified. This report shall include at a minimum the following:
1. Description of issue identified, including photographs as applicable.
 2. Recommended course of action.
 3. Supplementary information relative to previous maintenance or repairs attempted for resolution of issue.

- C. Contractor shall plan to attend a warranty review meeting with CA at site with Owner.
- D. Architect / Engineer shall issue a formal course of action to Contractor for resolution of issues identified.
- E. Contractor shall employ services and materials necessary for compliance to action statement from Architect / Engineer. All repairs and actions taken by Contractor shall be coordinated with Owner, with a formal log of work completed provided to Owner, Architect / Engineer and CA at completion of all warranty work.

3.14 EXCLUSIONS

- A. Responsibility for Construction Means and Methods: The Commissioning Agent is not responsible for construction means, methods, job safety, or any construction management functions on the job site.
- B. Hands-On Work by the Commissioning Agent: The Contractor shall provide all services requiring tools or the use of tools to start-up, test, adjust, or otherwise bring equipment and systems into a fully operational state. The CA shall coordinate and observe these procedures (and may make minor adjustments), but shall not perform construction or technician services other than verification of testing, adjusting, balancing, and control functions.

END OF SECTION

SECTION 03 11 00

CONCRETE FORMWORK

1. PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Formwork for cast-in-place concrete, with shoring, bracing, and anchorage.
- B. Openings for other affected work.
- C. Form accessories.
- D. Stripping forms.

1.2 REFERENCES

- A. CBC - California Building Code, (CCR) California Code of Regulations, Title 24, Part 2, Chapter 19A.
- B. ACI 301 - Specifications for Structural Concrete for Buildings.
- C. PS 1-09 - Structural Plywood.

1.3 SYSTEM DESCRIPTION

- A. Design, engineer, and construct formwork, shoring, and bracing to meet design and code requirements, so that resultant concrete conforms to required shapes, lines, and dimensions.

1.4 QUALITY ASSURANCE

- A. Construct and erect concrete formwork in accordance with ACI 301.

1.5 REGULATORY REQUIREMENTS

- A. Conform to CBC - California Building Code, (CCR) California Code of Regulations, Title 24, Part 2.

2. PART 2 PRODUCTS

2.1 FORM MATERIALS

- A. Plywood: PS1-09, BB Plyform grade, Class I, Exterior classification.
- B. Lumber: Douglas Fir species; construction grade; with grade stamp clearly visible.

2.2 FORMWORK ACCESSORIES

- A. Form Ties: Snap-off metal of adjustable length; cone type; 1 inch break back dimension; free of defects that will leave holes no larger than one inch diameter in concrete surface.
- B. Form Release Agent: Colorless material which will not stain concrete, absorb moisture, or impair natural bonding or color characteristics of coating intended for use on concrete.
- C. Fillets for Chamfered Corners: Wood strips type; 3/4 x 3/4 inch size; maximum possible lengths.
- D. Dovetail Anchor Slots: Minimum 22 gage galvanized steel; foam filled; release tape sealed slots; bent tab anchors; securable to concrete formwork; manufactured by Heckmann Building Products Co., www.heckmannbuildingprods.com.

- E. Flashing Reglets: 26 gage thick galvanized steel; longest possible lengths; release tape sealed slots; with alignment splines for joints; securable to concrete formwork; Type CO reglet manufactured by Fry Reglet www.fryreglet.com.
- F. Nails, Spikes, Lag Bolts, Through Bolts, Anchorages: Sized as required; of strength and character to maintain formwork in place while placing concrete.

3. PART 3 EXECUTION

3.1 INSPECTION

- A. Verify lines, levels, and measurements before proceeding with formwork.

3.2 PREPARATION

- A. Obtain Architect's approval for use of earth forms for footings.
- B. Minimize form joints. Symmetrically align joints and make watertight to prevent leakage of mortar.
- C. Arrange and assemble formwork to permit stripping, so that concrete is not damaged during its removal.
- D. Arrange forms to allow stripping without removal of principal shores, where required to remain in place.

3.3 ERECTION

- A. Erect formwork, shoring and bracing to achieve design requirements, in accordance with requirements of ACI 301.
- B. Provide bracing to ensure stability of formwork. Strengthen formwork liable to be overstressed by construction loads.
- C. Camber slabs and beams to achieve ACI 301 tolerances.
- D. Provide chamfer strips on external corners of beams joists columns and walls.
- E. Obtain approval before framing openings in structural members which are not indicated on Drawings.
- F. Do not displace or damage vapor barrier placed by Section 03 30 00.
- G. Construct formwork to maintain tolerances in accordance with ACI 301.

3.4 APPLICATION OF FORM RELEASE AGENT

- A. Apply form release agent on formwork in accordance with manufacturer's instructions. Apply prior to placing reinforcing steel, anchoring devices, and embedded items.
- B. Do not apply form release agent where concrete surfaces are scheduled to receive applied coverings which may be affected by agent. Soak contact surfaces of untreated forms with clean water. Keep surfaces wet prior to placing concrete.

3.5 INSERTS, EMBEDDED PARTS, AND OPENINGS

- A. Provide formed openings where required for work embedded in or passing through concrete.
- B. Coordinate work of other Sections in forming and setting openings, slots, recesses, chases, sleeves, bolts, anchors, and other inserts.
- C. Install accessories in accordance with manufacturer's instructions, level and plumb. Ensure items are not disturbed during concrete placement.

3.6 FORM REMOVAL

- A. Do not remove forms and bracing until concrete has sufficient strength to support its own weight and imposed loads.
- B. Reshore structural members due to design requirements or construction conditions to permit successive construction.
- C. Remove formwork progressively so no unbalanced loads are imposed on structure.
- D. Do not damage concrete surfaces during form removal.
- E. Store reusable forms for exposed architectural concrete to prevent damage to contact surfaces.
- F. Remove formwork in same sequence as concrete placement to achieve similar concrete surface coloration.

3.7 CLEANING

- A. Clean forms to remove foreign matter as erection proceeds.
- B. Ensure that water and debris drain to exterior through clean-out ports.

3.8 EARTH FORMS

- A. Construct wood edge strips at top sides of excavations as indicated on drawings.
- B. Provide forms for footings and foundation walls wherever concrete cannot be placed against solid earth.
- C. Remove loose dirt and debris from form area prior to concrete placement.
- D. Concrete for foundations may be placed directly into neat excavations provided the foundation trench walls are stable as determined by the Architect (Structural Engineer) subject to the approval of The Division of the State Architect.
- E. When earth formed foundations are used, the minimum formwork shown on the drawings is mandatory to insure clean excavations prior to and during concrete placement.

END OF SECTION

SECTION 03 20 00

CONCRETE REINFORCING

1. PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Reinforcing steel bars, welded steel wire fabric fabricated steel bar or rod mats for cast-in-place concrete.
- B. Support chairs, bolsters, bar supports, and spacers, for supporting reinforcement.
- C. Fibrous secondary reinforcement for slabs-on-grade.

1.2 REFERENCES

- A. CBC - California Building Code, (CCR) California Code of Regulations, Title 24, Part 2, Chapter 19A (ACI 318).
- B. ACI 301 - Specifications for Structural Concrete for Buildings.
- C. ACI 315 (SP-66) - Details and Detailing of Concrete Reinforcement.
- D. ACI 318 - Building Code Requirements for Structural Concrete.
- E. ASTM A1064 - Carbon-Steel Wire and Welded Wire Reinforcement, Plain and Deformed, for Concrete.
- F. ASTM A615 - Deformed and Plain Carbon-Steel Bars for Concrete Reinforcement.
- G. ASTM A706 - Standard Specification for Low Alloy Steel Deformed Bars for Concrete Reinforcement.
- H. ASTM C1116 - Specification for Fiber-Reinforced Concrete and Shotcrete.
- I. AWS D1.4 - Structural Welding Code Reinforcing Steel.
- J. CRSI - Manual of Practice.
- K. CRSI - Placing Reinforcing Bars.

1.3 QUALITY ASSURANCE

- A. Perform concrete reinforcement work in accordance with CRSI Manual of Standard Practice.
- B. Conform to ACI 301 and ACI 315 (SP-66).
- C. Conform to CBC California Building Code, (CCR) California Code of Regulations, Title 24, Part 2.

1.4 CERTIFICATES

- A. Submit mill test certificates of supplied concrete reinforcing, indicating physical and chemical analysis.

2. PART 2 PRODUCTS

2.1 MATERIALS

- A. Reinforcing Steel: ASTM A615, Grade 40 for No. 4 bars and smaller, Grade 60 for No. 5 bars and larger. Billet-steel deformed bars, uncoated finish.
- B. Welded Reinforcement: ASTM A706, Grade 60, deformed bars, unfinished.
- C. Welded Steel Wire Fabric: ASTM A1064 plain type; coiled rolls; uncoated finish.

- D. Steel Wire: ASTM A1064, plain, cold drawn steel.
- E. Fibrous Reinforcement:
 - 1. Collated, fibrillated, polypropylene fibers with length varying from 1-1/2 to 2 inches; nylon filamentized fibers of 3/4 inch length; cellulose fibers of 1/8 inch length; cellulose fibers of 1/8 inch length meeting requirements of ASTM C1116, Type III.
 - 2. Manufacturers:
 - (a) Forta Mono or Forta, Forta Corp., www.fortacorp.com.
 - (b) Fibermix or Fibermesh, SI Concrete Corp., www.fibermesh.com.
 - (c) Nycon, Nycon, Inc., www.nycon.com.
 - (d) Grace Fibers or Micro Fibers, W.R. Grace and Co., www.graceconstruction.com.
 - (e) Buckeye Building Fibers, www.ultrafiber500.com.
 - 3. Substitutions: Under provisions of Section 01 25 13.

2.2 ACCESSORY MATERIALS

- A. Tie Wire: Minimum 16 gage annealed type.
- B. Chairs, Bolsters, Bar Supports, Spacers: Sized and shaped for strength and support of reinforcement during installation and placement of concrete including load bearing pad on bottom to prevent vapor barrier puncture.

2.3 FABRICATION

- A. Fabricate in accordance with ACI 315 (SP-66), providing concrete cover specified in Section 03 30 00.
- B. Locate reinforcing splices not indicated on Drawings at points of minimum stress.
- C. Weld reinforcing bars in accordance with AWS D1.4.

3. PART 3 EXECUTION

3.1 INSTALLATION

- A. Before placing concrete, clean reinforcement of foreign particles or coatings.
- B. Place, support, and secure reinforcement against displacement. Do not deviate from alignment or measurement.
- C. Mix fibrous reinforcement into concrete material according to Section 03 30 00.
- D. Do not displace or damage vapor barrier required by Section 03 30 00.

3.2 FIELD QUALITY CONTROL

- A. Field inspection and testing will be performed under provisions of Section 01 45 29 and as required by the Division of the State Architect and District Inspector.

END OF SECTION

SECTION 03 30 00

CAST-IN-PLACE CONCRETE

1. PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Cast-in-place concrete foundation walls, and footings.
- B. Floors and slabs on vapor barrier.
- C. Control, expansion, and contraction joint devices associated with concrete work.
- D. Curing and sealing compound.
- E. Retaining walls, utility slabs.
- F. Equipment pads, Thrust blocks, Light pole bases, Flag pole bases.
- G. Lightweight concrete floor fill on underlayment.

1.2 REFERENCES

- A. The 2010 Americans with Disabilities Act (ADA) Standards for Accessible Design.
- B. CBC - California Building Code, (CCR) California Code of Regulations Title 24, Part 2, Chapter 19A.
- C. CBC - California Building Code, (CCR) California Code of Regulations, Title 24, Part 2, California State Accessibility Standards.
- D. ACI 301 - Specifications for Structural Concrete for Buildings.
- E. ACI 302.1R - Guide for Concrete Floor and Slab Construction.
- F. ACI 305R - Hot Weather Concreting.
- G. ACI 306.R - Standard Specification for Cold Weather Concreting.
- H. ACI 318 - Building Code Requirements for Structural Concrete.
- I. ASTM C33 - Concrete Aggregates.
- J. ASTM C94 - Ready-Mixed Concrete.
- K. ASTM C109 - Standard Test Method for Compressive Strength of Hydraulic Cement Mortars.
- L. ASTM C150 - Portland Cement.
- M. ASTM C260 - Air-Entraining Admixtures for Concrete.
- N. ASTM C289 - Potential Reactivity of Aggregate.
- O. ASTM C309 - Liquid Membrane Forming Compound.

- P. ASTM C330 - Lightweight Aggregates for Structural Concrete.
- Q. ASTM C494 - Standard Specifications for Chemical Admixtures for Concrete.
- R. ASTM C567 - Unit Weight of Structural Lightweight Concrete.
- S. ASTM C618- Standard Specification for Coal Fly Ash and Raw or Calcined Natural Pozzolan for Use as a Mineral Admixture for Concrete.
- T. ASTM C932 - Surface-Applied Bonding Agents.
- U. ASTM C1315 - Liquid Membrane-Forming Compounds Having Special Properties for Curing and Sealing Concrete.
- V. ASTM C1602 - Standard Specification for Mixing Water Used in the Production of Hydraulic Cement Concrete.
- W. ASTM D226 - Asphalt Saturated Organic Felt used in Roofing and Waterproofing.
- X. ASTM D1751 - Preformed Expansion Joint Filler for Concrete Paving and Structural Construction.
- Y. ASTM E96 – Standard Test Methods for Water Vapor Transmission of Materials.
- Z. ASTM E154 - Standard Test Methods for Water Vapor Retardants used in Contact with Earth Under Concrete Slabs, on Walls, or as Ground Cover.
- AA. ASTM E1643 - Installation of Water Vapor Retarders used in Contact with Earth or Granular Fill Under Concrete Slab.
- BB. ASTM E1155 - Determining Floor Flatness and Levelness Using the F-Number System.
- CC. ASTM E1745 - Standard Specifications for Plastic Water Vapor Retarders Used in Contact with Soil Or Granular Fill Under Concrete Slabs.
- DD. ASTM F1249 - Standard Test Method for Water Vapor Transmission Rate Through Plastic Film and Sheeting Using a Modulated Infrared Sensor.
- EE. ASTM F1869 - Standard Test Method for Measuring Moisture Vapor Emission Rate of Concrete Subfloor Using Anhydrous Calcium Chloride.
- FF. National Ready Mix Concrete Association - Plant Certification Program.
- GG. Stormwater Best Management Practice Handbook (BMP Handbook), Construction Edition, as published by the California Storm Water Quality Association.

1.3 QUALITY ASSURANCE

- A. Perform work in accordance with ACI 301.
- B. Installation of vapor barrier shall be in accordance with ASTM E1643 and manufacturer's installation guides and recommendations. Provide Architect written site reports from manufacturer's field service representative, indicating observation of vapor barrier installation prior to concrete placement.
- C. Obtain concrete materials from same source throughout the Work.

1.4 QUALIFICATIONS

- A. Manufacturer: Manufacturer of ready-mix concrete products complying with ASTM C94 requirements for production facilities and equipment. Certified according to National Ready Mix Concrete Associates Plant Certification Program.

1.5 DESIGN MIX

- A. Submit design mix for each class of concrete, prepared by a California Registered Civil Engineer, to Testing Laboratory and Architect for review.

1.6 REGULATORY REQUIREMENTS

- A. Conform to CBC - California Building Code, (CCR) California Code of Regulations, Title 24, Part 2.
- B. Conform to CBC - California Building Code, (CCR) California Code of Regulations, Title 24, Part 2, and the 2010 ADA Standards for Accessible Design for access requirements for individuals with disabilities.

1.7 SUBMITTALS

- A. Submit product data and manufacturer's instructions for all accessories under provisions of Section 01 33 00.

1.8 PRE-INSTALLATION CONFERENCE

- A. Convene a conference two weeks prior to commencing placement of floor slab work of this section, under provisions of Section 01 31 00.
- B. Require attendance of parties directly affecting the work of this Section.
- C. Agenda:
 - 1. Placement of subgrade beneath floor slab.
 - 2. Testing of subgrade beneath floor slab.
 - 3. Delivery and placement of concrete.
 - 4. Testing and inspection procedures for concrete.
 - 5. Submittal of mix design for concrete.
 - 6. Hot and cold weather concreting procedures.
 - 7. Vapor barrier location and installation.
 - 8. Placement of control and expansion joints.
 - 9. Steel reinforcement installation.
 - 10. Installation of inserts and embedded items.
 - 11. Finishes and finishing.
 - 12. Forming and form removal limitations.

13. Floor slab flatness and levelness requirements.
14. Curing process and procedures.
15. Protection of finished floor slabs.
16. Floor slab joint and crack repair.
17. Moisture vapor transmission testing.

1.9 WARRANTY

- A. Provide fifteen year warranty from curing, hardening and vapor barrier compound manufacturer under provisions of Section 01 77 00.
- B. Warranty: Include coverage for removal and replacement of finish floor materials that delaminate from interior floor slabs due to moisture migration and excessive vapor emissions or due to presence of efflorescence and alkali contaminants.
 1. Subfloor Moisture Conditions: Moisture emission rate of no more than 3 lb/1000 sq. ft./24 hours when tested by Quantitative Anhydrous Calcium Chloride Test, ASTM F1869, with subfloor temperature not less than 65 degrees F.
 2. Subfloor Alkalinity Conditions: A pH range of between 5 to 9 when subfloor is wetted with potable water and pHdrion paper is applied.
 3. Warranty to be supported by \$1,000,000.00 product liability insurance policy issued directly to the Owner.
- C. Provide ten year warranty from waterproofing admixture manufacturer that surfaces treated with crystalline waterproofing admixture will remain free from water leakage.
- D. Provide warranty from vapor barrier manufacturer that products meet the current requirements of ASTM E1745 and will be free from material defects for the life of the building.

1.10 ENVIRONMENTAL REQUIREMENTS

- A. Provide concrete curing, finishing, and waste management techniques as defined in Section 4 of the Storm Water Best Management Practice Handbook, (BMP Handbook) Construction Edition.

2. PART 2 PRODUCTS

2.1 FORMWORK

- A. As specified in Section 03 11 00.

2.2 REINFORCEMENT

- A. Reinforcing steel as specified in Section 03 20 00.

2.3 FIBROUS REINFORCEMENT

- A. Fibrous reinforcement as specified in Section 03 20 00.

2.4 CONCRETE MATERIALS

- A. Cement: ASTM C150, Type I or Type II Portland type; low alkali; grey color.
- B. Fine and Coarse Aggregates Normal Weight Concrete: ASTM C33, non reactive when tested in accordance with ASTM C289 and Appendix X-1 of ASTM C33.
- C. Fine and Coarse Aggregate, Light Weight Concrete: ASTM C330.
- D. Water: ASTM C1602, clean and not detrimental to concrete.

2.5 ADMIXTURES

- A. Air Entrainment: ASTM C260.
- B. Fly Ash: ASTM C618, Class F.
- C. Water Reducing Admixture: ASTM C494, Type A.
- D. Crystalline Waterproofing Admixture: Xypex Admix C-1000 as manufactured by Xypex Chemical Corporation, www.xypex.com.
- E. Calcium chloride, or any other admixtures not allowable.

2.6 VAPOR BARRIER

- A. Material: 15 mil thick polyethylene film meeting the requirements of ASTM E1745, Class A, with a maximum permeance of 0.01 perms in accordance with ASTM E96/E154, Section 7, and a Water Vapor Transmission Rate (WVTR) of less than 0.0037 when tested according to ASTM F1249.
- B. Accessories:
 - 1. Minimum 4 inch wide polyethylene seaming tape with pressure sensitive adhesive.
 - 2. Minimum 6 inch wide multi-layered textured polyethylene concrete bonding tape.
 - 3. Polymer-modified liquid vapor retarder mastic.
 - 4. PVC termination bar with pre-drilled holes.
 - 5. All accessories provided by vapor barrier manufacturer.
- C. Manufacturers:
 - 1. Fortifiber Building Products, www.fortifiber.com.
 - 2. Poly-America, www.yellowguard.com.
 - 3. Reef Industries, www.reefindustries.com.
 - 4. Stego Industries, www.stegoindustries.com.
 - 5. Substitutions: Under Provisions of Section 01 25 13.

2.7 ACCESSORIES

- A. Bonding Agent: ASTM C932; Weld-Crete as manufactured by Larsen Products Corp., www.larsenproducts.com.
- B. Non-shrink Grout: Premixed compound consisting of non-metallic aggregate, cement, water reducing and plasticizing agents; capable of developing minimum compressive strength of 7000 psi in 28 days.
- C. Joint Filler: ASTM D1751, 1/2 inch thick.
- D. Sand Fill: Manufactured "crusher run" sand free of silt, clay, loam, friable or soluble materials or organic matters, all passing the No. 4 sieve and only 5 percent passing the No. 200 sieve.
- E. Curing, Hardening and Vapor Barrier Compound: ASTM C1315, Type I, Class A and ASTM C309, Type 1, Class A, with maximum volatile organic compound (VOC) content rating as required to suit regulatory requirements. Material to have no less than 34 percent penetrating solids, have no visible sheen and be compatible with floor finish materials and overlayments. Provide the following:
 - 1. PMC 3300 Penetrating Sealer manufactured by Curranseal, www.curranseal.com.
- F. Sealing Compound: Ashford Formula manufactured by Curecrete Distribution, Inc., www.ashfordformula.com.
- G. Slip Resistant Aggregate: 95 percent minimum fused homogeneous aluminum oxide.
- H. Concrete Floor Slab, Saw Cut, Joint, Crack, Repair Material: Cement-based, polymer-modified product that can be feathered at edges to match adjacent floor elevations. Compressive strength not less than 4,200 psi at 28 days when tested according to ASTM C109. Equivalent to ARDEX SD-F Feather Finish, www.ardex.com. Epoxy base to be equivalent to W. R. Meadows Rezi-Weld Flex semi-rigid epoxy, www.wrmeadows.com.
- I. Substitutions: Under provisions of Section 01 25 13.

2.8 CONCRETE MIX

- A. Mix concrete in accordance with ASTM C94 ACI 318, Section 26.4.4.
- B. Footings: Proportion normal-weight concrete mixture as follows:
 - 1. Minimum Compressive Strength: 4,000 psi at 28 days.
 - 2. Maximum Water-Cement Materials Ratio: 0.45.
 - 3. Aggregate Size: 1-1/2 inch maximum.
 - 4. Slump Limit: 4 inch minimum, 6 inch maximum.
 - 5. Fly Ash: Maximum 25 percent by weight.
 - 6. Air Content: 2.5 percent, plus or minus 0.5 percent.
 - 7. Waterproofing Admixture: 3 percent by weight of cement.

C. Foundation Walls: Proportion normal-weight concrete mixture as follows:

1. Minimum Compressive Strength: 4,000 psi at 28 days.
2. Maximum Water-Cement Materials Ratio: 0.45.
3. Aggregate Size: 1-1/2 inch maximum.
4. Slump Limit: 4 inch minimum, 6 inch maximum.
5. Fly Ash: Maximum 25 percent by weight.
6. Air Content: 2.5 percent, plus or minus 0.5 percent.
7. Waterproofing Admixture: 3 percent by weight of cement.

D. Slabs-On-Grade: Proportion normal-weight concrete mixture as follows:

1. Minimum Compressive Strength: 4,000 psi at 28 days.
2. Minimum Cement Materials Content: 540 lb./cu. yd.
3. Maximum Water-Cement Materials Ratio: 0.45.
4. Aggregate Size: 1 inch maximum.
5. Aggregate Size at Polished Finish: ½ inch maximum.
6. Slump Limit: 3 inch minimum, 5 inch maximum.
7. Air Content: 2.5 percent, plus or minus 0.5 percent.
8. Fly Ash: Maximum 25 percent by weight.
9. Synthetic Fibers: Mix 1.5 to 1.6 lb. of collated, fibrillated polypropylene fibers or 1 lb. of nylon fibers per cubic yard of concrete as secondary reinforcement for slabs-on-grade.

E. Concrete Toppings: Proportion structural-light weight concrete mixture as follows:

1. Minimum Compressive Strength: 3,500 psi at 28 days.
2. Calculated Equilibrium Unit Weight: Dry weight not less than 95 lb./cu. ft or more than 110 lb./cu. ft., plus or minus 3 lb/cu.ft. as measured in accordance with ASTM C567.
3. Maximum Water-Cement Materials Ratio: 0.45.
4. Aggregate Size: 1 inch maximum.
5. Slump Limit: 3 inch minimum, 5 inch maximum.
6. Air Content: 2.5 percent, plus or minus 0.5 percent.
7. Fly Ash: Maximum 25 percent by weight.
8. Waterproofing Admixture: 3 percent by weight of cement.

9. Synthetic Fibers: Mix 1.5 to 1.6 lb. of collated, fibrillated polypropylene fibers or 1 lb. of nylon fibers per cubic yard of concrete as secondary reinforcement for slabs-on-grade.

3. PART 3 EXECUTION

3.1 INSPECTION

- A. Verify anchors, seats, plates, reinforcement, and other items to be cast into concrete are accurately placed, held securely, and will not cause difficulty in placing concrete.

3.2 VAPOR BARRIER

- A. Install vapor barrier in compliance with ASTM E1643 under interior slabs over sand subgrade.
- B. Install vapor barrier to exterior surface of below grade building foundation walls and grade beams. Seal to vertical surface of foundation wall with pressure sensitive tape and termination bar at an elevation consistent with the top of the adjacent finish grade.
- C. Lay vapor barrier with long dimension parallel with long dimension of space.
- D. Lap vapor barrier over footing and seal to vertical surface of interior foundation wall with pressure sensitive tape and termination bar at an elevation consistent with the top of the slab or terminate vapor barrier at horizontal edge of slab and foundation wall with continuous strip of concrete bonding tape.
- E. Overlap all joints in vapor barrier 6 inches and seal with tape.
- F. Seal all pipe penetrations of vapor barrier with pipe boot fabricated from vapor barrier material, tape and mastic.
- G. Repair damaged areas with vapor barrier, overlapping damaged area by 6 inches and taping all four sides.

3.3 PREPARATION

- A. At locations where new concrete is dowelled to existing work, drill holes in existing concrete, insert steel dowels, and pack solid with non-shrink grout.
- B. Place 2 inch thick sand fill over subgrade.
- C. Compact sand fill as specified in Section 31 20 00.

3.4 PLACING CONCRETE

- A. Notify Architect minimum 24 hours prior to commencement of concreting operations.
- B. Place concrete in accordance with ACI 301.
- C. Hot Weather Placement: ACI 305R.
 1. Maintain concrete temperature below 90 deg F at time of placement. Chilled mixing water or chopped ice may be used to control temperature, provided water equivalent of ice is calculated to total amount of mixing water.
 2. Fog-spray forms, steel reinforcement, and subgrade just before placing concrete in hot weather. Keep subgrade uniformly moist without standing water, soft spots, or dry areas.

D. Cold Weather Placement: ACI 306R.

1. When average high and low temperature is expected to fall below 40 deg F for three successive days, maintain delivered concrete mixture temperature within the temperature range required by ACI 306.1

- E. Ensure reinforcement, inserts, embedded parts and formed joints are not disturbed during concrete placement.
- F. Do not disturb or damage vapor barrier while placing concrete. Repair damage as required to maintain integrity of barrier.
- G. Place concrete continuously between predetermined construction and control joints. Do not break or interrupt successive pours such that cold joints occur.
- H. Place interior floor slabs on fill in a strip sequence pattern.
- I. Excessive honeycomb or embedded debris in concrete is not acceptable.

3.5 SEPARATE FLOOR TOPPING

- A. Prior to placing floor topping roughen existing substrate concrete surface and remove deleterious material. Broom and vacuum clean.
- B. Apply bonding agent to substrate concrete in accordance with manufacturer's instructions.
- C. Place dividers edge strips reinforcing and other items to be cast into topping.
- D. Place topping to required lines and levels.
- E. Screed topping level, maintain surface flatness.

3.6 JOINTS

- A. Saw cut control joints at an optimum time after finishing. Use 3/16 inch thick blade, cutting 1/3 into depth of slab thickness.
- B. Review locations of joints when indicated and make recommendations for any additional joints or suggestions for new locations. Lack of joints or misplacement of joints will not constitute justification of slab cracking.
- C. Provide control joints at 15 feet on center unless otherwise indicated.
- D. Where indicated on the drawings, separate slabs from vertical surfaces with joint filler. Extend joint filler from bottom of slab to within 1/4 inch of finished slab surface.

3.7 FLOOR SLAB JOINT FILLING AND CRACK REPAIR

- A. Prepare, clean, and install joint repair material according to manufacturer's written instructions.
- B. Defer joint filling and crack repair until concrete has aged a minimum of 60 days.
- C. Remove dirt, debris, saw cuttings, curing compounds, and sealers from joints; leave contact faces of joint clean and dry.
- D. Mechanically V-groove as necessary all saw cuts, joints and cracks, to a minimum width of 1/4 inch and a minimum depth of 5/8 inch.

- E. Fill bottom of joint at slab on grade locations to a depth of at least 3/16 inch with semi-rigid epoxy. Omit semi-rigid epoxy at above grade slab locations.
- F. Place silica sand over epoxy filler.
- G. Prepare and prime joint substrate as recommended by joint repair material manufacturer.
- H. Fill all saw cuts, joints, and cracks with cement based joint repair material to top of concrete surface.
- I. Steel trowel edges of joint repair material to a feather edge to match adjacent floor elevation.

3.8 FINISHING OF FORMED SURFACES

A. Rough form finish:

- 1. Leave surfaces with the texture imparted by forms, except patch tie holes and defects.
- 2. Remove fins exceeding 1/4 inch in height.
- 3. Use for below grade foundation walls and concealed spaces.

B. Grout cleaned finish:

- 1. Do not start cleaning operations until all contiguous surfaces to be cleaned are completed and accessible.
- 2. Do not permit cleaning as the work progresses.
- 3. Mix one part Portland cement and 1-1/2 parts fine sand with sufficient water to produce a grout having the consistency of thick paint.
- 4. Wet the surface of the concrete sufficiently to prevent absorption of water from the grout and apply the grout uniformly with brushes or spray gun.
- 5. Immediately after applying the grout, scrub the surface vigorously with a cork float or stone to coat the surface and fill all air bubbles and holes.
- 6. While the grout is still plastic, remove all excess grout by working the surface with a rubber float, sack, or other means.
- 7. After the surface whites from drying (about 30 minutes at normal temperatures), rub vigorously with clean burlap.
- 8. Keep the surface damp for at least 36 hours after final rubbing.
- 9. Use for repair of exposed finish surfaces to receive paint or clear sealer and for exposed to view exterior foundation stem walls.

3.9 FINISHING SLABS

- A. Uniformly spread, screed and consolidate concrete. Do not spread concrete by vibration.
- B. Float Finish: Float with hand float or with a powered disc float. High spots to be cut down and low spots to be filled. Use as preparation for further finishing.

- C. Scratched Finish: Mechanically float surfaces. Roughen with stiff brushes before final set. Use for porcelain tile with full bed setting systems substrate slab beneath topping and where indicated.
- D. Troweled Finish: After floating, steel trowel to smooth, mark free surface. Use for exposed floors and slabs to receive carpeting resilient flooring and where indicated. Do not over trowel or burnish surface.
- E. Fine Broom Finish: After floating and while the surface is still plastic, provide a fine textured finish by drawing a fine fiber bristle broom uniformly over the surface in one direction only. Use for exposed floors and slabs where indicated.
- F. Slip Resistant Finish: After floating and while the surface is still plastic, uniformly broadcast aluminum oxide particles onto surface at the rate of 25 pounds per 100 sq. ft. Trowel particles into surface to provide embedment but do not force below surface. Use for exposed floors and slabs which constitute ramps with slope of 6 percent or greater, exposed stair treads, and as indicated.

3.10 SLAB TOLERANCES

- A. Maintain slab tolerance as defined in ACI 302.1R of (SOV) F_F35 and F_L25 and (MLV) F_F24 and F_L17 as measured by ASTM E1155 for slabs on grade.
- B. Correct the slab surface if the actual F_F/F_L number for the floor installation measures less than required.
- C. After correction of slab surface to specified tolerance, apply curing, hardening and vapor barrier over corrected surface.
- D. In areas of floor drains, maintain floor levels at the walls and slope surface uniformly to drains at 1/8 inch per foot.

3.11 CURING

- A. Apply curing, hardening and vapor barrier compound on all floor slabs that are not exposed and indicated to be sealed.
- B. Cure concrete surfaces in accordance with ACI 301.
- C. Spray apply curing, hardening and vapor barrier compound on finished slab surfaces located below grade, at grade, and above grade in two "wet on wet" flood coats at the total rate of 200 sq. ft./gallon in accordance with manufacturer's instructions.
- D. Application of compound shall be by a trained applicator acceptable to compound manufacturer.
- E. After application of curing, hardening, and vapor barrier compound, moist cure concrete using the following method:
 - 1. Spraying: Fog spray clean, potable water over floor slab areas and maintain moist for 10 days.
 - 2. Polyethylene Film: Spread over floor slab areas, lap edges and sides, maintain in place for 10 days.

3.12 SEALING

- A. Apply sealing compound on finished floor slab surfaces that are not to receive a finished floor covering and are indicated to be exposed and sealed.
- B. Apply sealing compound immediately following finishing operation.

- C. Apply sealing compound in sufficient quantities to keep entire surface wet for a minimum of 30 minutes.
- D. Lightly mist surface with water as compound is absorbed into surface.
- E. Flush surface with water and squeegee surface free of excess compound.
- F. Burnish final concrete surface with propane burnisher.

3.13 PATCHING

- A. Notify Architect immediately upon removal of forms to determine areas that will require patching.
- B. Surface defects shall include color and texture irregularities, stains, cracks, spalls, air bubbles, honeycombs, rock pockets, fins and other projections and discolorations in the surface that cannot be removed by cleaning.
- C. Patch imperfections in accordance with ACI 301.

3.14 DEFECTIVE CONCRETE

- A. Modify or replace concrete not conforming to required levels and lines, details, and elevations.
- B. Repair or replace concrete not properly placed or of the specified type.

3.15 FIELD QUALITY CONTROL

- A. Field inspection and testing will be performed under provisions of Section 01 45 29 and as required by the Division of the State Architect and District Inspector.
- B. Owner's Inspector will take cylinders and perform slump and air entrainment tests in accordance with ACI 301 and will arrange for pick-up by Testing Laboratory.
- C. Three cylinders will be taken for every 50 yards, or fraction thereof, for each class of concrete for each day.
- D. Tests of cement and aggregates will be performed by Testing Laboratory to ensure conformance with requirements stated herein.
- E. Slab tolerance as measured by ASTM E1155 shall be performed within 72 hours of floor slab installation.
- F. Maintain records of placed concrete items. Record date, location of pour, quantity, air temperature, and test samples taken.

3.16 PROTECTION

- A. Protect finished work under provisions of Section 01 61 00.
- B. Immediately after placement, protect concrete from premature drying, excessively hot or cold temperatures, and mechanical injury.
- C. Maintain concrete with minimal moisture loss at relatively constant temperature for period necessary for hydration of cement and hardening of concrete.

END OF SECTION

SECTION 03 35 10

POLISHED CONCRETE FLOOR SYSTEM

1. PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Polished concrete floor system.
- B. Joint filler.
- C. Application schedule.

1.2 REFERENCES

- A. ANSI / NFSI B101.3 Wet Dynamic COF (coefficient of friction) Standard.
- B. ASTM D 523 – Standard Test Method for Specular Gloss.
- C. ASTM E 1155 – Standard Test Method for Determining FF Floor Flatness and FL Floor Levelness Numbers.
- D. CPC - Concrete Polishing Council - Affiliate of the American Society of Concrete Contractors.

1.3 SYSTEM DESCRIPTION

- A. Polished concrete floor system for new interior concrete floors by dry grinding and polishing with various size grit metal-bonded and resin-bonded diamonds and application of concrete densifier.
- B. Performance Requirements: Polished concrete floor system shall meet the following criteria:
 - 1. Static Coefficient of Friction, ANSI / NFSI B101.3 COF Test:
 - (a) Wet or Dry Surface: 0.41 average Ra value.
 - 2. Specular Gloss/Reflectance, ASTM D 523:
 - (a) 20 Degrees: 1.2.
 - (b) 60 Degrees: 2.5.
 - (c) 85 Degrees: 0.03.
 - 3. Floor Surface Profile, ASTM E 1155:
 - (a) Floor Flatness, Minimum Local Value (MLV FF): FF 24
 - (b) Floor Levelness, Minimum Local Value (MLV FL): FL 17

1.4 SUBMITTALS

- A. Submit product data and installation instructions under the provisions of Section 01 33 00.
- B. Product Data: Submit product data for densifier sealers and joint filler.
- C. Instructions: Submit instructions for surface preparation and installation.

1.5 OPERATIONS AND MAINTENANCE DATA

- A. Submit maintenance data under provisions of Section 01 77 00.
- B. Maintenance Manual: Submit maintenance manual, including maintenance and cleaning instructions for polished concrete floor system.

1.6 QUALITY ASSURANCE

- A. Installer's Qualifications: Certified CPC installer with a minimum of 5 years experience..
- B. Installer's Certification: Submit CPC certification for installer and installer's employees.
- C. Installer's Project References: Submit list of successfully completed polished concrete floor system projects, including project name and location, name of architect, and type and quantity of polished concrete floor system installed.

1.7 PRE-INSTALLATION CONFERENCE

- A. Convene pre-installation meeting two weeks prior to commencing installation of polished concrete floor system under the provisions of Section 01 31 00.
- B. Require attendance of parties directly affecting work of this Section.
- C. Review surface preparation, installation, field quality control, and protection.

1.8 MOCKUP

- A. Provide mockup of polished floor system under provisions of Section 01 43 00.
- B. Provide a minimum of a 10'-0" x 10'-0" floor area for review.
- C. When accepted, mockup will demonstrate minimum standard for the Work. Mockup may remain as part of the Work.

1.9 SEQUENCING AND SCHEDULING

- A. Sequence and schedule Work under provisions of Section 01 11 00.
- B. Schedule Work to avoid prolonged exposure to future Work that may be detrimental to the finish work of this Section.

1.10 DELIVERY, STORAGE, AND HANDLING

- A. Deliver, store and protect products to site under provisions of Section 01 61 00.
- B. Deliver materials to site in manufacturer's original, unopened containers and packaging, with labels clearly identifying product name and manufacturer.
- C. Store materials in clean, dry area indoors in accordance with manufacturer's instructions.
- D. Protect materials during handling and application to prevent contamination or damage.

2. PART 2 PRODUCTS

2.1 INSTALLATION EQUIPMENT

- A. Roto-Miller Planing Machine:
 - 1. Type: Self-propelled, vertically rotating concrete planning machine

2. Weight: 700 pounds minimum
3. Grinding Width: 13 inches minimum
4. Motor: 15HP minimum
5. Cutting Disk Diameter: 10 inches minimum

B. Floor Grinder:

1. Type: Multi-orbital, planetary-action, opposing-rotational, diamond-headed floor grinder.
2. Weight: 850 pounds minimum.
3. Grinding Pressure: 675 pounds minimum.
4. Grinding Width: 32 inches minimum.
5. Motor: 15 HP minimum.
6. RPM: 1,750 maximum.
7. Head: 3-head system contours to floor surface.

C. Vacuum System:

1. Type: As required to perform required dust extraction during grinding and polishing of concrete floor.
2. Filtration: Direct-connect, HEPA filtration system.

D. Diamond Tooling for Grinding and Aggregate Exposure

1. 16/30/40 grit 10 inch diamond blade.

E. Diamond Tooling for Coating Removal:

1. 40-grit metal-bonded diamonds.
2. 80-grit metal-bonded diamonds.

F. Diamond Tooling for Initial Grinding:

1. 150-grit metal-bonded diamonds.

G. Diamond Tooling to Prepare Floor for Polishing:

1. 150-grit metal-bonded diamonds.

H. Diamond Tooling for Polishing Concrete:

1. 100-grit resin-bonded diamonds.
2. 200-grit resin-bonded diamonds.
3. 400-grit resin-bonded diamonds.
4. 800-grit resin-bonded diamonds.
5. 1,500-grit resin-bonded diamonds.
6. 3,000- grit resin -bonded diamonds.

2.2 MATERIALS

- A. Permanent sealing, densifying, and hardening compound that is odorless and free of all VOCs.
- B. Concrete Densifier:
 - 1. Ameripolish, Inc., 3DHS Densifier, www.ameripolish.com.
 - 2. Ardex, PC 50, Lithium Densifier, www.ardexamericas.com.
 - 3. Diamatic, FlorSil, Lithium Densifier, www.diamaticusa.com.
 - 4. Concrete Polishing Solutions , Armor Densifier MFL, www.go2cps.com.
 - 5. L & M Construction Chemicals, Inc., FGS Hardener Plus, www.lmcc.com.
 - 6. Perfect Polish, Impregnating Concrete Hardener, www.perfectpolishonline.com.
 - 7. ProSoCo, Consolideck LS, www.consolideck.com.
 - 8. Westcoat, SC-21 Lithium Silicate Densifier, www.westcoat.com.
- C. Concrete Sealer:
 - 1. Ameripolish, Inc., SR-2 Stain Resistor, www.ameripolish.com.
 - 2. Ardex, PC Finish, www.ardexamericas.com.
 - 3. Diamatic, Flor-Finish, www.diamaticusa.com.
 - 4. Concrete Polishing Solutions, Armor Stain Shield MFL, www.go2cps.com
 - 5. L & M Construction Chemicals, Inc., FGS PermaShine Petrotect, www.lmcc.com
 - 6. Perfect Polish, Impregnating Concrete Hardener, www.perfectpolishonline.com
 - 7. ProSoCo, Consolideck , LS Guard, www.consolideck.com.
 - 8. Westcoat, SC-24 Polish Guard, www.westcoat.com.
- D. Joint Filler: Semi-rigid, two-part, self-leveling 100 percent polyurea joint filler. Spal-Pro RS 88 as manufactured by Metzger / McGuire, www.metzgermcguire.com.
- E. Substitutions: Under provisions of Section 01 25 13.

3. PART3 EXECUTION

3.1 EXAMINATION

- A. Examine floor to receive polished concrete floor system.
- B. Notify Architect of conditions that would adversely affect installation or subsequent use.
- C. Do not begin surface preparation or installation until unacceptable conditions are corrected.

3.2 SURFACE PREPARATION

- A. Protection: Protect surrounding areas and adjacent surfaces from the following:
 - 1. Minimal accumulation of dust from grinding and polishing.

2. Contact with overspray of concrete densifier.
3. Contact with overspray of concrete sealer.
- B. Surface Preparation: Prepare surfaces in accordance with installer's instructions.
- C. Clean Surfaces: Remove dirt, dust, debris, oil, grease, curing agents, bond breakers, paint, coatings, and other surface contaminants which could adversely affect installation of polished concrete floor system.

3.3 INSTALLATION

- A. Install polished concrete floor system in accordance with installer's instructions at locations indicated on the Drawings.
- B. Aggregate Exposure:
 1. Medium Aggregate: Medium course aggregate exposure.
- C. Polished Concrete Floor System: CPC Sheen Level 4 – Glossy Shine.
 1. Preparation Step:
 - a. Begin aggregate exposure grind by running roto-miller planing machine with a maximum setting of 1/8 inch removal per pass, leaving a profiled surface.
 - b. Remove profile left by roto-miller planing machine by grinding with 16-grit metal-bonded diamonds.
 - c. Inspect the concrete surface to determine the consistency of aggregate exposed. If the aggregate is unacceptable, repeat steps a and b, removing no more than 1/8 inch of surface per pass.
 - d. Remove existing floor coatings and level floor by grinding with 40-grit metal-bonded diamonds.
 - e. Open-up concrete to accept concrete densifier by grinding with 80-grit metal-bonded diamonds.
 2. Apply concrete densifier to deeply saturate floor.
 3. Remove residue of concrete densifier dried on floor surface by grinding with 150-grit metal-bonded diamonds.
 4. Floor Closure Polishing:
 - a. Remove 150-grit metal-bonded diamond scratches by grinding with 100-grit resin-bonded diamonds.
 - b. Remove 150-grit metal-bonded and 100-grit resin-bonded diamond scratches by grinding with 200-grit resin-bonded diamonds.
 - c. Prepare floor for polishing by grinding with 400-grit resin-bonded diamonds.
 - d. Achieve light-reflective finish when viewed from a distance of 30 feet by grinding with 800-grit resin-bonded diamonds.
 5. Final Polish:
 - a. Start final polish by grinding with 1,500-grit resin-bonded diamonds.
 - b. Complete final polish by grinding with 3,000-grit resin-bonded diamonds.
 6. Apply concrete sealer.

3.4 JOINT FILLER INSTALLATION

- A. Defer installation until a minimum of 28 days after slab installation.
- B. Where joints have minor edge chips, said chips shall be squared-off and filled along with the joint itself.
- C. Install filler material according to manufacturer's instructions. Coordinate with polishing operations.
- D. Thoroughly clean all joints to their full depth. Remove all dust and debris.
- E. Install backer rod in construction joints at a minimum depth of 2 inches. Do not install backer rod in saw-cut control joints.
- F. Fill joints to slightly overflowing condition. After filler is fully cured, razor cut off excess to flush profile.

3.5 FIELD QUALITY CONTROL

- A. Inspect completed polished concrete floor system with Owner, Contractor, Architect, and Installer.
- B. Review procedures with Architect to correct unacceptable areas of completed polished concrete floor system.

3.6 PROTECTION

- A. Protect completed polished concrete floor system from damage until Substantial Completion.
 - 1. Do not allow vehicle and pedestrian traffic on unprotected floor.
 - 2. Do not allow construction materials, equipment, and tools on unprotected floor.
- B. Immediately remove mortar splatter, spilled liquids, oil, grease, paint, coatings, and other surface contaminants which could adversely affect completed polished concrete floor system.
- C. Repair damaged areas of completed polished concrete floor system to satisfaction of Architect.

3.7 APPLICATION SCHEDULE

- A. Schedule of installation:

Floor Location	Sheen Level
1. Lobby A101	4
2. Collaboration Space E125	4
3. Lobby B111	4

END OF SECTION

SECTION 03 48 19

PRECAST CONCRETE STAIR TREADS AND CAPS

1. PART 1 - GENERAL

1.1 SUMMARY:

A. Section Includes:

1. Precast concrete stair treads welded to supports on steel stairs.
2. Precast concrete wall cap

B. Related Sections:

1. Section 055100 Steel Stairs: Stairs and stringers designed, fabricated and installed to meet applicable building codes, including weld plates for field attachment of Steptread welding plates.
2. Section 04 20 00 Unit Masonry: Structural columns as indicated on drawings.

1.2 REFERENCES:

A. American Society for Testing and Materials (ASTM):

ASTM C33	Concrete Aggregates
ASTM C139	Concrete Compressive Strength
ASTM C 144	Aggregate for Masonry Mortar
ASTM C 150	Portland cement
ASTM C 642	Water Absorption, Density, Voids in Hardened Conc
ASTM C 666	Rapid Freeze/Thaw Resistance of Conc
ASTM C 979	Pigments for Integrally Colored Concrete
ASTM C 1028	Coefficient of Friction

1.3 SUBMITTALS:

- A. Shop Drawings: Provide setting drawings and templates showing recommended installation of anchorage devices under provisions of Section 01 33 00
- B. Samples: Submit under provisions of Section 01 33 00 two 3" wide by full depth samples of each type of stair tread unit to show the full range of color and texture of treads and integral detectable warning stripes, for selection and approval, apply sealer on one sample.
- C. Manufacturer's Installation Details: Submit complete.
- D. Warranty: Provide certified copies of manufacturer's product warranties.

1.4 SUBSTITUTIONS:

- A. Under provisions of Section 01 25 13

1.5 QUALITY ASSURANCE:

- A. Compliance with Regulations: Comply with requirements of state and local building codes and with rules and regulations relating to building accessibility.
- B. Qualifications of Manufacturer: Company specializing in manufacture of precast concrete stair treads with a minimum of 10 continuous years of documented experience.
- C. Treads and connection shall be capable of supporting dead loads plus a uniform live load of 100 pounds per square foot.

- D. Pre-installation Conference: As directed by the Architect

1.6 DELIVERY, STORAGE AND HANDLING:

- A. Deliver all materials to the installation site in the manufacturer's original packaging. Packaging shall contain manufacturer's name, customer name, order, identification number, and other related information.
- B. Handle and store stair treads in accordance with manufacturer's recommendations.

1.7 WARRANTY

- A. Provide warranty covering precast concrete stair treads, against defects in material and workmanship for a period of 5 years. Unusual abuse and neglect are excepted.

PART 2 - PRODUCTS

2.1 MANUFACTURER:

Stepstone, Inc.
17025 South Main Street
Gardena, CA 90248
(310) 327-7474
(800) 572-9029
FAX (310) 217-1424
www.stepstoneinc.com

2.2 MATERIALS:

- A. Stair treads shall be CalArc "Steptreads", precast concrete, consisting of Portland cement, aggregate, color admixtures, and reinforcing, factory formed to profiles indicated.
 - 1. Portland Cement: ASTM C 150, Type III, high early strength.
 - 2. Aggregate: ASTM C 33.
 - 3. Color Admixture: By Davis Colors, or equal, as required to achieve color as selected.
 - 4. Aggregate for exposed aggregate surface: As selected.
 - 5. Reinforcement - Standard 2-1/2 inch Steptreads: Galvanized welded wire mesh, No. 7 and No. 10, 2 inch by 6 inch.
 - 6. Reinforcement - Long Span Steptreads: Galvanized 1/4" deformed rebar cage and 3 lengths of 1/4" galvanized 3/8" rebar.
- B. Tread style:
 - 1. Open Riser – available thickness noted by profile:
 - a. Wedge profile with 2" wide Wooster model no. WP24-A integral detectable warning stripe. Color to be selected by architect from full range of (18) Spectra colors.
 - b. Maximum span for Open Riser Treads is 60 inches. Provide dual treads with seam at center of stair widths when over 60 inches.
- C. Provide starter nosing with integral detectable warning stripe to match tread style and color.
 - a. Provide for every tread, deck, and landing at exterior stairs.
 - b. Provide for bottom treads, upper deck, and mid-landings of each stair run at interior stairs.
- D. Concrete Cap Stone: Classic Bullnosed Peaked Pilaster Caps (Sandblasted) – 24 inch x 24 inch x 4.5 inch
 - a. Provide at top of CMU columns as indicated on drawings.

2.3 COLORS AND FINISHES:

- A. Colors: Davis Colors, integral color admixture.
 - a. Color to be selected by architect from manufacturer's standard colors.
- B. Finishes: Walking surfaces of treads shall have minimum coefficient of friction of 0.60, wet and dry.
 - 1. Broom finish
- C. Factory Application of Sealer: Factory apply one coat of penetrating sealer to all surfaces of paving units. Sealer shall be non-staining, penetrating material, suitable for exterior or interior use, type which does not discolor or darken the surface.

2.4 PHYSICAL PROPERTIES:

- A. Compressive strength: Minimum 5,000 psi.
- B. 12" wide x 3" thick, length as required for width of stair.
- C. Weight:
 - 1. Open Riser: 30 pounds per square foot at 2-1/2 inches thick; 36 pounds per square foot at 3 inches thick.
- D. Water absorption: Not more than 6.0 % average, not more than 7.0 % for any individual unit for standard colors.
- E. Unit size: Within 3/16 inch of designated length, width and thickness.

2.5 ATTACHMENT ACCESSORIES:

- A. For Welding to Steel stringers:
 - 1. 11 gauge galvanized weld plate, 4" x 7-1/4" for 2-1/2" thick Treads.
 - 2. 3/8" galvanized weld plate, 6" x 6" for 3" thick Long-Span Closed and Open Riser Treads.
 - 3. Starter Nosings have a galvanized weld plate/angle (2-1/2" x 2-1/2" x 3/16")

2.6 FABRICATION:

- A. Stair treads shall be hand-made, wet-cast of cement conforming to ASTM C 150, Type III, and aggregates conforming to ASTM C 33.
- B. Reinforcement - Standard 2-1/2" thick Steptreads: Galvanized welded wire mesh, No. 7 and No. 10, 2 inch by 6 inch.
- C. Reinforcement - Long Span Steptreads: Galvanized rebar cage.

2.7 SOURCE QUALITY CONTROL:

- A. Concrete for Steptreads shall be tested frequently to assure that mixes provide units having not less than 5,000 psi compressive strength at 28 days (average test strength not less than 4,500 psi).
- B. Minor chips, hairline cracks, air voids and slight variations in color and finish are normal in precast concrete. When viewed in typical daylight illumination from a distance of 20 feet, minor cracks and air voids that cannot be seen with the naked eye are not grounds for rejection.

PART 3 - EXECUTION

3.1 EXAMINATION:

- A. Verify that structural components of stairs and risers are in place, aligned and level, within tolerances for proper installation of stair treads, and required structural inspections have been completed.

3.2 INSTALLATION - GENERAL:

- A. Installation shall comply with requirements of applicable building codes and state and local jurisdictions.
- B. Install stair treads aligned, level and with uniform treads and risers throughout the extent of the stair. Where cutting is necessary, use powered masonry saw.
- C. Do not install stair treads having excessively stained, defaced, or damaged faces, edges, or corners where to remain exposed. Remove dust and dirt from stair tread units using oil-free compressed air.
- D. Install cap stone centered on CMU column and level. Provide (2) minimum 3/8-inch cast in place inserts per cap and install per manufacturer's instructions.

3.3 INSTALLATION: WELDED TO STEEL STAIR SUPPORTS:

- A. Weld plates on Steptreads shall be welded to structural steel stairs as indicated on approved submittals.
- B. Welding shall comply with AWS D1.1, Structural Welding Code.

3.4 CLEANING:

- A. Clean exposed surfaces of stair treads. Use cleaners appropriate for precast concrete finishes and colors. Acid based cleaners may alter finish and color.

3.5 COMPLETION:

- A. Protect precast concrete paving units from damage due to subsequent building operations.
- B. After installation and before completion, inspect precast concrete paving units for construction damage and obtain new precast concrete paving units if required.
- C. Immediately prior to final acceptance of project, clean precast concrete paving units.

END OF SECTION

SECTION 04 05 13

MASONRY MORTAR

1. PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Mortar and grout for masonry.

1.2 REFERENCES

- A. CBC - California Building Code, (CCR) California Code of Regulations, Title 24, Part 2.
- B. ASTM C144 - Aggregate for Masonry Mortar.
- C. ASTM C150 - Portland Cement.
- D. ASTM C207 - Hydrated Lime for Masonry Purposes.
- E. ASTM C270 - Mortar for Unit Masonry.
- F. ASTM C404 - Aggregates for Masonry Grout.
- G. ASTM C476 - Grout for Masonry.
- H. ASTM C618 - Standard Specification for Coal Fly Ash and Raw or Calcined Natural Pozzolan for use as a Mineral Admixture for Concrete.

1.3 SUBMITTALS

- A. Submit samples under provisions of Section 01 33 00.
- B. Submit two ribbons of mortar color, illustrating color and color range.

1.4 STORAGE AND HANDLING

- A. Maintain packaged materials clean, dry, and protected against dampness, freezing, and foreign matter.

1.5 ENVIRONMENTAL REQUIREMENTS

- A. Maintain materials and surrounding air temperatures to minimum 40 degrees F prior to, during, and 48 hours after completion of masonry work.

1.6 MIX DESIGN

- A. Submit design mix prepared by a California Registered Civil Engineer to testing laboratory and Architect for review.

2. PART 2 PRODUCTS

2.1 MATERIALS

- A. Portland Cement: ASTM C150, Type I, low alkali, gray color.
- B. Mortar Aggregate: ASTM C144, standard masonry type, non reactive.
- C. Hydrated Lime: ASTM C207, Type S.
- D. Grout Aggregate: ASTM C404.

E. Fly Ash: ASTM C618, Class F.

F. Water: Clean and potable.

2.2 MORTAR COLOR

A. Mortar Color: Natural and synthetic mineral oxides, compounded for use in mortar mixes. Provide one of the following:

1. SGS Mortar Colors; Solomon Grind-Chem Services, Inc., www.solomoncolors.com.
2. True Tone Mortar Colors, Davis Colors, subsidiary of Rockwood Industries, Inc., www.daviscolors.com.
3. Substitution: Under provisions of Section 01 25 13.

B. Color: As selected by Architect.

2.3 ADMIXTURES

A. Water Repellant: Liquid type; Dry Block as manufactured by GCP Applied Technologies, www.gcpat.com or MasterPel 240MA as manufactured by Master Builders, Inc., www.master-builders-solutions.basf.us.

B. Sika Grout Aid as manufactured by Sika Corp., www.sikausa.com.

C. Substitutions: Under provisions of Section 01 25 13.

2.4 MORTAR MIXES

A. Comply with CBC, California Building Code, (CCR), California Code of Regulations, Title 24, Part 2, Section 2103A.2.

B. Limit fly ash content to 15 percent maximum.

C. Acceptable Alternative: Mix Preblended Masonry Mortars as manufactured by E-Z Mix, Inc., or Amerimix.

2.5 MORTAR MIXING

A. Thoroughly mix mortar ingredients in quantities needed for immediate use.

B. Add mortar color in accordance with manufacturer's instructions. Provide uniformity of mix and coloration.

C. Add water-repellant admixture to all exterior mortar in quantities recommended by manufacturer for type of mortar mix used.

D. Do not use anti-freeze compounds to lower the freezing point of mortar.

E. If water is lost by evaporation, retemper only within 2 hours of mixing.

F. Use mortar within two hours after mixing at temperatures of 80 degrees F, or 2-1/2 hours at temperatures under 40 degrees F.

G. Mortar which has hardened or stiffened due to hydration of cement shall not be used.

2.6 GROUT MIXES

A. Comply with CBC, California Building Code, (CCR) California Code of Regulations, Title 24, Part 2, Section 2103A.3.

1. Fine Grout: spaces less than 2 inches in horizontal dimension.
2. Coarse Grout: spaces 2 inches or more in least horizontal dimension.

3. Mix 1 lb of grout aid per 100 lbs of cementitious materials.
4. Limit fly ash content to 25 percent maximum.

2.7 GROUT MIXING

- A. Thoroughly mix grout ingredients in quantities needed for immediate use in accordance with ASTM C476.
- B. Do not use anti-freeze compounds to lower the freezing point of grout.

3. PART 3 EXECUTION

3.1 PREPARATION

- A. Plug cleanout holes with masonry units to prevent leakage of grout materials. Brace masonry for wet grout pressure.

3.2 INSTALLATION

- A. Install mortar and grout to requirements of the specific masonry Section.
- B. Work grout into masonry cores and cavities to eliminate voids.
- C. Do not displace reinforcement while placing grout.
- D. Remove grout spaces of excess mortar.

3.3 FIELD QUALITY CONTROL

- A. Testing and analysis of mortar and grout will be performed under provisions of Section 01 45 29 and as required by Division of the State Architect and District Inspector.

END OF SECTION

SECTION 04 20 00

UNIT MASONRY

1. PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Concrete masonry units.
- B. Reinforcement, anchorage, and accessories.

1.2 REFERENCES

- A. ASTM C90 - Load-Bearing Concrete Masonry Units.
- B. ASTM C652 - Hollow Brick (Hollow Masonry made from Clay or Shale).
- C. ASTM C744- Prefaced Concrete and Calcium Silicate Masonry Units.
- D. ASTM D226 - Asphalt Saturated Organic Felt Used in Roofing and Waterproofing.
- E. ASTM D1056 - Flexible Cellular Materials - Sponge or Expanded Rubber.
- F. ASTM D2000 - Rubber Properties in Automotive Applications.
- G. ASTM D2240 - Rubber Property - Durometer Hardness.
- H. UL - Underwriters' Laboratories.
- I. MSJC - Masonry Standards Joint Committee (ACI 530/ASCE 5/TMS 402).
- J. DSA - Division of the State Architect.

1.3 SUBMITTALS

- A. Submit samples under provisions of Section 01 33 00.
- B. Submit four samples of each type of unit to illustrate color, texture and extremes of color range.
- C. Submit manufacturer's certificate under provisions of Section 01 33 00 that products meet or exceed specified requirements.
- D. Submit high lift grouting methods to Architect and testing laboratory for review.

1.4 REGULATORY REQUIREMENTS

- A. Conform to UL requirements for fire rated masonry construction.

1.5 MOCK-UP

- A. Provide mock-up of composite masonry under provisions of Section 01 43 00.
- B. Erect panel 6 feet long by 4 feet high by full thickness.
- C. When accepted, mock-up will demonstrate minimum standard for the Work. Mock-up may remain as part of the Work.

1.6 PRE-INSTALLATION CONFERENCE

- A. Convene two weeks prior to commencing work of this Section, under provisions of Section 01 31 00.

1.7 STORAGE, AND HANDLING

- A. Store and protect products under provisions of Section 01 61 00.

1.8 ENVIRONMENTAL REQUIREMENTS

- A. Weather Requirements: MSJC - Masonry Standards Joint Committee, Hot and Cold Weather Masonry Construction Manual (ACI 530/ASCE 5/TMS 402).

1.9 SEQUENCING AND SCHEDULING

- A. Coordinate work under provisions of Section 01 31 00.

2. PART 2 PRODUCTS

2.1 MANUFACTURERS - CONCRETE MASONRY UNITS

- A. Angelus Block, Co., Inc. www.angelusblock.com.
- B. Basalite Concrete Products, www.basalite.com.
- C. Desert Block Co., Inc., www.desertblock.com.
- D. Orco Block Co., Inc., www.orco.com.
- E. RCP Block and Brick, Inc., www.rcpblock.com.
- F. Substitutions: Under provisions of Section 01 25 13.

2.2 CONCRETE MASONRY UNITS

- A. Hollow Load Bearing Block Units: ASTM C90, medium weight. Masonry units shall be single or double open end units as required for proper installation.
- B. All exterior concrete masonry units shall contain Dry Block, an integral water-repellant admixture as manufactured by GCP Applied Technologies, www.gcpat.com or MasterPel 240 as manufactured by Master Builders, Inc., www.master-builders-solutions.basf.us.com. Quantity of admixture to be in accordance with manufacturer's recommendations.
- C. Provide single, double, and triple faced units as required for all exposed surfaces:
 - 1. Precision Units: Provide at all exterior and interior exposed and interior concealed locations where not otherwise indicated. Provide at all structural bearing connection locations, intersection with interior dissimilar partitions, at all electrical cover plates, thermostats, and elsewhere as indicated on drawings.
 - 2. Cap Blocks: Provide 2 inch thick solid units at all locations indicated on drawings.
 - 3. Window Sills: Provide nominal 8 x 4 x 10 solid units at all windows unless otherwise indicated.
 - 4. Lintel Blocks: Provide 8 x 8 x 16 units at all door and window heads and locations indicated on drawings.
- D. Color:
 - 1. Smooth Units: Grey where painted or plastered. Integral color where exposed: To be selected by Architect.

- 2. Cap Blocks: Grey where painted or plastered. Integral color where exposed: To be selected by Architect.
- 3. Window Sills: Grey where painted or plastered. Integral color where exposed: To be selected by Architect.
- 4. Lintel Blocks: Grey where painted or plastered. Integral color where exposed: To be selected by Architect.
- E. Masonry Units: Nominal modular sizes as indicated on drawings. Provide special units for degree corners, bond beams, lintels and other shapes indicated, or make up from saw cut units as indicated.

2.3 MORTAR AND GROUT

- A. Mortar: Type specified in Section 04 05 13.
- B. Grout: Type specified in Section 04 05 13.

2.4 REINFORCEMENT AND ANCHORAGE

- A. Reinforcing Steel: Type specified in Section 03 20 00; sizes indicated.
- B. Anchors: Types and sizes indicated and required for intended use.

2.5 ACCESSORIES

- A. Cleaning Solutions: Non-acidic, not harmful to masonry work or adjacent materials.
- B. Preformed Expansion Joints: ASTM D2000, designation 2AA-805, rubber material with durometer hardness of 80 when tested in accordance with ASTM D2240. Provide with corner and tee accessories, fused joints.
- C. Joint Filler: ASTM D1056, Type 2, Class A, Grade 1, closed cell neoprene oversized 35 percent to joint width.
- D. Building Paper: ASTM D226, Type I (No. 15) asphalt saturated felt.

3. PART 3 EXECUTION

3.1 EXAMINATION

- A. Verify that field conditions are acceptable and are ready to receive work.
- B. Verify items provided by other Sections of work are properly sized and located.
- C. Verify that built-in items are in proper location, and ready for roughing into masonry work.
- D. Beginning of installation means installer accepts existing conditions.

3.2 PREPARATION

- A. Direct and coordinate placement of metal anchors supplied by other Sections.
- B. Provide temporary bracing during installation of masonry work. Maintain in place until building structure provides permanent bracing.
- C. Roughen masonry contact surface of foundation and floors by exposing clean aggregate.

3.3 COURSING

- A. Establish lines, levels, and coursing indicated. Protect from displacement.
- B. Maintain masonry courses to uniform dimension. Form vertical and horizontal joints of uniform thickness.

- C. Lay concrete masonry units in running bond. Course one unit and one mortar joint to equal 8 inches. Form concave mortar joints.

3.4 PLACING AND BONDING

- A. Lay hollow masonry units with face shell bedding on head and bed joints.
- B. Buttering corners of joints or excessive furrowing of mortar joints are not permitted.
- C. Remove excess mortar as Work progresses.
- D. Interlock intersections and external corners.
- E. Do not shift or tap masonry units after mortar has achieved initial set. Where adjustment must be made, remove mortar and replace.
- F. Perform job site cutting of masonry units with proper tools to provide straight, clean, unchipped edges. Prevent broken masonry unit corners or edges.

3.5 REINFORCEMENT

- A. Support and secure reinforcing bars from displacement. Maintain position within 1/2 inch of dimensioned position.

3.6 LINTELS

- A. Install reinforced unit masonry lintels over openings.
- B. Use single piece reinforcing bars only.
- C. Support and secure reinforcing bars from displacement. Maintain position within 1/2 inch of dimensioned position.
- D. Place and consolidate grout fill without displacing reinforcing.
- E. Allow masonry lintels to attain specified strength before removing temporary supports.

3.7 REINFORCED UNIT MASONRY

- A. Lay masonry units with core cells vertically aligned clear of mortar and unobstructed.
- B. Place mortar in masonry unit bed joints back 1/4 inch from edge of unit grout spaces, bevel back and upward. Permit mortar to cure 3 days before placing grout for high lift grouting and 24 hours for low lift grouting.
- C. Reinforce masonry unit cores with reinforcement bars and grout as indicated.
- D. Retain vertical reinforcement in position at top and bottom of cells and at intervals not exceeding 160 bar diameters. Do not splice between lateral support unless otherwise indicated.
- E. Brace reinforcement and secure in place to allow no movement during grouting.
- F. Grouting:
 - 1. Use Fine Grout per Section 04 05 13 for filling spaces less than 2 inches in one or both horizontal directions.
 - 2. Use Coarse Grout per Section 04 05 13 for filling spaces 2 inches or larger in both horizontal directions.

3. Grouting Technique: Low-lift grouting technique subject to requirements specified below. Optional high lift grouting technique may be used subject to requirements specified below only after obtaining approval by DSA of any proposed high lift grouting methods.

G. Low-Lift Grouting:

1. Provide minimum clear dimension of 2-1/2 inch and clear area of 8 sq. in. in vertical cores to be grouted.
2. Place vertical reinforcement prior to laying of masonry units. Extend above elevation of maximum pour height as required for splicing.
3. Lay masonry units to maximum pour height. Do not exceed 4'-0" height, or if bond beam occurs below this height, stop pour at course below bond beam.
4. Pour grout using chute or container with spout. Rod or vibrate grout during placing. Place grout continuously; do not interrupt pouring of grout for more than 1 hour. Terminate grout pours 1-1/2 inches below top course of pour.
5. Bond Beams: Stop grout in vertical cells 1-1/2 inches below bond beam course. Place horizontal reinforcement in bond beams; lap at corners and intersections as shown. Place grout in bond beam course before filling vertical cores above bond beam.

H. High-Lift Grouting:

1. Do not use high-lift grouting technique for grouting unless minimum cavity dimension and area is 3-1/2 inch and 10 sq.in., respectively.
2. Provide cleanout holes in first course at all vertical cells which are to be filled with grout. Use units with one face shell removed and provide temporary supports for units above, or use header units with concrete brick supports, or cut openings in one face shell.
3. Construct masonry to full height of maximum grout pour specified, prior to placing grout. Limit grout lifts to a maximum height of 4 feet and grout pour to a maximum height of 12'-0" for 8 inch walls and 16'-0" for 12 inch walls, unless specifically approved otherwise.
4. Place vertical reinforcement before grouting. Place before or after laying masonry units, as required by job conditions. Tie vertical reinforcement to dowels at base of masonry where shown and thread masonry over or around reinforcement.
5. Place horizontal beam reinforcement as the masonry units are laid.
6. Preparation of Grout Spaces: Prior to grouting, inspect and clean grout spaces. Remove dust, dirt, mortar droppings, loose pieces of masonry and other foreign materials from grout spaces. Clean reinforcement and adjust to proper position. Clean top surface of structural members supporting masonry to ensure bond. After final cleaning and inspection, close cleanout holes and brace closures to resist grout pressures.
7. Do not place grout until entire height of masonry to be grouted has attained sufficient strength to resist displacement of masonry units and breaking of mortar bond. Install shores and bracing, if required, before starting grouting operations.
8. Limit grout pours to sections which can be completed in one working day with not more than one hour interruption of pouring operation. Place grout in lifts which do not exceed 4 feet. Allow not less than 30 minutes, or more than one hour between lifts of a given pour. Vibrate each grout lift during pouring operation. Place grout in lintels or beams over openings in one continuous pour.
9. Where bond beam occurs more than one course below top of pour, fill bond beam course to within 1 inch of vertically reinforced cavities, during construction of masonry.

10. When more than one pour is required to complete a given section of masonry, extend reinforcement beyond masonry as required for splicing. Pour grout to within 1-1/2 inches of top course of first pour. After grouted masonry is cured, lay masonry units and place reinforcement for second pour section before grouting. Repeat sequence if more pours are required.

3.8 CONTROL JOINTS

- A. Size control joint in accordance with Section 07 92 00 for sealant performance.
- B. Form control joint with a sheet building paper bond breaker fitted to one side of masonry unit. Fill resultant joint with mortar. Rake joint at exposed unit faces for placement of backer rod and sealant.
- C. Form control joints using half size masonry units as required in running bond.
- D. Locate joints in concrete masonry unit walls at intervals not to exceed 24 feet unless indicated otherwise.
- E. Locate joints at wall intersections, openings and of change in wall heights and thicknesses.
- F. Continue horizontal reinforcement through control joint.

3.9 EXPANSION JOINTS

- A. Do not continue reinforcement through expansion joints.
- B. Install preformed expansion joint material in continuous lengths.
- C. Form expansion joints using half size masonry units as required in running bond.
- D. Size expansion joints in accordance with Section 07 92 00 for sealant performance.
- E. Form expansion joints as detailed.

3.10 BUILT-IN WORK

- A. As work progresses, build in metal door frames window frames, wood nailing strips, anchor bolts, plates and other items furnished by other Sections.
- B. Build in items plumb and level.
- C. Bed anchors of metal door and glazed frames in adjacent mortar joints. Fill frame voids solid with grout.
- D. Do not build in organic materials subject to deterioration.

3.11 TOLERANCES

- A. Maximum Variation From Alignment of Columns and Pilasters: 1/4 inch.
- B. Maximum Variation From Unit to Adjacent Unit: 1/16 inch.
- C. Maximum Variation From Plane of Wall: 1/4 inch in 10 feet and 1/2 inch in 20 feet or more.
- D. Maximum Variation From Plumb: 1/4 inch per story non-cumulative; 1/2 inch in two stories or more.
- E. Maximum Variation From Level Coursing: 1/8 inch in 4 feet and 1/4 inch in 12 feet maximum.
- F. Maximum Variation of Joint Thickness: 1/8 inch in 4 feet.
- G. Maximum Variation From Cross Sectional Thickness of Walls: 1/4 inch.

3.12 CUTTING AND FITTING

- A. Cut and fit for chases, pipes, conduit, sleeves and grounds. Coordinate with other Sections of work to provide correct size, shape, and location.
- B. Obtain Architect's approval prior to cutting or fitting masonry work not indicated or where appearance or strength of masonry work may be impaired.

3.13 PARGING

- A. Dampen masonry walls prior to parging.
- B. Parge masonry walls in one uniform coat of mortar to a total thickness of 1/2 inch.
- C. Steel trowel surface smooth and flat with a maximum surface variation of 1/8 inch per foot.

3.14 FIELD QUALITY CONTROL

- A. Field inspection and testing will be performed under provisions of Section 01 45 29.

3.15 CLEANING

- A. Clean work under provisions of Section 01 77 00.
- B. Remove excess mortar and mortar smears as work progresses.
- C. Replace defective mortar. Match adjacent work.
- D. Clean soiled surfaces with non-acid cleaning solution.
- E. Use non-metallic tools in cleaning operations.

3.16 PROTECTION OF FINISHED WORK

- A. Protect finished installation under provisions of Section 01 61 00.
- B. At the end of each days work and during times of inclement weather cover top of masonry wall with polyethylene sheeting. Extend covering down each side of wall for a distance of 2 feet minimum. Secure in place to avoid displacement.
- C. Without damaging completed work, provide protective boards at exposed external corners which may be damaged by construction activities.

END OF SECTION

SECTION 05 12 00

STRUCTURAL STEEL FRAMING

1. PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Structural steel framing members and support members.
- B. Baseplates, and anchor bolts.
- C. Grouting under baseplates.

1.2 REFERENCES

- A. CBC - California Building Code, (CCR) California Code of Regulations, Title 24, Part 2.
- B. ASTM A36 - Carbon Structural Steel.
- C. ASTM A53 - Pipe, Steel, Black and Hot-Dipped, Zinc Coated, Welded and Seamless.
- D. ASTM A108 - Steel Bars, Carbon, Cold-Finished, Standard Quality.
- E. ASTM A307 - Carbon Steel Bolts and Studs, 60,000 psi Tensile Strength
- F. ASTM A325 - High Strength Bolts for Structural Steel Joints.
- G. ASTM A490 - Structural Bolts, alloy Steel, Heat Treated, 150 ksi Minimum Tensile Strength.
- H. ASTM A500 - Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Round and Shapes.
- I. ASTM A992 - Standard Specification for Steel for Structural Shapes for Use in Building Framing.
- J. ASTM C1107 - Packaged Dry, Hydraulic Cement Grout (non shrink).
- K. ASTM F1554 - Standard Specification for Anchor Bolts, Steel, 36, 55, and 105 KSI Yield Strength.
- L. AWS A2.4 - Standard Welding Symbols.
- M. AWS D1.1 - Structural Welding Code - Steel.
- N. AISC - Specification for the Design, Fabrication and Erection of Structural Steel for Buildings.
- O. AISC - Specification for Architectural Exposed Structural Steel.
- P. SSPC - The Society for Protective Coatings.

1.3 SUBMITTALS

- A. Submit under provisions of Section 01 33 00.
- B. Shop Drawings:
 - 1. Indicate profiles, sizes, spacing, and locations of structural members, connections, cambers and loads.
 - 2. Indicate welded connections with AWS A2.4 welding symbols. Indicate net weld lengths.
- C. Manufacturer's Mill Certificate: Submit under provisions of Section 01 33 00 certifying that products meet or exceed specified requirements.

- D. Mill Test Reports: Submit under provisions of Section 01 33 00 Manufacturer's Certificates, indicating structural strength and destructive and non-destructive test analysis.
- E. Welders' Certificates: Submit under provisions of Section 01 33 00, certifying welders employed on the Work, verifying AWS qualification within the previous 12 months.
- F. Architectural Exposed Structural Steel (AESS) - submit under Section 05 12 13.

1.4 QUALITY ASSURANCE

- A. Fabricate structural steel members in accordance with AISC-Specification for the Design, Fabrication and Erection of Structural Steel for Buildings.
- B. Perform Work in accordance with AISC and Section 05 12 13 - Specification for Architectural Exposed Structural Steel.

1.5 QUALIFICATIONS

- A. Design connections not detailed on the Drawings under direct supervision of a Professional Structural Engineer experienced in design of this work and licensed in the State of California.
- B. Design connections in accordance with CBC California Building Code, (CCR) California Code of Regulations, Title 24, Part 2, Chapter 22A.

2. PART 2 PRODUCTS

2.1 MATERIALS

- A. Structural Steel Members: ASTM A36. W and WT shapes, ASTM A992.
- B. Structural Tubing: ASTM A500, Grade B.
- C. Steel Pipe: ASTM A53, Grade B.
- D. Shear Stud Connectors: ASTM A108, Grade 1015, forged steel, headed, unfinished.
- E. Threaded Bolts, Nuts, and Washers: ASTM A325 unless noted otherwise on structural drawings.
- F. Anchor Bolts: ASTM A307. ASTM F1554 if over 9-1/2 inches long or as indicated on structural drawings.
- G. Welding Materials: AWS D1.1; type required for materials being welded.
- H. Grout: ASTM C1107, non-shrink type, pre-mixed compound consisting of non-metallic aggregate, cement, water reducing and plasticizing additives, capable of developing a minimum compressive strength of 7,000 psi at 28 days.

2.2 FABRICATION

- A. Fabricate structural steel members in accordance with AISC Specification.
- B. Continuously seal joined members by continuous welds. Grind exposed welds smooth.

2.3 FINISH

- A. Prepare structural component surfaces in accordance with SSPC SP-2.
- B. Shop and Touch-Up Primer: SSPC 15, Type 1, Red Oxide.
- C. Shop prime structural steel members. Do not prime surfaces that will be fireproofed, field welded or in contact with concrete or masonry.

- D. Finish: Site paint exposed to view structural steel members under provisions of Section 09 90 00. For AESS refer to Section 05 12 13.

2.4 SOURCE QUALITY CONTROL AND TESTS

- A. Testing and analysis of components will be performed under provisions of Section 01 45 29.

3. PART 3 EXECUTION

3.1 EXAMINATION

- A. Verify that field conditions are acceptable and are ready to receive work.
- B. Beginning of installation means erector accepts existing conditions.

3.2 ERECTION

- A. Allow for erection loads, and for sufficient temporary bracing to maintain structure safe, plumb, and in true alignment until completion of erection and installation of permanent bracing.
- B. Field weld components indicated on Drawings.
- C. Field connect members with threaded fasteners indicated; torque to required resistance.
- D. Do not field cut or alter structural members without approval of Architect.
- E. After erection, prime welds, abrasions, and surfaces not shop primed, except surfaces to be in contact with concrete.

3.3 GROUTING

- A. Clean concrete on masonry bearing surfaces.
- B. Roughen bearing surface prior to setting base and bearing plates.
- C. Set base and bearing plates on wedges, shims, or setting nuts.
- D. Tighten anchor bolts after members are positioned and plumb.
- E. Cut off protruding wedges or shims flush with edge of base or bearing plate.
- F. Pack grout solidly between bearing surfaces and plates so no voids remain.
- G. Finish exposed surfaces, protect installed materials, and allow to cure.

3.4 ERECTION TOLERANCES

- A. Erect structural steel members in accordance with AISC Specification.

3.5 FIELD QUALITY CONTROL

- A. Field inspection and testing will be performed under provisions of Section 01 45 29.

END OF SECTION

SECTION 05 12 13

ARCHITECTURALLY EXPOSED STRUCTURAL STEEL FRAMING

1. PART 1 GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

- 1. Architecturally exposed structural steel (AESS).
- 2. Section 05 12 00 "Structural Steel Framing" requirements that also apply to AESS.

B. Related Requirements:

- 1. Section 05 50 00 "Metal Fabrications" for steel lintels and shelf angles not attached to structural-steel frame, miscellaneous steel fabrications and other metal items not defined as structural steel.
- 2. Section 09 90 00 Painting for surface preparation and priming requirements.

1.3 DEFINITIONS

- A. AESS: Architecturally exposed structural steel.
- B. Category AESS 4: Structural steel that is categorized by ANSI/AISC 303, Section 10, as AESS 4 and is designated as AESS 4 or Category AESS 4 in the Contract Documents.
- C. SEAC/RMSCA Guide Specification: SEAC/RMSCA's "Sample Specification, Section 05 02 13: Architecturally Exposed Structural Steel."

1.4 COORDINATION

- A. Coordinate surface preparation requirements for shop-primed items.
- B. Coordinate selection of shop primers with topcoats to be applied over them. Comply with paint and coating manufacturers' written recommendations to ensure that shop primers and topcoats are compatible with one another.

1.5 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct conference at Project site.

1.6 ACTION SUBMITTALS

A. Product Data:

- 1. Tension-control, high-strength, bolt-nut-washer assemblies.
- 2. Corrosion-resisting (weathering steel), tension-control, high-strength, bolt-nut-washer assemblies.
- 3. Filler.
- 4. Primer.

5. Galvanized-steel primer.
 6. Etching cleaner.
 7. Galvanized repair paint.
- B. Shop Drawings: Show fabrication of AESS components. Shop Drawings for structural steel may be used for AESS.
1. Identify AESS category for each steel member and connection, including transitions between AESS categories and between AESS and non-AESS.
 2. Include details of cuts, connections, splices, camber, holes, and other pertinent data.
 3. Include embedment Drawings.
 4. Indicate orientation of mill marks and HSS seams.
 5. Indicate welds by standard AWS symbols, distinguishing between shop and field welds, and show size, length, and type of each weld. Show backing bars that are to be removed and supplemental fillet welds where backing bars are to remain. Indicate grinding, finish, and profile of welds.
 6. Indicate type, size, and length of bolts, distinguishing between shop and field bolts. Identify pretensioned and slip-critical, high-strength bolted connections. Indicate orientation and location of bolt heads.
 7. Indicate exposed surfaces and edges and surface preparation being used.
 8. Indicate special tolerances and erection requirements.
 9. Indicate weep holes for HSS and vent holes for galvanized HSS.
 10. Indicate surface preparation, primer, and coating requirements, including systems specified in other Sections.
- C. Samples: Submit Samples to set quality standards for AESS.
1. Two steel plates, 3/8 by 8 by 4 inches, with long edges joined by a groove weld and with weld ground smooth.
 2. Steel plate, 3/8 by 8 by 8 inches, with one end of a short length of rectangular steel tube, 4 by 6 by 3/8 inches, welded to plate with a continuous fillet weld and with weld ground smooth and blended.
 3. Round steel tube or pipe, minimum 8 inches in diameter, with end of another round steel tube or pipe, approximately 4 inches in diameter, welded to its side at a 45-degree angle with a continuous fillet weld and with weld ground smooth and blended.

1.7 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For Installer fabricator shop-painting applicator.
- B. Paint Compatibility Certificates: From manufacturers of topcoats applied over shop primers, certifying that shop primers are compatible with topcoats.

1.8 QUALITY ASSURANCE

- A. Fabricator Qualifications: A qualified fabricator that participates in the AISC Quality Certification Program and is designated an AISC-Certified Plant, Category BU, or is accredited by the IAS Fabricator Inspection Program for Structural Steel (AC 172) and is experienced in fabricating AESS similar to that indicated on this Project.

- B. Installer Qualifications: A qualified Installer who participates in the AISC Quality Certification Program, is designated an AISC-Certified Erector, Category ACSE, Category CSE, and is experienced in erecting AESS similar to that indicated on this Project.
- C. Shop-Painting Applicators: Qualified according to AISC's Sophisticated Paint Endorsement P1 Endorsement P2, Endorsement P3 or SSPC-QP 3.
- D. Mockups: Build mockups of AESS to set quality standards for fabrication and installation.
 - 1. Build mockup of typical portion of AESS as shown on Drawings.
 - 2. Coordinate painting requirements with Section 09 90 00 Painting.
 - 3. Coordinate high-performance coatings requirements with Section 099600 "High-Performance Coatings."
 - 4. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.9 DELIVERY, STORAGE, AND HANDLING

- A. Use special care in handling AESS to prevent twisting, warping, nicking, and other damage during fabrication, delivery, and erection. Store materials to permit easy access for inspection and identification. Keep AESS members off ground and spaced by using pallets, dunnage, or other supports and spacers. Protect AESS members and packaged materials from corrosion and deterioration.
 - 1. Do not store AESS materials on structure in a manner that might cause distortion, damage, or overload to members or supporting structures. Repair or replace damaged materials or structures as directed.

1.10 FIELD CONDITIONS

- A. Field Measurements: Where AESS is indicated to fit against other construction, verify actual dimensions by field measurements before fabrication.

2. PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Comply with requirements of ANSI/AISC 303, Sections 1 through 9 and as modified in Section 10, "Architecturally Exposed Structural Steel."

2.2 BOLTS, CONNECTORS, AND ANCHORS

- A. Tension-Control, High-Strength, Bolt-Nut-Washer Assemblies: ASTM F3125/F3125M, Grade F1852, Type 1, round-head assemblies consisting of steel structural bolts with splined ends; ASTM A563, Grade DH, heavy-hex carbon-steel nuts; and ASTM F436/F436M, Type 1, hardened carbon-steel washers.
 - 1. Finish: Mechanically deposited zinc coating.
- B. Corrosion-Resisting (Weathering) Steel, Tension-Control, High-Strength, Bolt-Nut-Washer Assemblies: ASTM F3125/F3125M, Grade F1852, Type 3, round-head assemblies consisting of steel structural bolts with splined ends; ASTM A563, Grade DH3, heavy-hex carbon-steel nuts; and ASTM F436/F436M, Type 3, hardened carbon-steel washers.

2.3 FILLER

- A. Polyester filler intended for use in repairing dents in automobile bodies.

2.4 PRIMER

A. Steel Primer:

1. Comply with Section 09 90 00 Painting.
2. SSPC-Paint 23, latex primer.
3. Fabricator's standard lead- and chromate-free, nonasphaltic, rust-inhibiting primer complying with MPI#79 and compatible with topcoat.

B. Galvanized-Steel Primer: MPI#134.

1. Etching Cleaner: MPI#25, for galvanized steel.
2. Galvanizing Repair Paint: MPI#19, ASTM A780/A780M.

2.5 FABRICATION

A. Shop fabricate and assemble AECS to the maximum extent possible. Locate field joints at concealed locations if possible. Detail assemblies to minimize handling and to expedite erection.

1. Use special care handling and fabricating AECS before and after shop painting to minimize damage to shop finish.

B. Category AECS 4:

1. Comply with overall profile dimensions of AWS D1.1/D1.1M for welded built-up members. Keep appearance and quality of welds consistent. Maintain true alignment of members without warp exceeding specified tolerances.
2. Prepare surfaces according to Part 2 "Shop Priming" Article and SSPC-SP 6 (WAB)/NACE WAB-3.
3. Grind sheared, punched, and flame-cut edges to remove burrs and provide smooth surfaces and eased edges.
4. Make intermittent welds appear continuous, using filler or additional welding.
5. Seal weld open ends of hollow structural sections with 3/8-inch closure plates.
6. Limit butt and plug weld projections to 1/16 inch.
7. Install bolt heads on the same side of each connection and maintain orientation consistently from one connection to another.
8. Remove weld spatter, slivers, and similar surface discontinuities.
9. Remove blemishes and surface irregularities resulting from temporary braces or fixtures by filling or grinding, before cleaning, treating, and shop priming.
10. Grind tack welds smooth unless incorporated into final welds.
11. Remove backing and runoff tabs, and grind welds smooth.
12. Limit as-fabricated straightness tolerance to one-half that permitted for structural-steel materials in ANSI/AISC 303.
13. Limit as-fabricated curved structural steel tolerance to that permitted for structural-steel materials in ANSI/AISC 303.

14. Limit as-fabricated straightness tolerance of welded built-up members to one-half that permitted by AWS D1.1/D1.1M.
 15. Conceal fabrication and erection markings from view in the completed structure.
 16. Make welds uniform and smooth.
 17. Cut out mill marks from mill material or hide these markings from view in the completed structure. Where neither method is possible, remove mill marks by grinding and filling surfaces as approved by Architect.
 18. Grind butt and plug welds smooth or fill, removing weld splatter exposed to view.
 19. Orient HSS seams as indicated or away from view.
 20. Align and match abutting member cross sections.
 21. At visible open joints of copes, miters, and cuts, maintain uniform clear gaps of 1/8 inch. At closed joints, maintain uniform contact within 1/16 inch.
 22. Fabricate with exposed surfaces smooth, square, and of surface quality approved by Architect.
 23. Treat HSS seams to appear seamless.
 24. Contour and blend welds and weld transitions between members, removing splatter exposed to view.
 25. Fill surface imperfections with filler and sand smooth to achieve surface quality approved by Architect.
 26. Minimize weld show-through and distortion on the opposite side of exposed connections by grinding to a smooth profile aligned with adjacent material.
- C. Erection marks, painted marks, and other marks are permitted on galvanized steel surfaces of completed structure.

2.6 SHOP CONNECTIONS

- A. High-Strength Bolts: Shop install high-strength bolts according to RCSC's "Specification for Structural Joints Using High-Strength Bolts" for type of bolt and type of joint specified.
 1. Joint Type: Snug tightened, Pretensioned, Slip critical.
- B. Weld Connections: Comply with AWS D1.1/D1.1M and AWS D1.8/D1.8M for tolerances, appearances, welding procedure specifications, weld quality, and methods used in correcting welding work.

2.7 GALVANIZING

- A. Hot-Dip Galvanized Finish: Apply zinc coating by the hot-dip process to structural steel according to ASTM A123/A123M.
 1. Do not quench or apply post-galvanizing treatments that might interfere with paint adhesion.
 2. Fill vent and drain holes that are exposed in the finished Work, unless indicated to remain as weep holes, by plugging with zinc solder and filing off smooth.
 3. Galvanize AESS [lintels] <Insert description> attached to structural-steel frame and located in exterior walls.

2.8 SHOP PRIMING

- A. Shop prime steel surfaces, except the following:
 - 1. Surfaces embedded in concrete or mortar. Extend priming of partially embedded members to a depth of 2 inches.
 - 2. Surfaces to be field welded.
 - 3. Surfaces to be high-strength bolted with slip-critical connections.
 - 4. Galvanized surfaces unless indicated to be painted.
- B. Surface Preparation: Clean nongalvanized surfaces to be painted. Remove loose rust and mill scale and spatter, slag, or flux deposits. Prepare surfaces according to the following specifications and standards:
 - 1. SSPC-SP 2.
 - 2. SSPC-SP 3.
 - 3. SSPC-SP 7 (WAB)/NACE WAB-4.
 - 4. SSPC-SP 14 (WAB)/NACE WAB-8.
 - 5. SSPC-SP 11.
 - 6. SSPC-SP 6 (WAB)/NACE WAB-3.
 - 7. SSPC-SP 10 (WAB)/NACE WAB-2.
 - 8. SSPC-SP 5 (WAB)/NACE WAB-1.
 - 9. SSPC-SP 8.
- C. Preparing Galvanized Steel for Shop Priming: After galvanizing, thoroughly clean steel of grease, dirt, oil, flux, and other foreign matter, and treat with etching cleaner or according to SSPC-SP 16.
- D. Priming: Immediately after surface preparation, apply primer according to manufacturer's written instructions and at rate recommended by SSPC to provide a minimum dry film thickness of 1.5 mils. Use priming methods that result in full coverage of joints, corners, edges, and exposed surfaces.
 - 1. Stripe paint corners, crevices, bolts, welds, and eased edges.
 - 2. Apply two coats of shop paint to surfaces that are inaccessible after assembly or erection. Change color of second coat to distinguish it from first.

3. PART 3 - EXECUTION

3.1 EXAMINATION

- A. Verify, with steel erector present, elevations of concrete- and masonry-bearing surfaces and locations of anchor rods, bearing plates, and other embedments for compliance with requirements.
 - 1. Prepare a certified survey of bearing surfaces, anchor rods, bearing plates, and other embedments, showing dimensions, locations, angles, and elevations.
- B. Examine AESS for twists, kinks, warping, gouges, and other imperfections before erecting.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Provide temporary shores, guys, braces, and other supports during erection to keep AESS secure, plumb, and in alignment against temporary construction loads and loads equal in intensity to design loads. Remove temporary supports when permanent structural steel, connections, and bracing are in place unless otherwise indicated.

3.3 ERECTION

- A. Take special care during erection to avoid marking or distorting the AESS and to minimize damage to shop painting. Set AESS accurately in locations and to elevations indicated and according to ANSI/AISC 303 and ANSI/AISC 360.
 - 1. Remove welded tabs that were used for attaching temporary bracing and safety cabling and that are exposed to view in the completed Work. Take care to avoid any blemishes, holes, or unsightly surfaces resulting from the use or removal of temporary elements.
 - 2. Grind tack welds smooth.
 - 3. Remove backing and runoff tabs, and grind welds smooth.
 - 4. Orient bolt heads on the same side of each connection and maintain orientation consistently from one connection to another.
 - 5. Remove erection bolts in Category AESS 4, fill holes with weld metal or filler, and grind or sand smooth to achieve surface quality approved by Architect.
 - 6. Fill weld access holes in Category AESS 4 with weld metal or filler and grind, or sand smooth to achieve surface quality as approved by Architect.
 - 7. Conceal fabrication and erection markings from view in the completed structure.
- B. In addition to ANSI/AISC 303, Section 10 requirements, comply with the following.
 - 1. Erection of Category AESS 4:
 - (a) Erect AESS to the standard frame tolerances specified in ANSI/AISC 303 for non-AESS.
 - (b) Comply with AWS D1.1/D1.1M. Keep appearance and quality of welds consistent. Maintain true alignment of members without warp exceeding specified tolerances.
 - (c) Remove weld spatter, slivers, and similar surface discontinuities.
 - (d) Grind off butt and plug weld projections larger than 1/16 inch.
 - (e) Continuous welds shall be of uniform size and profile.
 - (f) Ream holes that must be enlarged. Use of drift pins or burning is not permitted. Replace misaligned connection plates where holes cannot be aligned with acceptable appearance.
 - (g) Splice members only where indicated on Drawings.
 - (h) No torch cutting or field fabrication is permitted.
 - (i) Weld profiles, quality, and finish shall be as approved by Architect.
 - (j) Make joint welds, including tack welds, appear continuous by filling intermittent welds.
 - (k) Grind welds smooth.

- (l) Minimize weld show-through and distortion on the opposite side of exposed connections by grinding to a smooth profile aligned with adjacent material.
- (m) Oversize welds where ground, contoured, or blended, and grind to provide a smooth transition, matching profile approved by Architect.

3.4 FIELD CONNECTIONS

- A. High-Strength Bolts: Install high-strength bolts according to RCSC's "Specification for Structural Joints Using High-Strength Bolts" for type of bolt and type of joint specified.
 - 1. Joint Type: Snug tightened Pretensioned Slip critical.
- B. Weld Connections: Comply with AWS D1.1/D1.1M and AWS D1.8/D1.8M for tolerances, appearances, welding procedure specifications, weld quality, and methods used in correcting welding work.

3.5 REPAIR

- A. Galvanized Surfaces: Clean field welds, bolted connections, and abraded areas, and touchup galvanizing to comply with ASTM A780/A780M.
- B. Touchup Painting:
 - 1. Immediately after erection, clean field welds, bolted connections, and abraded areas of shop paint, and paint exposed areas with the same material as used for shop painting, to comply with SSPC-PA 1 for touching up shop-painted surfaces.
 - (a) Clean and prepare surfaces by SSPC-SP 2 hand-tool cleaning or SSPC-SP 3 power-tool cleaning.
 - 2. Cleaning and touchup painting are specified in Section 09 90 00 Painting.

3.6 FIELD QUALITY CONTROL

- A. Testing Agency: Owner will engage a qualified testing agency to inspect AESS as specified in Section 051200 "Structural Steel Framing." The testing agency is not responsible for enforcing requirements relating to aesthetic effect.
- B. Architect will observe AESS in place to determine acceptability relating to aesthetic effect.

END OF SECTION

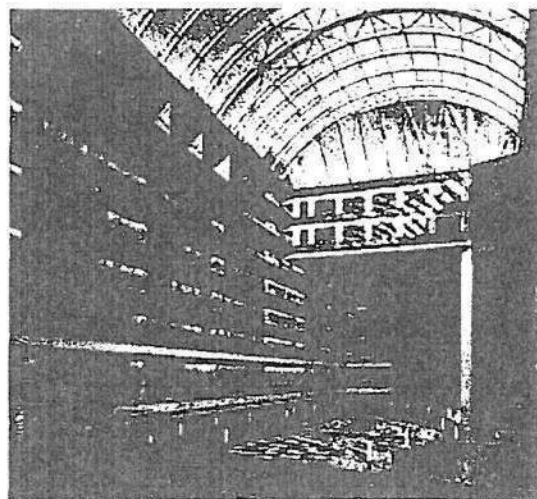


TABLE 10.1: AESS Category Matrix

CATEGORY		AESS 1	AESS 4	AESS 3	AESS 2	AESS 1	AESS
I.D.	CHARACTERISTICS	CUSTOM ELEMENTS	SHOWCASE ELEMENTS	FEATURE ELEMENTS IN CLOSE VIEW	FEATURE ELEMENTS NOT IN CLOSE VIEW	BASIC ELEMENTS	STANDARD STRUCTURAL STEEL
1.1	Surface preparation to SSPC-SP 6		X	X	X	X	
1.2	Sharp edges ground smooth		X	X	X	X	
1.3	Continuous weld appearance		X	X	X	X	
1.4	Standard structural bolts		X	X	X	X	
1.5	Weld spatters removed		X	X	X	X	
2.1	Visual Samples		X	X	optional		
2.2	One-half standard fabrication tolerances		X	X	X		
2.3	Fabrication marks not apparent		X	X	X		
2.4	Welds uniform and smooth		X	X	X		
3.1	Mill marks removed		X	X			
3.2	Butt and plug welds ground smooth and filled		X	X			
3.3	HSS weld seam oriented for reduced visibility		X	X			
3.4	Cross-sectional abutting surface aligned		X	X			
3.5	Joint gap tolerances minimized		X	X			
3.6	All welded connections		X	optional			
4.1	HSS seam not apparent		X				
4.2	Welds contoured and blended		X				
4.3	Surfaces filled and sanded		X				
4.4	Weld show-through minimized		X				
C.1							

▲ A matrix is provided in Section 10 of the AISC Code, outlining which fabrication processes are present within each category. And for exposed steel goals that don't fit into categories AESS 1 through 4, a Custom category (C) and blank matrix space are available for teams to discuss and create their own unique guidelines.

Note: Descriptions of the I.D. characteristics can be found on **page 25**, to the right of the AESS Category Matrix.



Details tend to disappear from the naked eye the further away they are located. When an object is beyond 20 ft, the distinction between components is not as clearly seen as when it is within reach. For example, the residential project on the left allows people touch every element of the exposed structure, all of which is in close view. The exposed steel in the office building on the right is so high that only maintenance staff, and the occasional bird, will be able to see the level of fabrication.

SECTION 05 21 00

STEEL JOIST FRAMING

1. PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Open web steel joists with bridging, attached seats, and anchors.
- B. Loose bearing plates and anchor bolts for site placement.
- C. Framed roof openings greater than 18 inches.

1.2 REFERENCES

- A. ASTM A36 - Structural Steel.
- B. ASTM A108 - Steel Bars, Carbon, Cold-Finished, Standard Quality.
- C. ASTM A307 - Carbon Steel Threaded Standard Fasteners.
- D. AWS D1.1 - Structural Welding Code.
- E. SJI (Steel Joist Institute) - Standard Specifications, Load Tables, and Weight Tables for Steel Joists and Joist Girders.
- F. SSPC - The Society for Protective Coatings.

1.3 SUBMITTALS

- A. Submit under provisions of Section 01 33 00.
- B. Shop Drawings:
 - 1. Indicate standard designations, configuration, sizes, spacing, locations of joists, joist leg extensions.
 - 2. Joist coding, bridging, connections, and attachments.
 - 3. Cambers.
- C. Welders' Certificates: Submit manufacturer's certificates that welders employed on the Work have met AWS verification within the previous 12 months.
- D. Drawings and calculations shall be submitted and approved by DSA prior to joist fabrication and shall conform to all submittal requirements in DSA 1R 22-3.13.

1.4 QUALITY ASSURANCE

- A. Perform Work in accordance with SJI Standard Specifications, Load Tables, and Weight Tables, including headers and other supplementary framing.
- B. Maintain one copy of document on site.
- C. Design connections not detailed on the Drawings under direct supervision of a Structural Engineer experienced in design of this work and licensed in the State of California.

1.5 QUALIFICATIONS

- A. Fabricator: Company specializing in performing the work of this Section with minimum five years documented experience.

- B. Erector: Company specializing in performing the work of this Section with minimum five years documented experience.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Deliver, store and protect products to site under provisions of Section 01 61 00 and to SJI requirements.
- B. Protect joists from distortion or damage.

1.7 FIELD MEASUREMENTS

- A. Verify that field measurements are as shown on shop drawings.

2. PART 2 PRODUCTS

2.1 MATERIALS

- A. Open Web Joists Members: As indicated on structural drawings.
- B. Anchor Bolts, Nuts, and Washers: ASTM A307.
- C. Shear Stud Connectors: ASTM A108, Grade 1015, forged steel, headed, uncoated.
- D. Primer: SSPC 15, Type 1, Red Oxide.
- E. Structural Steel For Supplementary Framing and Joist Leg Extensions: ASTM A36.
- F. Welding Materials: AWS D1.1; type required for materials being welded.

2.2 FABRICATION

- A. Provide bottom and top chord extensions as indicated.

2.3 FINISH

- A. Prepare joist component surfaces in accordance with SSPC SP-2.
- B. Shop prime joists. Do not prime surfaces that will be fireproofed, field welded.
- C. Finish: Site paint exposed to view steel joints under provisions of Section 09 90 00.

3. PART 3 EXECUTION

3.1 EXAMINATION

- A. Verify that field conditions are acceptable and are ready to receive work.
- B. Beginning of installation means erector accepts existing conditions.

3.2 ERECTION

- A. Erect and bear joists on supports.
- B. Allow for erection loads. Provide sufficient temporary bracing to maintain framing safe, plumb, and in true alignment until completion of erection and installation of permanent bridging and bracing.
- C. After joist alignment and installation of framing, field weld joist seat to bearing plates or angles.
- D. Position and field weld joist chord extensions and wall attachments as detailed.
- E. Frame roof openings greater than 18 inches with supplementary framing.

- F. Do not permit erection of decking until joists are braced, bridged, and secured.
- G. Do not field cut or alter structural members without approval of joist fabricator.
- H. After erection, prime welds, abrasions, and surfaces not shop primed, except surfaces to be in contact with concrete.

3.3 ERECTION TOLERANCES

- A. Conform to SJI Specifications.

3.4 FIELD QUALITY CONTROL

- A. Field inspection and testing of components will be performed under provisions of Section 01 45 29.

END OF SECTION

SECTION 05 31 13

STEEL FLOOR DECKING

1. PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Steel floor deck and accessories.
- B. Formed steel deck end forms to contain wet concrete.
- C. Acoustical insulation fill.
- D. Framing for openings up to and including 18 inches.
- E. Bearing plates and angles.
- F. Shear stud connectors.

1.2 REFERENCES

- A. ASTM A36 - Structural Steel.
- B. ASTM A108 - Steel Bars, Carbon, Cold-Finished, Standard Quality.
- C. ASTM A653 - General Requirements for Steel Sheet, Zinc-Coated, (Galvanized) or Zinc-Iron Alloy Coated (Galvannealed) by the Hot-Dip Process.
- D. ASTM A924 - General Requirements for Steel Sheet, Metallic-Coated by the Hot-Dip Process.
- E. AWS D1.1 - Structural Welding Code - Steel.
- F. AWS D1.3 - Structural Welding Code - Sheet Steel.
- G. ICC-ES - International Code Council Evaluation Service, Inc.
- H. SDI - Design Manual for Composite Decks, Form Decks, Roof Decks.
- I. SSPC - The Society for Protective Coatings.

1.3 SUBMITTALS

- A. Submit under provisions of Section 01 33 00.
- B. Shop Drawings: Indicate decking plan, support locations, projections, openings and reinforcement, pertinent details, and accessories.
- C. Product Data: Provide deck profile characteristics and dimensions, structural properties, finishes, and design values.
- D. Welders' Certification: Submit certificates that welders employed on the work have met AWS verification within the previous 12 months.
- E. Any "Acceptable Manufacturer" product that is not specifically listed in structural drawings will require side by side comparison with "listed products" showing deflection, strength, bending, and loading values and must meet or exceed listed product. Side by side comparison will be required to be approved by DSA prior to use on project.

1.4 QUALIFICATIONS

- A. Installer: Company specializing in performing the work of this Section with minimum five years documented experience.
- B. Design for conditions and loading not detailed on the drawings under direct supervision of a Professional Structural Engineer experienced in design of this work and licensed in the State of California.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Deliver, store and protect products to site under provisions of Section 01 61 00.
- B. Cut plastic wrap to encourage ventilation.
- C. Separate sheets and store decking on dry wood sleepers; slope for positive drainage.

1.6 FIELD MEASUREMENTS

- A. Verify that field measurements are as shown on shop drawings.

2. PART 2 PRODUCTS

2.1 MANUFACTURERS

- A. ASC Steel Deck, IAPMO No. 0329, www.ascsteeldeck.com.
- B. Epic Metals Corp., IAPMO No. 226, www.epicmetals.com.
- C. Verco Manufacturing Co., IAPMO No. 0217, www.vercodeck.com.
- D. Vulcraft, ICC-ES No. ESR-1227, www.vulcraft.com.
- E. Substitutions: Under provisions of Section 01 25 13 and approved by DSA showing that deflection, strength, bending, and shear values of product meet or exceed those of materials called out on structural drawings.

2.2 MATERIALS

- A. Sheet Steel: ASTM A653, SS, Grade 40; with G60 galvanized coating conforming to ASTM A924.
- B. Miscellaneous Steel Shapes: ASTM A36 steel, galvanized.
- C. Stud Shear Connectors: ASTM A108 steel, Grade 1015, forged steel, headed, uncoated.
- D. Welding Materials: AWS D1.1 and AWS D1.3.
- E. Touch-Up Primer: SSPC 20.

2.3 ACCESSORIES

- A. Flute Closures: Closed cell foam rubber, 1 inch thick; profiled to fit tight to the decking.
- B. Metal Closure Strips, Wet Concrete Stops, Cover Plates, and Related Accessories: 16 gage galvanized sheet steel; of profile and size required.
- C. Fabricate floor drain pan of 14 gage sheet steel, flat bottom, sloped sides, recessed 1-1/2 inches below floor deck surface, bearing flange 3 inches wide, sealed watertight.
- D. Weld Washers: Mild steel, uncoated, 3/4 inch outside diameter, 1/8 inch thick.

2.4 FABRICATION

- A. Metal Decking : See structural drawings.
- Span Design : See structural drawings.
- Minimum Metal Thickness(Excluding Finish) : See structural drawings.
- Nominal Height : See structural drawings.
- Formed Sheet Width : 36 inch.
- Side Joints : See structural drawings.
- Flute Sides : Diagonally ribbed for improved concrete bond.

2.5 FINISH

- A. Finish: Site paint exposed to view galvanized steel floor deck under provisions of Section 09 90 00.

3. PART 3 EXECUTION

3.1 EXAMINATION

- A. Verify that field conditions are acceptable and are ready to receive work.
- B. Beginning of installation means installer accepts existing conditions.

3.2 INSTALLATION

- A. Erect metal decking in accordance with SDI Design Manual and notes on Structural Drawings.
- B. Bear decking on steel supports with 3 inch minimum bearing. Align and level.
- C. Fasten deck to steel support members at ends and intermediate supports with fusion welds through weld washers as indicated on the drawings.
- D. Weld in accordance with AWS D1.1 and AWS D1.3.
- E. Weld male/female side laps as indicated on drawings.
- F. Reinforce steel deck openings from 6 to 18 inches in size with 4 x 3 x 1/4 inch, LLV, steel angles. Place angles perpendicular to flutes; extend minimum one and one-half times opening dimension beyond each side of opening and fusion weld to deck at each flute.
- G. Install 6 inch minimum wide sheet steel cover plates, of same thickness as decking, where deck changes direction. Fusion weld 12 inches oc maximum.
- H. To contain wet concrete, install stops unless detailed with steel angles at floor edge upturned to top surface of slab. Provide stops of sufficient strength to remain stationary without distortion.
- I. Install sheet steel closures and angle flashings to close openings between deck and walls, columns, and openings.
- J. Install single row of foam flute closures above walls and partitions perpendicular to deck flutes.
- K. Position floor drain pans with flange bearing on top surface of deck. Fusion weld at each deck flute.

- L. Weld stud shear connectors through steel deck to structural members below.
- M. Immediately after welding deck and other metal components in position, coat welds, burned areas, and damaged surface coating, with touch-up prime paint.

END OF SECTION

SECTION 05 31 23

STEEL ROOF DECKING

1. PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Steel roof deck and accessories.
- B. Framing for openings up to and including 18 inches.
- C. Bearing plates and angles.
- D. Acoustical insulation.

1.2 REFERENCES

- A. ASTM A36 - Structural Steel.
- B. ASTM A653 - General Requirements for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy Coated (Galvannealed) by the Hot-Dip Process.
- C. ASTM A924 - General Requirements for Steel Sheet, Metallic-Coated by the Hot-Dip Process.
- D. AWS D1.1 - Structural Welding Code - Steel.
- E. AWS D1.3 - Structural Welding Code - Sheet Metal.
- F. ICC-ES - International Code Council Evaluation Services, Inc.
- G. SDI - Design Manual for Composite Decks, Form Decks, Roof Decks.
- H. SSPC - The Society for Protective Coatings.

1.3 SUBMITTALS

- A. Submit under provisions of Section 01 33 00.
- B. Shop Drawings: Indicate decking plan, support locations, projections, openings and reinforcement, pertinent details, and accessories.
- C. Product Data: Provide deck profile characteristics and dimensions, structural properties, finishes, and design values.
- D. Welders' Certification: Submit certificates that welders employed on the Work have met AWS verification within the previous 12 months.
- E. Any "Acceptable Manufacturer" product that is not specifically listed in structural drawings will require side by side comparison with "listed products" showing deflection, strength, bending, and loading values and must meet or exceed listed product. Side by side comparison will be required to be approved by DSA prior to use on project.

1.4 QUALIFICATIONS

- A. Installer: Company specializing in performing the work of this Section with minimum five years documented experience.
- B. Design for conditions and loading not detailed on the drawings under direct supervision of a Professional Structural Engineer experienced in design of this work and licensed in the State of California.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Deliver, store and protect products under provisions of Section 01 61 00.
- B. Cut plastic wrap to encourage ventilation.
- C. Separate sheets and store decking on dry wood sleepers; slope for positive drainage.

1.6 FIELD MEASUREMENTS

- A. Verify that field measurements are as shown on shop drawings.

2. PART 2 PRODUCTS

2.1 MANUFACTURERS

- A. ASC Steel Deck, Inc., IAPMO No. 0161, www.ascsteeldeck.com.
- B. Epic Metals Corp., IAPMO No. 0226, www.epicmetals.com.
- C. Verco Manufacturing Co., IAPMO No. 0217, www.vercodeck.com.
- D. Vulcraft, ICC-ES No. ESR-1227, www.vulcraft.com.
- E. Substitutions: Under provisions of Section 01 25 13 and approved by DSA showing that deflection, strength, bending, and shear values of product meet or exceed those of materials called out on structural drawings.

2.2 MATERIALS

- A. Sheet Steel: ASTM A653, SS, Grade 40; with G90 galvanized coating conforming to ASTM A924.
- B. Miscellaneous Steel Shapes: ASTM A36 steel, galvanized.
- C. Welding Materials: AWS D1.1 and AWS D1.3.
- D. Touch-Up Primer: SSPC 20.

2.3 FABRICATION

- A. Metal Decking : See structural drawings.
 - Span Design : See structural drawings.
 - Minimum Metal Thickness(Excluding Finish) : See structural drawings.
 - Nominal Height : See structural drawings.
 - Formed Sheet Width : 36 inch
 - Side Joints : See structural drawings.
- B. Acoustical Deck : See structural drawings.
 - Span Design : See structural drawings.
 - Minimum Metal Thickness(Excluding Finish) : See structural drawings.
 - Nominal Height : See structural drawings.
 - Formed Sheet Width : 36 inch
 - Side Joints : See structural drawings.
 - Perforations : 1/8 inch diameter staggered 3/8 inch oc

2.4 ACCESSORIES

- A. Flute Closures: Closed cell foam rubber, one inch thick; profiled to fit tight to the decking.
- B. Metal Closure Strips, Cover Plates, Cant Strips, Ridge and Valley plates and Related Accessories: 16 gage precoated galvanized sheet steel; of profile and size as indicated.
- C. Weld Washers: Mild steel, uncoated, 3/4 inch outside diameter, 1/8 inch thick.
- D. Acoustical Insulation: Glass fiber type, minimum 1.5 lb/cu ft density; profiled to suit deck.

2.5 FINISH

- A. Finish: Site paint exposed to view galvanized steel roof deck under provisions of 09 90 00.
- B. Comply with the current applicable regulations for VOC content for coatings of the California Air Resources Board (CARB) and the Environmental Protection Agency (EPA).
- C. Precoating of roof deck to be factory performed by roof deck manufacturer or by independent coating company as listed below:
 - 1. BJ Powder Coating, www.bjpowdercoating.com
 - 2. Exclusive Powder Coating, www.e-powdercoating.com
 - 3. Inland Powder Coating, www.inlandpowder.com
 - 4. Substitutions: Under provisions of Section 01 25 13.

3. PART 3 EXECUTION

3.1 EXAMINATION

- A. Verify that field conditions are acceptable and are ready to receive work.
- B. Beginning of installation means installer accepts existing conditions.

3.2 INSTALLATION

- A. Erect metal decking in accordance with SDI Design Manual and Structural Drawings.
- B. Bear decking on steel supports with 3 inch minimum bearing. Align and level.
- C. Fasten deck to steel support members at ends and intermediate supports as indicated on Structural Drawings.
- D. Weld in accordance with AWS D1.1 and AWS D1.3.
- E. Mechanically fasten male/female side laps per structural drawings.
- F. Reinforce steel deck openings from 6 to 18 inches in size with 4 x 3 x 1/4 inch, LLV, steel angles. Place angles perpendicular to flutes; extend minimum one and one-half times opening dimension beyond each side of opening and fusion weld to deck at each flute.
- G. Install 6 inch minimum wide sheet steel cover plates, of same thickness as decking, where deck changes direction. Fusion weld.
- H. To contain wet concrete, install stops at roof edge upturned to top surface of slab. Provide stops of sufficient strength to remain stationary under wet concrete without distortion.

- I. Install sheet steel closures and angle flashings to close openings between deck and walls, columns, and openings.
- J. Install ridge and valley plates where two differing roof deck slopes intersect.
- K. Place metal cant strips in position and fusion weld.
- L. Install single row of foam flute closures above walls and partitions perpendicular to deck flutes.
- M. Immediately after deck and other metal components are in position, coat damaged surface coating, with touch-up prime paint.
- N. Provide acoustical insulation for installation under provisions of Section 07 22 00, Roof Deck Insulation.

END OF SECTION

SECTION 05 40 00

COLD FORMED METAL FRAMING

1. PART 1 GENERAL

1.1 WORK INCLUDED

- A. Load bearing and non-load bearing formed steel stud exterior wall and interior wall framing.
- B. Formed steel joist framing and bridging.

1.2 REFERENCES

- A. ASTM A653 - Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by Hot Dip Process.
- B. ASTM A780 - Repair of Damaged and Uncoated Areas of Hot-Dip Galvanized Coatings.
- C. ASTM A924 - General Requirements for Steel Sheet, Metallic-Coated by the Hot-Dipped Process.
- D. ASTM C954 - Steel Drill Screws for the Application of Gypsum Panel Products or Metal Plaster Bases to Steel Studs from 0.033 Inch to 0.112 Inch in Thickness.
- E. ASTM C955 - Load Bearing (Transverse and Axial) Steel Studs, Runners (Tracks) and Bracing or Bridging for Screw Application of Gypsum Panel Products and Metal Plaster Bases.
- F. ASTM C1007 - Installation of Load Bearing (Transverse and Axial) Steel Studs and Related Accessories.
- G. AISI - Specification for Design of Cold Formed Steel Structural Members.
- H. AWS D1.1 - Structural Welding Code - Steel.
- I. AWS D1.3 - Structural Welding Code - Sheet Steel.
- J. SFIA - Steel Framing Industry Association.
- K. SSPC - The Society for Protective Coatings.
- L. SSMA - Steel Stud Manufacturers Association.

1.3 QUALITY ASSURANCE

- A. Manufacturer: Company specializing in structural framing components with five years minimum experience.
- B. Installer: Experienced installer who has completed cold-formed metal framing similar in material, design, and extent to that indicated for this project.

1.4 SUBMITTALS

- A. Submit product data under provisions of Section 01 33 00.
- B. Indicate on shop drawings, component details, framed openings, bearing, anchorage, loading, welds, type and location of fasteners, and accessories or items required of other related work per construction documents.
- C. Provide stud, ceiling joist, roof joist, layout per construction documents.
- D. Provide product data on standard framing members. Describe materials and finish, product criteria and limitations.

2. PART 2 PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

- A. California Expanded Metal Products Co., (ICC - ESR - 3016) www.cemcosteel.com.
- B. Consolidated Fabricators Corp., (IAPMO - UER-0313) www.confabbpd.com.
- C. ClarkDietrich Building Systems, Inc., (Intertek CCRR - 0206) www.clarkdietrich.com.
- D. Frametek Steel Products, (ICC - ESR - 4205) www.frameteksteel.com.
- E. Stud Manufacturing Co., (ICC - ESR - 3064P) www.scafco.com.
- F. United Metal Products, Inc., (LATF - 16949) www.unitedmetalproducts.com.
- G. Substitutions: Under provisions of Section 01 25 13.

2.2 FRAMING SYSTEM

- A. With each type of metal framing required, provide manufacturer's standard steel runners, blocking, lintels, clip angles, shoes, reinforcements, fasteners, and accessories required to provide a complete framing system for applications indicated.

2.3 FRAMING MATERIAL

- A. ASTM A653, structural steel, of thickness, depth, finish, and grade indicated.

2.4 FRAMING COMPONENTS

- A. Studs: Standard C-shaped steel studs, punched, complying with ASTM C955 as indicated on structural drawings.
- B. Steel Track: Standard U-shaped steel track of same material, finish, and thickness as studs, unpunched, complying with ASTM C955, unless noted otherwise on structural drawings.
- C. Deflection Track: Top runner track designed to allow for deflection of structure to interior partition fabricated of same material, finish and thickness as studs and of the following configuration:
 - 1. Top runner track with slotted flanges, 2-1/2 inch deep with vertical slots 1 inch on center.
 - 2. Products: Subject to compliance with requirements, provide one of the following:
 - (a) Max Trak as manufactured by ClarkDietrich Building Systems, (Intertek CCRR-0205), www.clarkdietrich.com.
 - (b) SLT standard slotted track as manufactured by Steel Stud Manufacturing C., (IAPMO ER-0283), www.scafco.com.
- D. Joists: Standard C-shaped steel sections, unpunched, with stiffened flanges, complying with ASTM C955 and as indicated on structural drawings.
- E. Built-up Members: Standard C-shaped steel section, with stiffened flanges, nested into a U-shaped steel track, with unstiffened flanges, unpunched; of same material, finish and thickness as adjacent members complying with ASTM C955.
- F. Vertical Deflection Clips: Standard bypass clips, capable of accommodating upward and downward vertical displacement of primary structure.

2.5 FASTENERS

- A. Self-drilling, Self-tapping Screws: ASTM C954, sized to conform to applications indicated, galvanized finish.
- B. Welding: In conformance with AWS D1.1 and AWS D1.3.

2.6 ACCESSORIES

- A. Bracing, Furring, Bridging: Formed sheet steel, 0.0428 inch minimum thickness, galvanized finish.
- B. Plates, Gussets, Clips: Formed sheet steel, 0.0428 inch minimum thickness, galvanized finish.
- C. Flute Cover: FAS Strap as manufactured by CEMCO, www.cemco.com, or FC Flute Closure as manufactured by ClarkDietrich, www.clarkdietrich.com. Width to match flute opening in metal deck. Intumescent tape applied for fire rated head of wall conditions.

2.7 FINISHES

- A. Galvanizing: G60 coating class according to ASTM A924.
- B. Primer: SSPC 20.

3. PART 3 EXECUTION

3.1 INSPECTION

- A. Verify that building framing components are ready to receive work.
- B. Beginning of installation means acceptance of existing conditions.

3.2 ERECTION OF STUDDING

- A. Install components in accordance with SSMA, SFIA requirements, ASTM C1007, and manufacturer's instructions.
- B. Cut framing members by sawing or shearing; do not torch cut.
- C. Fasten framing members by welding or screw fastening as indicated and as follows:
 - 1. Comply with AWS D1.3 for welding work.
 - 2. Locate fasteners according to shop drawings with screw penetrating joined members by not less than three exposed screw threads.
- D. Align floor and ceiling tracks; locate to wall and partition layout. Secure in place with fasteners or welding at maximum 24 inches o.c.
- E. Place studs at 16 inches o.c.; u.n.o. per structural drawings; not more than 2 inches from abutting walls and at each side of openings. Connect both flanges of studs to tracks per structural drawings.
- F. Construct corners using minimum three studs. Double stud at wall opening, door, and window jambs.
- G. Erect load bearing studs one piece full length. Splicing of studs is not permitted.
- H. Erect load bearing studs, brace, and reinforce to develop full strength to meet design requirements.
- I. Fasten hole reinforcing plate over web penetrations which exceed standard punched openings.
- J. Extend stud framing through ceiling to underside of floor or roof structure above except where partitions are indicated to terminate at ceiling.

- K. Extend stud framing to ceiling only where indicated. Attach ceiling channel securely in accordance with details indicated.
- L. For sound and fire resistance rated partitions extend framing to underside of floor/roof or other continuous solid surface to obtain rating.
- M. Install intermediate studs above and below openings to match wall stud spacing.
- N. Provide deflection allowance in stud track, directly below horizontal building framing for non-load bearing framing.
- O. Attach steel plate to studs for attachment of fixtures anchored to walls.
- P. Install framing between studs for attachment of mechanical and electrical items, and to prevent stud rotation.
- Q. Install miscellaneous framing and connections, including supplementary framing, web stiffeners, clip angles, anchors, and fasteners to provide a complete and stable framing system.
- R. Touch-up field welds and damaged galvanized surfaces with primer in accordance with ASTM A780.

3.3 ERECTION OF JOISTS

- A. Install framing components in accordance with SSMA, SFIA requirements, ASTM C1007, and manufacturer's instructions.
- B. Make provisions for erection stresses. Provide temporary alignment and bracing.
- C. Place joists at 16 inches o.c.; u.n.o. per structural drawings; not more than 2 inches from abutting walls. Connect joists to supports per structural drawings.
- D. Set joists parallel and level, with lateral bracing and bridging.
- E. Locate joist end bearing directly over load bearing studs or provide load distributing member to top of stud track.
- F. Frame openings with built-up headers, nesting joists on combination.
- G. Install bridging at each end of joists and at intervals indicated.
- H. Install miscellaneous joist framing and connection, including web stiffeners, closure pieces, clip angles, continuous angles, hold-down angles, anchors, and fasteners to provide a complete and stable framing system.
- I. Provide joist web stiffeners at reaction points.
- J. Touch-up field welds and damaged galvanized surfaces with primer in accordance with ASTM A780.

3.4 TOLERANCES

- A. Erect framing level, plumb and true to line to a maximum allowable tolerance variation of 1/8 inch in 10 feet for member out-of-square tolerance.
- B. Spacing of individual members shall be no more than 1/8 inch from plan location.

END OF SECTION

SECTION 05 50 00

METAL FABRICATIONS

1. PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Shop fabricated ferrous metal items, galvanized and prime painted.
- B. Schedule of metal fabrications.

1.2 REFERENCES

- A. ASTM A36 - Structural Steel.
- B. ASTM A53 - Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless.
- C. ASTM A123 - Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products.
- D. ASTM A153 - Zinc Coating (Hot-Dip) on Iron and Steel Hardware.
- E. ASTM A307 - Carbon Steel Externally Threaded Standard Fasteners.
- F. ASTM A492 - Standard Specification for Stainless Steel Rope Wire.
- G. ASTM A500 - Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes.
- H. ASTM A741 - Standard Specification for Metallic-Coated Steel Wire Rope and Fittings for Highway Guardrail.
- I. ASTM A780 - Repair of Damaged and Uncoated Areas of Hot-Dip Galvanized Coatings
- J. AWS A2.4 - Standard Welding Symbols.
- K. AWS D1.1 - Structural Welding Code - Steel.
- L. SSPC - The Society for Protective Coatings.

1.3 SUBMITTALS

- A. Submit under provisions of Section 01 33 00.
- B. Shop Drawings: Indicate profiles, sizes, connection attachments, reinforcing, anchorage, size and type of fasteners, and accessories. Include erection drawings, elevations, and details where applicable.
- C. Indicate welded connections using standard AWS A2.4 welding symbols. Indicate net weld lengths.

1.4 QUALIFICATIONS

- A. Welders' Certificates: Submit under provisions of Section 01 33 00, certifying welders employed on the Work, verifying AWS qualification within the previous 12 months.

1.5 FIELD MEASUREMENTS

- A. Verify that field measurements are as indicated on Drawings.

2. PART 2 PRODUCTS

2.1 MATERIALS

- A. Steel Sections: ASTM A36.
- B. Steel Tubing: ASTM A500, Grade B.
- C. Plates: ASTM A36.
- D. Pipe: ASTM A53, Grade B, Schedule 40.
- E. Bolts, Nuts, and Washers: ASTM A307 galvanized to ASTM A153 for galvanized components.
- F. Zinc-coated Steel Wire Rope: ASTM A741
 - 1. Wire Rope Fittings: Hot-dip galvanized - steel connectors capable of sustaining load equal to minimum breaking strength of wire rope.
- G. Stainless Steel Wire Rope: ASTM A492, Type 316.
 - 1. Wire Rope Fittings: Stainless steel connectors, Type 316, capable of sustaining load equal to minimum breaking strength of wire rope.
- H. Welding Materials: AWS D1.1; type required for materials being welded.
- I. Wire Mesh manufactured by McNichols, www.mcnichols.com or approved substitution per Section 01 25 13.
 - 1. Rectangular, Hardware and Industrial Cloth, galvanized steel, hot dipped, welded - trimmed, 1 inch x 1/2 inch mesh (rectangular), 0.9370 inch x 0.4370 inch opening (rectangular), 0.063 inch thick (16 gauge) wire diameter, 84% open. To be used at pool fencing/gates.
 - 2. Rectangular, carbon steel, cold rolled, welded - trimmed, 4 inch x 2 inch mesh (rectangular), 3.7500 inch x 1.7500 inch opening (rectangular), 0.250 inch thick (2-3/4 gauge) wired diameter, 93% open. To be used at outdoor amphitheater.
- J. Shop and Touch Up Primer: SSPC 15, Type 1, red oxide.
- K. Touch-Up Primer for Galvanized Surfaces: SSPC 20.

2.2 FABRICATION, GENERAL

- A. Fit and shop assemble in largest practical sections, for delivery to site.
- B. Fabricate items with joints tightly fitted and secured.
- C. Continuously seal joined members by continuous welds unless indicated otherwise.
- D. Grind exposed joints flush and smooth with adjacent finish surface. Make exposed joints butt tight, flush, and hairline. Ease exposed edges to small uniform radius.
- E. Exposed Mechanical Fastenings: Flush countersunk screws or bolts; unobtrusively located; consistent with design of component, except where specifically noted otherwise.
- F. Supply components required for anchorage of fabrications. Fabricate anchors and related components of same material and finish as fabrication, except where specifically noted otherwise.

2.3 FINISHES

- A. Clean surfaces of rust, scale, grease, and foreign matter prior to finishing.
- B. Do not prime surfaces in direct contact with concrete or where field welding is required.
- C. Prime paint items with one coat.
- D. Galvanize assembled items to minimum 1.25 oz/sq ft zinc coating in accordance with ASTM A123.
- E. Repair damaged galvanized surfaces in accordance with ASTM A780 Method A2.
- F. Finish: Site paint exposed to view galvanized items under provisions of Section 09 90 00.

3. PART 3 EXECUTION

3.1 EXAMINATION

- A. Verify that field conditions are acceptable and are ready to receive work.
- B. Beginning of installation means erector accepts existing conditions.

3.2 PREPARATION

- A. Clean and strip primed steel items to bare metal where site welding is required.
- B. Supply items required to be cast into concrete or embedded in masonry with setting templates, to appropriate sections.

3.3 INSTALLATION

- A. Install items plumb and level, accurately fitted, free from distortion or defects.
- B. Allow for erection loads, and for sufficient temporary bracing to maintain true alignment until completion of erection and installation of permanent attachments.
- C. Field weld components indicated on Drawings.
- D. Perform field welding in accordance with AWS D1.1.
- E. Obtain Architect approval prior to site cutting or making adjustments not scheduled.
- F. After erection, prime welds, abrasions, and surfaces not shop primed, except surfaces to be in contact with concrete.

3.4 SCHEDULE

- A. The Schedule is a list of principal items only. Refer to Drawing details for items not specifically scheduled.
- B. Miscellaneous Framing and Supports: Steel not a part of structural steel framework as required to complete work; galvanized finish.
- C. Guard Rails: As detailed; galvanized finish.
- D. Bollards: Steel pipe, concrete filled, crowned cap, as detailed; galvanized finish.
- E. Opening Frames for Overhead Doors: Structural sections; prime paint finish.
- F. Steel Framing and Supports for Countertops: Angle framing fabricated as detailed, prime paint finish.
- G. Elevator Hoist Way Beams: Structural sections as detailed, prime paint finish.

- H. Elevator Door Sill Supports: Steel shapes as detailed, prime paint finish.
- I. Pull Up Stations: Steel shapes as detailed, galvanized finish.
- J. Tube Steel Fencing and Gates: Structural sections as detailed, prime paint finish.

END OF SECTION

SECTION 05 51 00

METAL STAIRS

1. PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Steel stair frame of structural sections, with closed risers.
- B. Pan to receive concrete fill, stair treads and landings.

1.2 REFERENCES

- A. 2010 Americans with Disabilities Act (ADA) Standards for Accessible Design.
- B. ASTM A36 - Structural Steel.
- C. ASTM A123 - Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products.
- D. ASTM A185 - Welded Steel Wire Fabric for Concrete Reinforcement.
- E. ASTM A283 - Carbon Steel Plates, Shapes, and Bars.
- F. ASTM A325 - High Strength Bolts for Structural Steel Joints.
- G. ASTM A500 - Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes.
- H. ASTM A653 - General Requirements for Steel Sheet, Metallic-Coated by Hot Dip Process.
- I. ASTM C150 - Portland Cement.
- J. AWS A2.4 - Standard Welding Symbols.
- K. AWS D1.1 - Structural Welding Code.
- L. CBC - California Building Code, (CCR) California Code of Regulations, Title 24, Part 2.
- M. NAAMM - Metal Stairs Manual.
- N. SSPC - The Society for Protective Coatings.

1.3 DESIGN REQUIREMENTS

- A. Fabricate stair assembly to support live load of 100 lbs/sq ft with deflection of stringer or landing framing not to exceed 1/360 of span.
- B. Fabricate stair assembly to NAAMM - Metal Stairs Manual, Commercial Class.
- C. Conform to CBC - California Building Code, (CCR), California Code of Regulations, Title 24, Part 2, and the 2010 ADA Standards for Accessible Design for accessibility requirements for individuals with disabilities.

1.4 SUBMITTALS

- A. Submit under provisions of Section 01 33 00.
- B. Shop Drawings: Indicate profiles, sizes, connection attachments, reinforcement, anchorage, size and type of fasteners, and accessories.
- C. Indicate welded connections using standard AWS A2.4 welding symbols. Indicate net weld lengths.

1.5 QUALIFICATIONS

- A. Welders' Certificates: Submit under provisions of Section 01 33 00, certifying welders employed on the Work, verifying AWS qualification within the previous 12 months.

1.6 FIELD MEASUREMENTS

- A. Verify that field measurements are as indicated on Drawings.

2. PART 2 PRODUCTS

2.1 MATERIALS

- A. Steel Sections: ASTM A36.
- B. Steel Tubing: ASTM A500, Grade B.
- C. Plates: ASTM A283.
- D. Sheet Steel: ASTM A653, SS, Grade 33.
- E. Stair Treads: Concrete in metal pan.
- F. Concrete for Treads and Landings: Portland cement, ASTM C150, Type I, 2,500 psi 28 day strength, 2 to 3 inch slump.
- G. Tread and Landing Concrete Reinforcement: Mesh, ASTM A185, size as detailed, unfinished.
- H. Bolts, Nuts, and Washers: ASTM A325.
- I. Exposed Mechanical Fastenings: Flush countersunk screws or bolts; consistent with design of stair structure.
- J. Welding Materials: AWS D1.1; type required for materials being welded.
- K. Shop and Touch-Up Primer: SSPC 15, Type 1, red oxide.
- L. Touch-up Primer for Galvanized Surfaces: SSPC 20.

2.2 FABRICATION - GENERAL

- A. Fit and shop assemble in largest practical sections, for delivery to site.
- B. Fabricate components with joints tightly fitted and secured.
- C. Continuously seal jointed pieces by continuous welds.
- D. Grind exposed joints flush and smooth with adjacent finish surface. Make exposed joints butt tight, flush, and hairline. Ease exposed edges to small uniform radius.
- E. Exposed Mechanical Fastenings: Flush countersunk screws or bolts; unobtrusively located; consistent with design of component, except where specifically noted otherwise.
- F. Supply components required for anchorage of fabrications. Fabricate anchors and related components of same material and finish as fabrication, except where specifically noted otherwise.
- G. Accurately form components required for anchorage of stairs and landings to each other and to building structure.

2.3 FABRICATION - PAN STAIRS AND LANDINGS

- A. Fabricate stairs and landings with closed risers and treads of metal pan construction, ready to receive concrete.
- B. Form treads and risers as indicated on structural drawings with gage sheet steel stock required to support design loadings.
- C. Secure reinforced tread pans to stringers with clip angles welded in place.
- D. Form stringers with rolled steel channels or rectangular hollow sections.
- E. Form landings with minimum sheet stock. Reinforce underside with angles or metal T's as shown on structural drawings to attain design load requirements.

2.4 FINISHES

- A. Clean surfaces of rust, scale, grease, and foreign matter prior to finishing.
- B. Galvanize assembled items to minimum 1.25 oz/sq ft zinc coating in accordance with ASTM A123 for all exterior installations.
- C. Prime paint items with one coat.
- D. Do not prime surfaces in direct contact with concrete or where field welding is required.
- E. Metal Finish: Site paint under provisions of Section 09 90 00.
- F. Concrete Finish: Medium broom finish.
- G. Paint a 2 inch wide yellow warning stripe one inch from edge of nosing of each tread at exterior stair treads and at top and bottom treads at interior stair treads and at upper approach. Stripe to be full width of tread.

3. PART 3 EXECUTION

3.1 EXAMINATION

- A. Verify that field conditions are acceptable and are ready to receive work.
- B. Beginning of installation means erector accepts existing conditions.

3.2 PREPARATION

- A. Clean and strip primed steel items to bare metal where site welding is required.
- B. Supply items required to be cast into concrete and embedded in masonry with setting templates, to appropriate sections.

3.3 INSTALLATION

- A. Install items plumb and level, accurately fitted, free from distortion or defects.
- B. Provide anchors, plates, angles, hangers, and struts required for connecting stairs to structure.
- C. Allow for erection loads, and for sufficient temporary bracing to maintain true alignment until completion of erection and installation of permanent attachments.
- D. Field weld components indicated on Drawings. Perform field welding in accordance with AWS D1.1.
- E. Field bolt and weld to match shop bolting and welding. Conceal bolts and screws whenever possible. Where not concealed, use flush countersunk fastenings.

- F. Mechanically fasten joints butted tight, flush, and hairline. Grind welds smooth and flush.
- G. Obtain Architect approval prior to site cutting or making adjustments not scheduled.
- H. After erection, prime welds, abrasions, and surfaces not shop primed, except surfaces to be in contact with concrete.

END OF SECTION

SECTION 05 51 33

METAL LADDERS

1. PART 1 GENERAL

1.1 WORK INCLUDED

- A. Prefabricated aluminum roof access ladders.
- B. Personal fall assist system.
- C. Protective cages.
- D. Rest platforms.

1.2 REFERENCES

- A. AWS D1.2 - Structural Welding Code - Aluminum.
- B. OSHA - Standards of Occupational Safety and Health Administration.
- C. ANSI - ANSI A-14.3 Standards.
- D. ASTM B221 - Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Shapes and Tubes.

1.3 FIELD MEASUREMENTS

- A. Verify actual dimensions on site prior to fabrication.
- B. Contractor shall be responsible for a complete installation of all components required.

2. PART 2 PRODUCTS

2.1 MANUFACTURERS:

- A. O'Keeffe's Inc., www.okeeffes.com.
- B. Alaco Aluminum Ladders, www.alacoladder.com.
- C. Dur-Red Products, www.dur-red.com.
- D. Lapeyre Stair, Inc., www.lapeyrestair.com.
- E. Precision Ladders, LLC, www.precisionladders.com.
- F. Substitution: Under provisions of Section 01 25 13.

2.2 MATERIALS

- A. Rungs shall be round or square and a minimum of 1-1/8 inch in section, formed from aluminum extrusion, ASTM B221 alloy 6061-T6, and shall be deeply serrated on all sides to provide maximum foot grip and traction. Rungs shall be able to withstand a 250 pound loading without failure. Space rungs 12 inches o.c. as indicated.
- B. Channel side rail shall be minimum 3 inch x 1 inch x 1/8 inch aluminum extrusions, ASTM B221 alloy 6061-T6.

- C. Personal Fall Assist System: Continuous 3/8 inch diameter cable fall protection system with automatic pass thru cable guide and fall arrestor; top and bottom bracket assembly with bottom life line tensioner and top shock absorber; ladder climbing harness; all meeting OSHA requirements.
- D. Rest platform shall be .063 inch thick aluminum grip strut grating, ASTM B221 6061-T6 alloy.
- E. Finish:
 - 1. Clear natural anodized finish for all interior ladders.
 - 2. Factory finish all exterior ladders with manufacturer's standard powder coating in color as selected by Architect.

2.3 ACCESSORIES

- A. Anchorage devices and bolts necessary for installation as required by manufacturer's recommendations.

2.4 FABRICATION

- A. Materials used shall be new stock, straight within industry tolerances and free of any defects in finish or structure.
- B. Cutting of stock shall be by mechanical means to assure a smooth square and true working edge.
- C. Mechanical Connections: Bolted connections shall be made with cast aluminum connectors and stainless steel anchorage devices.
- D. Welded Connections: In accordance with AWS D1.2 requirements.
- E. Protection of aluminum from dissimilar materials:
 - 1. Dissimilar metals except stainless steel, white bronze, and solid zinc, shall be painted with a heavy brush coat of zinc-chromate primer and one coat of aluminum paint.
 - 2. Aluminum surfaces in contact with mortar, concrete, plaster or other masonry materials shall be given one heavy brush coat of bituminous paint.

3. PART 3 EXECUTION

3.1 PREPARATION

- A. Verify proper timing for ladder installation to prevent undue delay in job progress.
- B. Installation of ladder units shall be considered as acceptance by the Contractor of the adjacent construction as substantially conforming to the intended details and capability of supporting the ladder unit.

3.2 INSTALLATION:

- A. Secure ladders in position as indicated on the Drawings and as required by manufacturer's specifications.

END OF SECTION

SECTION 05 52 00

METAL RAILINGS

1. PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Steel tube handrails, guardrails, balusters, and fittings.

1.2 REFERENCES

- A. 2010 Americans with Disabilities Act (ADA) Standards for Accessible Design.
- B. ASTM A36 - Specifications for Structural Steel.
- C. ASTM A123 - Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products.
- D. ASTM A500 - Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Round and Shapes.
- E. ASTM E985 - Permanent Metal Railing Systems and Rails for Buildings.
- F. AWS D1.1 - Structural Welding Code - Steel.
- G. NAAMM - Metal Finishes Manual.
- H. CBC - California Building Code, (CCR) California Code of Regulations, Title 24, Part 2, California State Accessibility Standards.
- I. SSPC - The Society for Protective Coatings.

1.3 DESIGN REQUIREMENTS

- A. Railing assemblies shall resist a force of 200 lbs applied in any direction at any point on the rail without damage or permanent set.
- B. Conform to CBC, California Building Code, (CCR) California Code of Regulations, Title 24, Part 2 and the 2010 ADA Standards for Accessible Design for accessibility requirements.
- C. Fabricate railing assembly, wall rails, and attachments to ASTM E985 requirements.

1.4 SUBMITTALS

- A. Submit under provisions of Section 01 33 00.
- B. Shop Drawings: Indicate profiles, sizes, connection attachments, anchorage, size and type of fasteners, and accessories.

1.5 FIELD MEASUREMENTS

- A. Verify that field measurements are as indicated on Drawings.

2. PART 2 PRODUCTS

2.1 MANUFACTURERS

- A. Craneveyor Corp., www.craneveyor.com.
- B. R and B Wagner, Inc., www.rbwagner.com.
- C. Substitutions: Under provisions of Section 01 25 13.

2.2 STEEL RAILING SYSTEM

- A. Rails and Posts: ASTM A500, Grade B, 1-1/2 inch square steel tubing, 3/16 inch wall thickness, welded joints with steel inserts for casting in concrete.
- B. Structural Plates, Shapes, and Bars: ASTM A36.
- C. Fittings: Elbows, T-shapes, flanges, escutcheons; machined steel.
- D. Wall Brackets: Julius Blum No. 1378, www.juliusblum.com.
- E. Splice Connectors: Steel welding collars.
- F. Welding Materials: AWS D1.1.

2.3 WIRE MESH FABRIC

- A. Manufactured by McNichols, www.mcnichols.com or approved substitution per Section 01 25 13. Rectangular, carbon steel, cold rolled, welded - trimmed, 4 inch x 2 inch mesh (rectangular), 3.7500 inch x 1.7500 inch opening (rectangular), 0.250 inch thick (2-3/4 gauge) wired diameter, 93% open.

2.4 FABRICATION

- A. Fit and shop assemble components in largest practical sizes, for delivery to site.
- B. Fabricate components with joints tightly fitted and secured.
- C. Exposed Mechanical Fastenings: Flush countersunk screws or bolts; unobtrusively located; consistent with design of component, except where specifically noted otherwise.
- D. Supply components required for anchorage of fabrications. Fabricate anchors and related components of same material and finish as fabrication, except where specifically noted otherwise.
- E. Continuously seal joined pieces by continuous welds in accordance with AWS requirements.
- F. Grind exposed joints flush and smooth with adjacent finish surface. Make exposed joints butt tight, flush, and hairline. Ease exposed edges to small uniform radius.
- G. Accurately form components to suit ramps, stairs and landings, to each other and to building structure.

2.5 FINISHES

- A. Clean surfaces of rust, scale, grease, and foreign matter prior to finishing.
- B. Do not prime surfaces in direct contact with concrete or where field welding is required.
- C. Galvanizing: 1.25 oz/sq ft zinc coating in accordance with ASTM A123.
- D. Touch-Up Primer for Galvanized Surfaces: SSPC 20.
- E. Finish: Site paint under provisions of Section 09 90 00.

3. PART 3 EXECUTION

3.1 EXAMINATION

- A. Verify that field conditions are acceptable and are ready to receive work.
- B. Beginning of installation means erector accepts existing conditions.

3.2 PREPARATION

- A. Clean and strip primed steel items to bare metal where site welding is required.
- B. Supply items required to be cast into concrete and embedded in masonry with setting templates, to appropriate Sections.

3.3 INSTALLATION

- A. Install in accordance with manufacturer's instructions.
- B. Install components plumb and level, accurately fitted, free from distortion or defects.
- C. Provide anchors required for connecting railings to structure. Anchor railing to structure.
- D. Field weld anchors as indicated on Drawings. Grind welds smooth. Touch-up welds with primer.
- E. Conceal bolts and screws whenever possible. Where not concealed, use flush countersunk fastenings.
- F. Install wall mounted handrail brackets to bottom of handrail.
- G. Install wall mounted handrails with a 1-1/2 inch space between wall and inside face of handrail.
- H. Extend handrail at top of stairs a minimum of 1'-0" past face of riser. Extend handrail at bottom of stairs a minimum distance of 1'-0" plus depth of one stair tread. The 1'-0" handrail extensions to be level and parallel with the landing surface.
- I. Extend handrails at top and bottom of ramps a minimum of 1'-0". The 1'-0" handrail extensions to be level and parallel with the landing surface.

END OF SECTION

SECTION 05 53 00

METAL GRATINGS

1. PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Formed steel gratings.
- B. Formed openings.

1.2 REFERENCES

- A. 2010 Americans with Disabilities Act (ADA) Standards for Accessible Design.
- B. ASTM A123 - Zinc (Hot Galvanized) Coatings on Products Fabricated from Rolled, Pressed, and Forged Steel Shapes, Plates, Bars, and Strip.
- C. ASTM A36 - Structural Steel.
- D. ASTM A525 - General Requirements for Steel Sheet, Zinc-coated (Galvanized) by the Hot-Dip Process.
- E. ASTM B210 - Aluminum-Alloy Drawn Seamless Tubes.
- F. ASTM B221 - Aluminum and Aluminum-Alloy Extruded Bar, Rod, Wire, Shape and Tube.
- G. CBC - California Building Code, (CCR) California Code of Regulations, Title 24, Part 2.
- H. NAAMM MGB 531 - Metal Bar Grating Manual.
- I. SSPC - The Society for Protective Coating.

1.3 SYSTEM DESCRIPTION

- A. Conform to CBC - California Building Code, (CCR) California Code of Regulations, Title 24, Part 2, for live and dead loads applicable to work of this Section.

1.4 QUALITY ASSURANCE

- A. For substitution requests, design grates under direct supervision of structural engineer registered in the State of California.

1.5 SUBMITTALS

- A. Submit shop drawings and product data under provisions of Section 01 33 00.
- B. Indicate details of grates, supports, span and deflection table, and perimeter construction details and tolerances.
- C. Submit samples under provisions of Section 01 33 00.
- D. Submit two samples 12 x 12 inches in size illustrating surface finish, color, and texture.
- E. Submit manufacturer's installation instructions under provisions of Section 01 33 00.

1.6 REGULATORY REQUIREMENTS

- A. Conform to CBC - California Building Code, (CCR) Title 24, Part 2 and the 2010 ADA Standards for Accessible Design for accessibility requirements.

2. PART 2 PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

- A. Ametco Mfg. Corp., www.ametco.com.
- B. Balco, Inc., www.balcousa.com.
- C. Grating Pacific, Inc., www.gratingpacific.com.
- D. McNichols Co., www.mcnichols.com.
- E. Substitutions: Under provisions of Section 01 25 13.

2.2 MATERIALS

- A. Sheet Steel: ASTM A525; carbon steel with raised lug pattern.
- B. Formed Steel: ASTM A36, A992 ksi yield, of shapes indicated.
- C. Touch-up Primer for Galvanized Surfaces: SSPC 20.

2.3 FASTENERS

- A. Fasteners: Galvanized steel.

2.4 ACCESSORIES

- A. Perimeter Closure: Of same material as grating.

2.5 FABRICATION

- A. Fabricate grates of sizes indicated.
- B. Weld joints of intersecting grating sections.
- C. Provide support framing for openings.
- D. Bearing Bar: 3.5 x 1/4 inches size, spaced 1 7/8 inches on center.
- E. Cross Bar: 3/8 x 3/8 inches size, spaced 4 inches on center.
- F. Anchorages: Welded.
- G. When located in accessible path of travel, maximum space between bars shall not exceed 1/2 inch.

2.6 FINISHES

- A. Galvanizing: ASTM A123, to 1.25 oz/sq ft weight.

3. PART 3 EXECUTION

3.1 EXAMINATION

- A. Verify that opening sizes and dimensional variations are acceptable to suit grating and plating tolerances.
- B. Verify that supports anchors are correctly positioned.
- C. Beginning of installation means installer accepts existing conditions.

3.2 INSTALLATION

- A. Install grates and floor plates in accordance with manufacturer's instructions.
- B. Mechanically cut galvanized finished surfaces. Do not use flame cutting tools.
- C. Secure grating with mechanical fasteners to prevent movement.
- D. When located in accessible path of travel, elongated openings shall be installed perpendicular to path of travel.

3.3 TOLERANCES

- A. Conform to NAAM MBG 531.
- B. Maximum Space Between Abutting Sections: 1/4 inch.
- C. Maximum Variation From Top Surface Plan of Abutting Sections: 1/4 inch.

END OF SECTION

SECTION 06 10 00

ROUGH CARPENTRY

1. PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Floor and wall sheathing.
- B. Fire retardant treatment of wood.

1.2 REFERENCES

- A. CBC - California Building Code, (CCR) California Code of Regulations Title 24, Part 2.
- B. ANSI/AF & PA NDS-12 - National Design Specifications for Wood Construction.
- C. APA - The Engineered Wood Association.
- D. ASTM E84 - Standard Test Method for Surface burning Characteristics of Building Materials.
- E. MS MIL-L-19140 - Fire Retardant Wood Preservative Chemicals.
- F. National Bureau of Standards - Product Standard PS-1-09 for Construction and Industrial Plywood.
- G. WCLIB - West Coast Lumber Inspection Bureau: Standard Grading Rules for West Coast Lumber.
- H. WWPA - Western Wood Products Association.

1.3 QUALITY ASSURANCE

- A. Plywood Grading Agency: Certified by APA.

1.4 REGULATORY REQUIREMENTS

- A. Conform to CBC, California Building Code, (CCR) California Code of Regulations, Title 24, Part 2, Chapter 23.
- B. Allowable stress design values shall be in compliance with the CBC, California Building Code, (CCR) California Code of Regulations, Title 24, Part 2, Section 2306, ANSI/AF & PA NDS-12 - National Design Specifications for Wood Construction, and ANSI/SDPWS - Special Design Provisions for Wind and Seismic.

1.5 SUBMITTALS

- A. Submit product data under provisions of Section 01 33 00.
- B. Provide technical data on wood preservative materials and application instructions.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Store and protect products under provisions of Section 01 61 00.
- B. Deliver materials free from pest infestation. Protect materials on site to prevent termite, beetle or other wood boring insect attacks.
- C. Stack lumber flat, off grade, with spacers between each bundle to promote air circulation. Provide for air circulation around and under coverings.

2. PART 2 PRODUCTS

2.1 LUMBER MATERIALS

- A. Lumber Grading Rules: WCLIB and WWP. Lumber shall bear WCLIB grade stamp.
- B. Non-structural Light Framing Studs, Plate and Blocking: Douglas Fir species, construction grade.
- C. Plank and Decking: Douglas Fir species, Com Dex.
- D. HDPE Lumber: Dimensional plastic lumber containing 90 percent recycled plastic by weight, weathered redwood in color, having an allowable flexural stress of 1,200 psi and a modulus of elasticity of 114,000 psi as determined by ASTM D6109.

2.2 PLYWOOD MATERIALS

- A. Wall Sheathing: APA Structural I, Grade C-D, Exposure 1 minimum 5-ply construction, meeting product standard PS-1-09.
- B. Floor Sheathing: APA Structural I, Grade C-D, Exposure 1. Minimum 5-ply construction, meeting Product Standard PS-1-09.
- C. Underlayment: APA Underlayment, Exposure 1, 3/8 inch thick, sanded; minimum 3-ply construction.
- D. Telephone and Electrical Panel Boards: APA Grade C-D with exterior glue, minimum 5 ply, 3/4 inch thick, meeting PS-1-09.

2.3 ACCESSORIES

- A. Fasteners: Hot-dipped galvanized steel for exterior, high humidity, and treated wood locations; plain finish elsewhere; size and type to suit condition.
- B. Connectors: As indicated.
- C. Anchors: Thru bolt or anchor bolt to concrete or masonry unless otherwise noted. Bolt for anchorage to steel unless otherwise noted.

2.4 FIRE RETARDANT TREATMENT

- A. Fire retardant wood to have a flame spread of less than 25 when tested in an extended 30-minute tunnel test according to ASTM E84.
- B. Dimensional lumber to be kiln dried to a maximum moisture content of 19 percent after treatment.
- C. Plywood to be kiln dried to a maximum moisture content of 15 percent after treatment.
- D. Fire retardant wood to comply with AWP. Standard C20 for lumber and C27 for plywood.
- E. Fire retardant chemicals to comply with FR-1 of AWP. Standard P-17 and shall be free of halogens, sulfates and ammonium phosphate.
- F. Carbon steel, galvanized steel, aluminum, copper, and red brass in contact with fire retardant wood shall exhibit corrosion rates less than one mil per year when tested in accordance with FS MIL-L-19140, Paragraph 4.6.5.2.
- G. Fire retardant chemicals must be registered for use as a wood preservative by the U.S. Environmental Protection Agency.
- H. Fire retardant treat indicated items and the following:
 - 1. Wall sheathing.

2. Wood nailers and similar members in connection with roofing and flashing.

3. PART 3 EXECUTION

3.1 FURRING, BLOCKING AND GROUNDS

- A. Provide wherever shown and where required for attachment of other work. Coordinate with work of other sections.
- B. Install plywood backboards for telephone, data and other electrical equipment.
- C. Form to shapes as shown and cut as required for true line and level of work to be attached. Coordinate location with other work involved.
- D. Attach to substrates as required to support applied loading. Countersink bolts and nuts flush with surfaces, unless otherwise indicated.
- E. Build into masonry during installation of masonry work. Where possible, anchor to formwork before concrete placement.
- F. Install plumb and level with closure strips at edges and openings. Shim with wood as required for tolerance of finished work.

3.2 SHEATHING

- A. Secure wall sheathing perpendicular to wall studs, with ends staggered, over firm bearing.
- B. Secure flooring underlayment with screws. Install after dust and dirt generating activities have ceased and prior to application of finished flooring. Apply perpendicular to subflooring. Stagger end joints of underlayment. Space panels 1/32 inch apart at ends and edges.
- C. Install telephone and electrical panel back boards where required. Size of backboards to be 12 inches beyond size of electrical panel boards.

3.3 RECYCLING CONSTRUCTION WASTE

- A. Recycle lumber waste under the provisions of Section 01 74 19.

3.4 FIELD QUALITY CONTROL

- A. Field inspection and testing will be performed under provisions of Section 01 45 29.
- B. Lumber materials will be inspected for compliance with material grading rules, limitations for moisture content and pest infestation prior to any materials being concealed from view or being covered with an architectural finish.

END OF SECTION

SECTION 06 20 00

FINISH CARPENTRY

1. PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Finish carpentry items, other than shop prefabricated casework.
- B. Hardware and attachment accessories.

1.2 REFERENCES

- A. ASTM E84 - Test Method for Surface Burning Characteristics of Building Materials.
- B. AWP - American Wood Preservers Association.
- C. CBC - California Building Code, (CCR) California Code of Regulations, Title 24, Part 2.
- D. UL - Underwriters' Laboratories, Inc.
- E. WI - Woodwork Institute: North American Architectural Woodwork Standards 3.0.

1.3 QUALITY ASSURANCE

- A. Manufacture millwork and finish carpentry items in accordance with quality standards of the North American Architectural Woodwork Standards of the Woodwork Institute.
- B. All millwork and the installation of millwork shall be monitored for compliance under the scope of the WI Monitored Compliance Program (MCP).
- C. Fees charged by the Woodwork Institute for their monitored compliance service are the responsibility of the millwork manufacturer.
- D. Provide WI Certified Compliance Labels on all items of millwork.
- E. Provide WI Inspection Service at the job site prior to installation. Provide to Architect a written report showing results of the reinspection.
- F. Upon completion of the installation, provide a WI Monitored Compliance Certificate.

1.4 REGULATORY REQUIREMENTS

- A. Conform to CBC and UL requirements for fire ratings.
- B. Conform to Flame Spread Classifications of Interior Millwork for flame spread ratings as tested according to ASTM E84.

1.5 SUBMITTALS

- A. Submit shop drawings under provisions of Section 01 33 00.
- B. Indicate materials, component profiles, fastening methods, jointing details, finishes, and accessories to a minimum scale of 1-1/2 inch to one foot. Provide WI Certified Compliance label on first page of each set.
- C. Submit samples under provisions of Section 01 33 00.
- D. Submit two samples 6 x 12 inch in size illustrating wood grain, species, and specified finish.

- E. Submit two samples 18 inch long of wood trim.
- 1.6 DELIVERY, STORAGE, AND HANDLING
 - A. Deliver, store and protect products under provisions of Section 01 61 00.
 - B. For interior applications conform to Section 2 of the North American Architectural Woodwork Standards for a climate controlled application.
 - C. Store materials in ventilated, interior locations under constant minimum temperatures of 60 degrees F and maximum relative humidity of 25 to 55 percent.

2. PART 2 PRODUCTS

2.1 FABRICATORS

- A. Active member of the Woodwork Institute, licensed by WI to provide the WI certified Compliance Certificates and Labels for the products and materials specified in this section, www.woodworkinstitute.com.
- B. Substitutions: Under provisions of Section 01 25 13.

2.2 MATERIALS

- A. Materials specified under the North American Architectural Woodwork Standards Section Numbers refer to lumber grades as follows: Section 3, Lumber - Hardwood/Softwoods; Section 4, Plywood - Hardwood/Softwood; Section 6, Exterior Trim; and Interior Trim; Section 7, Stair Work and Rails.

2.3 INTERIOR TRIM

- A. Fabricate in accordance with Section 6 of the North American Architectural Woodwork Standards.

<u>Item</u>	<u>Species</u>	<u>Grade</u>	<u>Intended Finish</u>
Base, Casing & Trim	Red Oak	Custom	Transparent

2.4 MISCELLANEOUS INTERIOR MILLWORK

- A. Fabricate in accordance with Section 6 of the North American Architectural Woodwork Standards.

<u>Item</u>	<u>Species</u>	<u>Grade</u>	<u>Intended Finish</u>
Wall cap/railing	Red Oak	Custom	Transparent

2.5 ADHESIVE

- A. Adhesives: Type 1 adhesive recommended by WI to accommodate application in accordance with the Appendix A to the North American Architectural Woodwork Standards.
- B. Wall Adhesive: Solvent release, cartridge type, compatible with wall substrate, capable of achieving durable bond.

2.6 ACCESSORIES

- A. Nails: Size and type to suit application, galvanized finish for interior use, stainless steel for exterior use.
- B. Bolts, Nuts, Washers, Blind Fasteners, Lags, and Screws: Size and type to suit application; galvanized finish for interior use, stainless steel for exterior use.
- C. Lumber for Shimming and Blocking: Softwood lumber of Douglas Fir species.
- D. Primer: Alkyd primer sealer.

- E. Wood Filler: Solvent base, tinted to match surface finish color.

2.7 FABRICATION

- A. Fabricate work in accordance with WI Premium grade standards.
- B. Shop assemble work for delivery to site, permitting passage through building openings.
- C. When necessary to cut and fit on site, provide materials with ample allowance for cutting. Provide trim for scribing and site cutting.

3. PART 3 EXECUTION

3.1 EXAMINATION

- A. Verify that surfaces and openings are ready to receive work and field measurements are as instructed by the fabricator.
- B. Verify mechanical, electrical, and building items affecting work of this Section are placed and ready to receive this work.
- C. Verify adequacy of backing and support framing.
- D. Beginning of installation means acceptance of existing conditions.

3.2 PREPARATION

- A. Before installation, prime paint surfaces of items or assemblies to be in contact with cementitious materials or that will be permanently concealed from view.

3.3 INSTALLATION

- A. Install work in accordance with the WI North American Architectural Woodwork Standards Premium quality standard.
- B. Install fire rated door frames in accordance with NFPA 80.

3.4 TOLERANCES

- A. Maximum Variation from True Position: 1/16 inch.
- B. Maximum Offset from True Alignment with Abutting Materials: 1/32 inch.

3.5 PREPARATION FOR FINISHING

- A. Set exposed fasteners. Apply wood filler in exposed fastener indentations. Sand work smooth.

3.6 FINISHING

- A. Site finish under provisions of Section 09 90 00.

3.7 PROTECTION

- A. Protect finished installation under provisions of Section 01 61 00.

END OF SECTION

SECTION 06 41 16

PLASTIC-LAMINATE-CLAD ARCHITECTURAL CABINETS

1. PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Special fabricated cabinet units.
- B. Countertops.
- C. Preparation for utilities.
- D. Cabinet hardware.
- E. Glass for cabinet units.

1.2 REFERENCES

- A. WI - Woodwork Institute of California: North American Architectural Woodwork Standards 3.1. (NAAWS)
- B. ASTM A167 - Stainless and Heat-Resisting Chromium-Nickel Steel Plate, Sheet, and Strip.
- C. ASTM A653 - Steel Sheet, Zinc Coated, (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.
- D. ASTM A924 - General Requirements for Steel Sheet, Zinc-Coated (Galvanized) by the Hot-Dip Process.
- E. ASTM E84 – Test Method for Surface Burning Characteristics of Building Materials.
- F. CBC – California Building Code, (CCR) California Code of Regulations, Title 24, Part 2.

1.3 QUALITY ASSURANCE - MONITORED COMPLIANCE PROGRAM

- A. Manufacture casework items in accordance with quality standards of the North American Architectural Woodwork Standards of the Woodwork Institute.
- B. All millwork and the installation of millwork shall be monitored for compliance under the scope of the WI Monitored Compliance Program (MCP).
- C. Fees charged by the Woodwork Institute for their monitored compliance service are the responsibility of the casework manufacturer.
- D. Provide WI Inspection Service at the millwork fabricator. Provide to Architect a written report showing the results of the inspection.
- E. Provide WI Certified Compliance Labels on all items of casework and countertops.
- F. Provide WI Inspection Service at the job site. Provide to Architect a written report showing the results of the inspection.

- G. Self Certification by the millwork fabricator or inspection by other than an authorized representative of The Woodwork Institute is not acceptable.
- H. Upon completion of the installation, provide a WI Monitored Compliance Certificate.

1.4 QUALITY ASSURANCE - CERTIFIED SEISMIC INSTALLATION PROGRAM

- A. Install casework items in accordance with the Woodwork Institute's Certified Seismic Installation Program (CSIP).
- B. Install casework in accordance with the Office of Statewide Health Planning and Development (OSHPD) Preapproval of Fixed Equipment Anchorages (OPA-2649-10 and OPM-0092-13).
- C. Prior to walls being closed up and covered, provide a written Woodwork Institute Certified Seismic Installation report confirming that backing is provided in all locations required for casework installation. Identify those areas where backing is missing or improperly located.
- D. On completion of installation of casework provide a Woodwork Institute Certified Seismic Installation Program Certificate. Identify the work covered and certify that the work as installed is in compliance with the requirements of the Woodwork Institute's Certified Seismic Installation Program (CSIP).
- E. Fees charged by the Woodwork Institute for monitoring and compliance for their Certified Seismic Installation Program (CSIP) are the responsibility of the casework manufacturer and installer.

1.5 REGULATORY REQUIREMENTS

- A. Conform to CBC requirements for flame spread classification in accordance with CBC Section 803 and Table 803.11.
- B. Conform to Flame Spread Classifications for Interior Millwork for flame spread ratings as tested according to ASTM E84.
- C. Materials of this section shall meet the requirements for formaldehyde as specified in the California Air Resources Board's Air Toxics Control Measure (ATCM) for Composite Wood (17CCR 93120 et seq.).

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Deliver, store, and protect products to site under provisions of Section 01 61 00.
- B. Conform to Section 2 of the North American Architectural Woodwork Standards for a climate controlled application.
- C. Delivery of casework shall be made only when the area of installation is enclosed, all plaster and concrete work is dry, the area is broom clean and environmental conditions are as specified.

1.7 ENVIRONMENTAL CONDITIONS

- A. Area of casework installation shall be fully enclosed, well ventilated, and protected from direct sunlight, excessive heat, rain and moisture.
- B. Relative humidity of the area of casework installation shall be maintained between 25 percent and 55 percent with a temperature range of between 60 degrees F to 90 degrees F.
- C. Casework shall be acclimated to the area of installation for a minimum of 72 hours prior to installation.

1.8 SUBMITTALS

- A. Submit shop drawings and product data under provisions of Section 01 33 00.
- B. Include materials, component profiles, fastening methods, assembly methods, joint details, accessory listings, and schedule of finishes.
- C. Provide WI Certified Compliance Label for the Certified Seismic Installation Program on the first page of shop drawings.
- D. Provide WI Certified Compliance label on first page of shop drawings. Include WI inspector's signature.
- E. Provide WI certificates of compliance and inspection reports.

2. PART 2 PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

- A. Active member of the Woodwork Institute licensed by WI to provide WI Certified Compliance Certificates and Labels for the products and materials specified in this section www.woodworkinstitute.com.
- B. Substitutions: Under provisions of Section 01 25 13.

2.2 MATERIALS

- A. Material shall conform to standards of the North American Architectural Woodwork Standards as follows: Section 3, Section 4, Section 10, and Section 11.

2.3 CABINET DESIGN

- A. Individual cabinets are indicated on the drawings by the WI Cabinet Design Series (CDS) numbering system, Design Ideas.

2.4 MODULAR CASEWORK - LAMINATED PLASTIC COVERED (STANDARD)

- A. Fabricate in accordance with Section 10 of the North American Architectural Woodwork Standards.
 - 1. WI Grade: Custom
 - 2. Core Material: Combination Core, PureBond Classic Core, www.columbiaforestproducts.com.
 - 3. Construction: Style - Frameless.
 - 4. Joinery: Doweled Joints.
 - 5. Cabinet Backs: Blind Dadoed.
 - 6. Cabinet Door Type: Flush overlay.
 - 7. Base: Moisture resistant.
 - 8. Shelves: 1-M-2 particle board, with HPDL two sides, 1 inch thick, MOE of 710,000, capable of supporting 50 lb/sq ft load with deflection of L/144.

- | | | |
|-----|--|---|
| 9. | Shelf Edge Bands | 0.028 inch high pressure plastic laminate in color to match shelf. All 4 edges of adjustable shelves to receive banding. |
| 10. | Door and Drawer Edge Bands: | 0.028 inch high pressure plastic laminate the same as exposed faces. |
| 11. | Exposed Surfaces
(Including shelves and interior of open front cabinets): | 0.028 inch high pressure plastic laminate, color and pattern as selected by Architect. A maximum of 5 colors and patterns to be selected. A minimum of 3 color combinations per room may be selected. |
| 12. | Semi-Exposed Surfaces
(Behind doors and inside drawers): | Low pressure decorative polyester or melamine laminate 0.020 inch thick in complimentary color to exposed surfaces as selected. |
| 13. | Security and Dust Panels: | Particle board, 3/4 inch thick at all lockable drawers. |
| 14. | Substitutions: | Under the provisions of Section 01 25 13. |

2.5 MODULAR CASEWORK - LAMINATED PLASTIC COVERED (LIBRARY SHELVING AND DISPLAY CASES)

- | | | |
|-----|--|---|
| 1. | WI Grade: | Premium |
| 2. | Core Material: | Combination Core, PureBond Classic Core, www.columbiaforestproducts.com . |
| 3. | Construction: | Style - Frameless. |
| 4. | Joinery: | Doweled Joints. |
| 5. | Cabinet Backs: | Blind Dadoed. |
| 6. | Cabinet Door Type: | Flush overlay with removable synthetic retainer for glass. |
| 7. | Base: | Moisture resistant. |
| 8. | Shelves: | 1-M-2 particle board, with HPDL two sides, 1 inch thick, MOE of 710,000, capable of supporting 50 lb/sq ft load with deflection of L/144. |
| 9. | Shelf Edge Bands | 0.028 inch high pressure plastic laminate in color to match shelf. All 4 edges of adjustable shelves to receive banding. |
| 10. | Door and Drawer Edge Bands: | 0.028 inch high pressure plastic laminate the same as exposed faces. |
| 11. | Exposed Surfaces
(Including shelves and interior of open front cabinets): | 0.028 inch high pressure plastic laminate, color and pattern as selected by Architect. A maximum of 5 colors and patterns to be selected. A minimum of 3 color combinations per room may be selected. |
| 12. | Semi-Exposed Surfaces
(Behind doors and inside drawers): | Low pressure decorative polyester or melamine laminate 0.020 inch thick in complimentary color to exposed surfaces as selected. |
| 13. | Security and Dust Panels: | Particle board, 3/4 inch thick at all lockable drawers. |
| 14. | Substitutions: | Under the provisions of Section 01 25 13. |

2.6 LAMINATED PLASTIC COUNTERTOPS

A. Fabricate in accordance with Section 11 of the North American Architectural Woodwork Standards.

1. WI Grade: Premium.
2. Core Thickness: 0.75 inch minimum.
3. Laminate Thickness: 0.050 inch or .042 inch for postformed use.
4. Front Edge Covering: Self-edged with drip groove.
5. Backsplash at Top: Horizontal butt.
6. Top of Back Splash: Square with scribe.
7. Construction Type: Assembly 2, deck mount, manufacturer assembled.
8. Plastic Colors and Pattern: To be selected from full range of manufacturer's colors.

2.7 STAINLESS STEEL COUNTERTOPS

- A. Stainless Steel: ASTM A167, Type 304, No. 4 finish, 0.050 inch thick.
- B. Core: Particleboard, minimum 3/4 inch thick.
- C. Edge: Marine edge, 1-1/2 inch total thickness.
- D. Backsplash: Integral cove with corners radiused 1-1/2 inch total thickness.
- E. Seams: Continuous welded seams. Grind smooth.

2.8 EPOXY RESIN COUNTERTOPS

A. Epoxy resin tops and splashes shall be fabricated in accordance with the following:

1. Core Thickness : 1 inch
2. Edge : Radius 1/4 inch with drip groove
3. Backsplash : Integral coved Square butt
4. Color : Black

2.9 SOLID POLYMER COUNTERTOPS

A. Manufacturers:

1. Avonite, Inc., Product: Avonite, www.avonite.com.
2. Diamond Surfaces USA, Product: Solid Surface, www.diamondsurfaces.com.
3. E.I. duPont de Nemours and Co., Inc., Product: Corian, www.corian.com.
4. Formica Corporation, Product: Solid Surfacing, www.formica.com.
5. LG Chemical, Product: Hi-Macs, www.hi-macs.com.
6. Lotte Advanced Materials, Product: Staron, www.staron.com.

7. WilsonArt, Product: Earthstone/Gibraltar, www.wilsonart.com.

8. Substitutions: Under provisions of Section 01 25 13.

B. Fabricate solid polymer tops and splashes in accordance with the following:

1. Top Thickness : 0.50 inch
2. Edge Detail : 1.50 inch thick; Square edge as indicated.
3. Color : To be selected from manufacturer's entire range of solid and textured colors.

2.10 JANITOR ROOMS

A. Provide economy grade casework in accordance with Section 10 of the North American Architectural Woodwork Standards.

2.11 GLAZING

A. Glass Doors: 1/4 inch thick clear laminated safety glazing with all exposed edges ground.

B. Glass Shelves: 5/8 inch thick laminated safety glazing with all exposed edges ground.

2.12 HARDWARE

A. Finish: Satin Aluminum.

B. Shelf Supports: Metal or molded polycarbonate clips set in drilled holes spaced 32 mm on center. Clips to have vertical locating pin for retention of shelf.

C. Drawer and Door Pulls: Epcos MC-402-4 U-shaped wire pull.

D. Cabinet Locks: Olympus 500/600 or CompXNational 8173/8178.

E. Drawer Slides for Drawers 24 inch Wide or Less: Accuride 7432.

F. Drawer Slides for Drawers over 24 inch Wide: Accuride 3640.

G. Drawer slides for File Drawers: Accuride 4034.

H. Hinges: Hafele, Aximat hinge. Hinges per leaf: 3'-0" high doors - 2 hinges, 3'-0" to 5'-0" high doors - 3 hinges, 5'-0" to 7'-4" high doors - 4 hinges, 7'-0" to 8'-0" - 5 hinges.

I. Sliding Door Track Assemblies: Grant 2023N sheaves and Grant 2011 track.

J. Grommets: Doug Mockett and Company, Inc., www.mockett.com. SG Series; plastic 1-3/4 inch diameter, 30 required. LO Series; plastic 6 x 3 inch 4 required. Colors as selected by Architect.

K. Hanger Rods: 1-1/16 inch diameter tubing, stainless steel.

L. Seismic Shelf Lip: 1/4 inch thick x 3 inch high acrylic plastic of color selected by Architect at all science, chemistry, and prep room shelving. Ease all edges of plastic.

- M. Countertop Support Bracket: 24 inch x 24 inch x 1/8 inch thick pre-manufactured angled steel bracket, black paint finish, minimum 1,000 lb. load support capability, with 7 predrilled anchor holes per bracket leg. Manufactured by A & M Hardware, Inc. www.aandmhardware.com
- N. Remainder of hardware required shall meet requirements of ANSI/BHMA Grade 1.
- O. Plumbing and electrical service fixtures as indicated in Division 22 and Division 26.
- P. Substitutions: Under the provisions of Section 01 25 13.

2.13 FABRICATION

- A. Shop assemble casework for delivery to site in units easily handled and to permit passage through building openings.
- B. When necessary to cut and fit on site, provide materials with ample allowance for cutting. Provide trim for scribing and site cutting.
- C. Provide cutouts for plumbing fixtures, inserts, appliances, outlet boxes, and other fixtures and fittings. Verify locations of cutouts from on-site dimensions. Seal contact surfaces of cut edges.
- D. Before installation, seal unfinished material installed for backs, bases, self-edge backing, stripping and other concealed portions with a water-repellant sealer.
- E. Provide all supports and required inserts for laboratory type sink units.
- F. Install plastic grommets in the field in plastic laminate casework and Owner furnished furniture as directed by the Owner's Representative and/or Architect.
- G. Install seismic shelf lips on all exposed edges of open laboratory shelving with flathead countersunk wood screws spaced 6 inches on center. Finish exposed screw heads to match color of shelf lip.
- H. Install one adjustable shelf for each 1'-0" of height for all wall mounted cabinets.
- I. Provide stretcher at top face of all door and drawer fronts.
- J. Provide locks on all doors and drawers.

3. PART 3 EXECUTION

3.1 INSPECTION

- A. Verify adequacy of backing and support framing.

3.2 INSTALLATION

- A. Set and secure casework in place rigid, plumb, and level.
- B. Install casework in accordance with Section 10 of the North American Architectural Woodwork Standards.
- C. Install casework items in accordance with the Woodwork Institute's Certified Seismic Installation Program (CSIP)

- D. Install countertops in accordance with Section 11 of the North American Architectural Woodwork Standards.

3.3 ADJUSTING AND CLEANING

- A. Adjust doors, drawers, hardware, fixtures and other moving or operating parts to function smoothly and correctly.
- B. Clean casework, counters, shelves, hardware, fittings and fixtures.

END OF SECTION

SECTION 07 12 00

BITUMINOUS WATERPROOFING

1. PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Cold applied asphalt bitumen waterproofing.
- B. Fabric reinforcement.
- C. Protective covering.
- D. Application Schedule.

1.2 REFERENCES

- A. ASTM C578 - Preformed, Cellular Polystyrene Thermal Insulation.
- B. ASTM D41 - Asphalt Primer Used in Roofing, Dampproofing and Water proofing.
- C. ASTM D1227 - Emulsified Asphalt Used as a Protective Coating for Roofing.
- D. ASTM D1668 - Glass Fabrics (Woven and Treated) for Roofing and Water proofing.
- E. NRCA (National Roofing Contractors Association) - Waterproofing Manual.

1.3 SYSTEM DESCRIPTION

- A. Waterproofing System: Prevent moisture migration to interior.
- B. System: Capable of resisting water head of 6 feet.

1.4 QUALITY ASSURANCE

- A. Manufacturer: Company specializing in manufacturing products specified in this Section with a minimum of five years documented experience.
- B. Applicator: Company specializing in bituminous waterproofing systems with five years minimum experience.
- C. Perform work in accordance with NRCA Waterproofing Manual.

1.5 SUBMITTALS

- A. Submit manufacturer's certificate under provisions of Section 01 33 00 that installed materials meet or exceed specified requirements.

1.6 WARRANTY

- A. Provide five year warranty under provisions of Section 01 77 00.
- B. Warranty: Include coverage of waterproofing failing to resist penetration of water except where such failures are the result of structural failures of building. Hairline cracking of concrete due to temperature change or shrinkage is not considered as structural failure.
- C. Include coverage during warranty period for removal and replacement of materials concealing waterproofing.

2. PART 2 PRODUCTS

2.1 BITUMEN MATERIALS

- A. Asphalt Primer: ASTM D41, compatible with substrate.
- B. Asphaltic Emulsion: ASTM D1227, Type II, Class 1, with fiberglass fibers.

2.2 SHEET MATERIALS

- A. Glass Fiber Fabric: ASTM D1668, Type III, woven.

2.3 ACCESSORIES

- A. Protection Board: ASTM C578, 1/2 inch thick expanded polystyrene board.

2.4 SUMMARY OF MATERIALS PER 100 SQUARE FEET

- | | |
|--|---------|
| A. Asphalt Primer (1-1/2 gallons) | 15 lbs. |
| B. First Course Coating (3 gals) | 30 lbs. |
| C. Glass Fabric (1 ply) | 1 lb. |
| D. Second Course Coating (3 gals) | 30 lbs. |
| E. Third Course Coating (3 gals) | 30 lbs. |
| F. Protection Course: 1/2 inch thick protection board. | |

3. PART 3 EXECUTION

3.1 INSPECTION

- A. Verify surfaces are solid, free of frozen matter, loose particles, cracks, pits, rough projections, and foreign matter detrimental to adhesion and application of waterproofing.
- B. Do not apply waterproofing to damp, frozen, dirty, dusty, or deck surfaces unacceptable to manufacturer.
- C. Verify items which penetrate surfaces to receive waterproofing are securely installed.
- D. Beginning of installation means acceptance of substrate.

3.2 PREPARATION

- A. Clean and prepare surfaces to receive waterproofing in accordance with manufacturer's instructions.
- B. Apply emulsion to seal penetrations, small cracks, and honeycomb in substrate.

3.3 APPLICATION

- A. Conform to drawing details included in NRCA - Waterproofing Manual.
- B. Prime surfaces with brush or spray coat.
- C. Apply brush coat of emulsion at 3 gallons per 100 sf and embed 12 inch wide ply of glass fabric extending out 6 inches on each surface at vertical wall angles and angles at footings and offsets.
- D. Apply brush or spray coat of emulsion at 3 gallons per 100 square feet. While wet, embed fabric, lapping 2 inches on sides and 4 inches on ends, butting all angles and corners. Brush surface to eliminate wrinkles and voids and allow to dry.

- E. Apply 18 inches wide reinforcing strip of fabric to vertical angles and angles at footings and offsets.
- F. Apply second and third courses of emulsion at rate of 3 gallons per 100 sf. Allow each course to dry before application of next course.

3.4 PROTECTION

- A. Protect finished membrane from damage during backfill operations by adhering protection board with mastic over treated surfaces.
- B. Scribe boards around pipes and projections.

3.5 APPLICATION SCHEDULE

- A. Exterior vertical face of below grade site retaining walls and grade beams.
- B. Interior vertical face of below grade planter walls.

END OF SECTION

SECTION 07 13 53

ELASTOMERIC SHEET WATERPROOFING

1. PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Below grade membrane waterproofing.
- B. Split slab deck waterproofing.
- C. Protection board drainage panel.
- D. Application Schedule.

1.2 REFERENCES

- A. ASTM C578 - Preformed, Cellular Polystyrene Thermal Insulation.
- B. ASTM D412 - Rubber Properties in Tension.
- C. ASTM D570 - Method for Water Absorption of Plastics.
- D. ASTM D1970 - Specification for Self Adhering Polymer Modified Bituminous Sheet Materials.
- E. ASTM E96 - Water Vapor Transmission of Materials in Sheet Form.
- F. ASTM E154 - Water Vapor Retarders Used in Contact with Earth, Under Concrete Slabs, on Walls, or as Ground Cover.

1.3 SYSTEM DESCRIPTION

- A. Waterproofing System: Sheet membrane capable of resisting water head of 200 feet and preventing moisture migration to interior.

1.4 QUALITY ASSURANCE

- A. Perform work in accordance with manufacturer's recommendations.
- B. Maintain one copy of document on site.

1.5 QUALIFICATIONS

- A. Manufacturer: Company specializing in the manufacture of products specified in this Section with minimum five years documented experience.
- B. Applicator: Company specializing in applying the work of this Section with minimum three years documented experience and approved by manufacturer.

1.6 PRE-INSTALLATION CONFERENCE

- A. Convene a conference two weeks prior to commencing work of this Section, under provisions of Section 01 31 00.

- B. Require attendance of parties directly affecting the work of this Section.

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Deliver, store and protect products to site under provisions of Section 01 61 00.

1.8 REGULATORY REQUIREMENTS

- A. Comply with all current federal, state, and local volatile organic compound (VOC) regulations.
- B. Do not use solvent based primers containing 1-1-1 trichloroethane or asphalt emulsions.

1.9 ENVIRONMENTAL REQUIREMENTS

- A. Do not apply products when surface or ambient temperature is below 25 degrees F.
- B. Do not apply to damp or frozen surfaces or during inclement weather.

1.10 SEQUENCING AND SCHEDULING

- A. Coordinate work under the provisions of Section 01 31 00.
- B. Coordinate work of this Section with foundation and backfilling requirements.
- C. Coordinate work of this Section with concrete paving and walkways.

1.11 WARRANTY

- A. Provide 5 year warranty under provisions of Section 01 77 00.
- B. Furnish manufacturer's warranty that materials will be free of defects in manufacture.
- C. Furnish applicator's warranty that the installation of materials will provide a leak free system.

2. PART 2 PRODUCTS

2.1 MANUFACTURERS

- A. GCP Applied Technologies; Product - Bituthene System 3000, www.gcpat.com.
- B. Pecora Corporation; Product - Duramem 700-SM, www.pecora.com.
- C. Carlisle Inc; Product - CCW Miradri 860, www.carlisleccw.com.
- D. MAPEI Corporation; Product - Mapethene HT, www.mapei.com.
- E. Polyguard Products, Inc.; Product-Polyguard 650, www.polyguardproducts.com.
- F. W.R. Meadows, Inc.; Product - Mel-Rol., www.wrmeadows.com.
- G. Tamko Products, Inc.; Product-TW-60, www.tamko.com.
- H. Substitutions: Under provisions of Section 01 25 13.

2.2 MEMBRANE MATERIALS

- A. Self-adhesive, cold-applied waterproofing sheet membrane consisting of a cross-laminated polyethylene film and rubberized asphalt of a thickness of .060 inches (60 mils) by 36 inch wide rolls, inter-wound with a disposable silicone-coated release sheet; conforming to the following:

<u>Properties</u>	<u>Test</u>	<u>Results</u>
Pliability, 180 degrees bend over 1 inch mandrel at - 45 degrees F	ASTM D1970	Unaffected
Tensile Strength (membrane)	ASTM D412	250 psi
Tensile Strength (film)	ASTM D412	5000 psi
Elongation	ASTM D412	300 percent
Puncture Resistance (membrane)	ASTM E154	40 lb
Permeance	ASTM E96 (Method B)	0.05 grains/sq. ft./ hr./in Hg
Water Absorption	ASTM D570	0.1 percent

2.3 ACCESSORIES

- A. Surface Conditioner: Acrylic latex diluted with water.
- B. Mastic: Rubberized asphaltic type recommended by membrane manufacturer.
- C. Liquid Membrane: Two component elastomeric, mastic grade.
- D. Cement Mortar: Epoxy or latex modified cementitious composition acceptable to membrane manufacturer.
- E. Concrete Patching Compound: Fast setting, non-shrinking patching compound, of type acceptable to membrane manufacturer.
- F. Tape: 2 sided adhesive tape acceptable to membrane manufacturer.

2.4 PROTECTION BOARD DRAINAGE PANEL

- A. Asphaltic Protection Board: One layer of premolded asphaltic hardboard sheet 1/8 inch thick, for horizontal application.
- B. Polystyrene Protection Board: ASTM C578 expanded polystyrene board, 1 inch minimum thickness, for vertical application.
- C. Protection Board Drainage Panel Adhesive: Type recommended by board manufacturer and compatible with membrane.
- D. Drainage Panel: Prefabricated drainage composite.
1. Hydroduct 220 by GCP Applied Technologies, www.gcpat.com.
 2. Mapedrain 25 by MAPEI Corp., www.mapei.com.

3. Mel-Drain 5035 by W.R. Meadows, Inc., www.wrmeadows.com.
4. Miradrain 6200 by Carlisle, Inc., www.carlisleccw.com.
5. J-D Rain by JDR Enterprises, www.j-drain.com.
6. Dura Drain by Pecora Corp., www.pecora.com
7. Substitutions: Under provisions of Section 01 25 13.

3. PART 3 EXECUTION

3.1 EXAMINATION

- A. Examine surfaces for conditions that would adversely affect execution. Do not proceed until unsatisfactory conditions are corrected. Beginning of installation constitutes acceptance of conditions.
- B. Ensure surfaces are reasonably smooth and free of holes, cracks or projections which might be detrimental to successful installation.
- C. Verify that items penetrating waterproofing system are securely installed.
- D. Verify that concrete surfaces have cured a period of time acceptable to membrane manufacturer.
- E. Verify that masonry joints are struck flush with face of unit or that a parge coat of mortar has been applied to face of masonry.

3.2 PREPARATION

- A. Protect adjacent surfaces not designated to receive waterproofing.
- B. Clean and prepare surfaces in accordance with manufacturer's instructions.
- C. Seal cracks and joints in accordance with manufacturer's instructions. Use proper depth-width ratio recommended by sealant manufacturer.
- D. Remove sharp projections, fins, and loose material. Remove form ties to 3/4 inch minimum behind face of wall. Fill holes, voids, and honeycomb areas flush with concrete patching compound or cement mortar.
- E. Seal penetrations in accordance with manufacturer's instructions.
- F. Provide fillet or cant at junction of vertical and horizontal surfaces using liquid membrane. Extend liquid membrane 6 inches each way from corner at a minimum 90 mil thickness.

3.3 WATERPROOFING INSTALLATION

- A. Install products in accordance with manufacturer's printed instructions.
- B. Extend membrane onto footing except terminate at point 12 inches below floor slab of protected space where footings are at greater depth.
- C. Apply latex surface conditioner at rate indicated by manufacturer. Condition only as much area as can be covered in same day.

- D. Prior to placing full membrane, install minimum 3/4 inch cant of liquid membrane, extending 6 inches each way at a minimum 90 mil thickness. Provide membrane strips at inside corners, outside corners, and working joints. Center strips along axis of corner and/or joint.
- E. Install sheets with edges and ends overlapped at dimensions recommended by manufacturer.
- F. Remove release paper layer. Roll out surface with mechanical roller to encourage full contact bond.
- G. Completely bond sheet to substrate, except those areas directly over or within 3 inches of working cracks or expansion joints.
- H. Extend membrane vertically up wall surfaces adjacent to deck surfaces a minimum of 6 inches. Extend into floor drains.
- I. Place uniform bead of mastic to joint edges at locations recommended by manufacturer.
- J. Seal perimeter ends and edges to adjoining surfaces.
- K. Seal items penetrating membrane with flashing membrane material and liquid membrane, ensuring positive seal with membrane and penetrating member.

3.4 PROTECTION BOARD DRAINAGE PANEL INSTALLATION

- A. Install polystyrene protection board system over membrane and retain in place with adhesive in accordance with manufacturer's instructions.
- B. Install asphalt protection board system in single layer with tight butt joints.
- C. Install drainage panel system over membrane with spots of adhesive in accordance with manufacturer's instructions.
- D. Place panel system with fabric facing out.
- E. Overlap flanges of adjacent drain cores.

3.5 FIELD QUALITY CONTROL

- A. Manufacturer's Field Services: Notify manufacturer prior to start of work and make arrangements for manufacturer's technical representative to be present during work to verify work is being conducted in accordance with their recommendations. Submit reports.
- B. Flood Tests - Horizontal Surfaces:
 - 1. Before completed surfaces are covered by protection board or other work, test for leaks with 2 inch depth of water maintained for 48 hours.
 - 2. Repair any leaks revealed by examination of substructure, and repeat test until no leakage is observed.

3.6 PROTECTION AND CLEANING

- A. Protect adjacent surfaces from damages and stains. Clean materials from surfaces where inadvertently applied.

3.7 APPLICATION SCHEDULE

- A. Exterior vertical face of below grade building walls and grade beams
- B. Exterior vertical face of elevator pit walls.
- C. Exterior horizontal plaza deck.

END OF SECTION

SECTION 07 21 13

PLYWOOD ADHERED RIGID WALL INSULATION

1. PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Continuous insulation EnergyShield Ply Pro wall panels.

1.2 RELATED SECTIONS

- A. Section 04 20 00 - Masonry Assemblies: Masonry base wall.
- B. Section 05 40 00 - Cold Formed Metal Framing.
- C. Section 07 25 00 - Air Barriers: Air seal materials over insulation to adjacent insulation.
- D. Section 09 21 16 - Gypsum Board Assemblies.
- E. Section 09 24 00 – Cement Plastering.

1.3 REFERENCES

- A. ASTM C 209 – Methods of Testing Insulating Board, Structural and Decorative.
- B. ASTM C 518 - Steady State Thermal Transmission By Means Of The Heat Flow Meter Apparatus (R Value)
- C. ASTM C 1289 – Specifications for Faced Rigid Cellular Polyisocyanurate Thermal Insulating Board.
- D. ASTM E 84 - Standard Test Method for Surface Burning Characteristics of Building Materials.
- E. ASTM E 96 - Test Method for Water Vapor Transmission of Materials.
- F. NFPA 285 - Standard Fire Test Method For Evaluation Of Fire Propagation Characteristics Of Exterior Non-Load-Bearing Wall Assemblies Containing Combustible Components.
- G. ICC-ES Evaluation Report - ICC-ESR- 1375
- H. DRJ Technical Evaluation Report # 1306-03

2. PART 2 PRODUCTS

2.1 MANUFACTURERS

- A. Acceptable Manufacturer: Insulating panels shall be EnergyShield Products by Atlas Roofing Corporation, 2000 Riveredge Pkwy. Phone: (678) 402-9639
- B. Substitutions: Under provisions of Section 01 25 13

2.2 BOARD INSULATION

A. Board Insulation:

Product: EnergyShield Ply Pro.

Description: ASTM C1289, Type 5, Grade 3, closed cell polyisocyanurate foam core faced with coated glass facers on both sides, bonded to nominally 5/8 inch thick fire-retardant treated plywood.

Retain the following for walls requiring NFPA 285 rating. Verify specific wall assemblies with Atlas Roofing Corporation.

1. Panel Size: 4 feet by 8 feet
2. Thickness / R Value: based on ASTM C 518 at 75 degrees F
 - a. 1.635 inches / R Value 6.8 with 5/8 inch plywood facing
3. Approved for use in NFPA 285 wall assemblies.
4. Flame spread/smoke developed rating: Class A, maximum 25/450, tested to ASTM E84.
5. Moisture vapor transmission: Maximum 1.2 perms, tested to ASTM E96 desiccant method.
6. Water absorption: Maximum 1.0 percent by volume, tested to ASTM C209.
7. Dimensional stability: Maximum 2 percent linear change, tested to ASTM D2126.
8. Microbial resistance; polyisocyanurate layer:
 - b. Pass ASTM D6329.
 - c. Pass UL 2824.
9. Service temperature: Minus 100 to plus 250 degrees F.

**** NOTE TO SPECIFIER ** Several factors are involved in the proper fastening of insulation composite panels. These include overall thickness of the panel, the weight of the specified cladding and the type of support provided at the base of the wall assembly. Please contact Atlas Roofing for current engineering report and assistance with fastening rate and fastener type.**

2.3 PANEL FASTENERS

- A. Fasteners: corrosion resistant type with oversized heads. Length of fasteners shall be as recommended by the panel manufacturer.

1. Atlas recommends Atlas Nailbase Fasteners SIP Heavy Duty (16 gauge steel stud up to 1/4 inch steel), and Atlas SIP SD (CMU, 18 gauge and lighter Steel Stud)

3. PART 3 EXECUTION

3.1 INSTALLATION

1. Install insulation in accordance with manufacturer's instructions.

END OF SECTION

SECTION 07 21 15

CONTINUOUS WALL PANEL INSULATION

1. PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Continuous wall panel insulation.
- B. Fasteners and accessories.

1.2 REFERENCES

- A. ASTM C 209 - Methods of Testing Insulating Board, Structural and Decorative.
- B. ASTM C 518 - Steady State Thermal Transmission By Means Of The Heat Flow Meter Apparatus (R Value).
- C. ASTM C 1289 - Specifications for Faced Rigid Cellular Polyisocyanurate Thermal Insulating Board.
- D. ASTM D 1621 - Test Methods for Compressive Properties of Rigid Cellular Plastics.
- E. ASTM D 2126 - Test Method for Response of Rigid Cellular Plastics to Thermal and Humid Aging.
- F. ASTM D 3273 - Standard Test Method for Resistance to Growth of Mold on the Surface of Interior Coatings in an Environmental Chamber.
- G. ASTM E 84 - Standard Test Method for Surface Burning Characteristics of Building Materials.
- H. ASTM E 96 - Test Method for Water Vapor Transmission of Materials.
- I. CBC - California Building Code, (CCR) California Code of Regulations, Title 24, Part 2.
- J. NFPA 285 - Standard Fire Test Method for Evaluation Of Fire Propagation Characteristics Of Exterior Non-Load-Bearing Wall Assemblies Containing Combustible Components.

1.3 SYSTEM DESCRIPTION

- A. NFPA 285 Exterior Wall Assembly - Steel Stud Construction:
 - 1. Base Wall System: Steel stud, minimum 1 layer 5/8 inch thick gypsum wallboard on interior, installed over steel studs: minimum 3-5/8 inches depth x minimum 33 mil thickness at a maximum of 24 inches o.c. with lateral bracing every 4 foot vertically.
 - 2. Exterior Finish:
 - (a) Plaster: Minimum 7/8 inch thick, Exterior Cement Plaster and Lath.
 - (b) Exterior Metal: Uninsulated Sheet Metal exterior wall coverings including Steel, Aluminum, and Copper.
 - (c) Fiber Cement Board siding. Porcelain or Ceramic Tile: Minimum 1/4 inch thick. Mechanical attachment required.
 - 3. Panel Thickness:
 - (a) 1 inch thick.

4. Stud Cavity:
 - (a) Fiberglass or Mineral Fiber rated as Class A per ASTM E 84. As specified in Section 07 21 16.
5. Exterior Sheathing:
 - (a) Exterior Glass Mat Gypsum Sheathing, minimum 5/8 inch thick, with integral weather and air resistant barrier as specified under Section 07 25 00.
6. Floorline Firestopping:
 - (a) 4 lbs./cu ft. mineral fiber based safin insulation at each floor line, attached with Z Clips or equivalent.
7. Weather Resistive Underlayment Applied to Exterior Insulation: Acceptable products specified in other sections are:
 - (a) DuPont:
 - (1) Tyvek Commercial Wrap
 - (b) Dryline:
 - (1) Building Wrap CP

1.4 PERFORMANCE REQUIREMENTS

A. Physical Properties (Foam Core):

1. Flame Spread Index : ASTM E 84, less than 25.
2. Smoke Developed: ASTM E 84, less than 250.
3. Compressive Strength: ASTM D 1621; Grade 3, 25 psi.
4. Dimensional Stability: ASTM D 2126, 2 percent linear change.
5. Moisture Vapor Permeance: ASTM E 96, 1.1 perm.
6. Water Absorption: ASTM C 209, less than 0.1 percent by volume.
7. Service Temperature: Minus 100 degrees to 250 degrees F.
8. Resistance to Mold: ASTM D 3273 Passed.

1.5 REGULATORY REQUIREMENTS

- A. Continuous insulation wall panels shall meet the continuous insulation standards of CBC Chapter 26.
- B. Continuous insulation wall panel system shall meet the requirements of NFPA 285.

1.6 SUBMITTALS

- A. Submit under provisions of Section 01 33 00.
- B. Product Data: Manufacturer's data sheets on wall panels and fasteners to be used, including:
 - 1. Preparation instructions and recommendations.
 - 2. Storage and handling requirements and recommendations.
 - 3. Installation methods.

1.7 QUALITY ASSURANCE

- A. Quality Assurance: Under provisions of Section 01 43 00.
- B. Manufacturer Qualifications: Manufacturer shall be a company that regularly manufactures and assembles specified insulation in house with no outside fabrication operations.

1.8 PRE-INSTALLATION CONFERENCE

- A. Convene a conference two weeks prior to commencing work of this Section under provisions of Section 01 31 00.
- B. Review installation procedures and coordination required with related Work. Include the following:
 - 1. Participants: Authorized representatives of the Contractor, Architect, Installer, and Manufacturer.
 - 2. Review wall assemblies for potential interference and conflicts.
 - 3. Coordinate layout and support provisions for interfacing work.
 - 4. Review continuous insulation wall panels installation methods and procedures related to application, including manufacturer's installation guidelines.
 - 5. Review firestopping requirements and weather resistive membrane requirements and placement locations.
 - 6. Review field quality control procedures.

1.9 DELIVERY, STORAGE, AND HANDLING

- A. Deliver, store and protect products to site under provisions of Section 01 61 00.
- B. Store products off the ground, in dry conditions, under cover and in manufacturer's unopened packaging until ready for installation.
- C. Protect against ignition at all times.

1.10 SEQUENCING

- A. Sequence work under provisions of Section 01 11 00.
- B. Coordinate with the installation of vapor retarders, air seal materials and underlayments.

- C. Ensure that products of this section are supplied to affected trades in time to prevent interruption of construction progress.

1.11 ENVIRONMENTAL REQUIREMENTS

- A. Maintain environmental conditions within limits recommended by manufacturer for optimum results.
- B. Do not install products under environmental conditions outside manufacturer's recommended limits.

2. PART 2 PRODUCTS

2.1 MANUFACTURERS

- A. Atlas Roofing, ICC-ES ESR-1375, www.atlasroofing.com.
- B. Carlisle Coatings and Waterproofing, ICC-ES ESR-3174, www.carlisleccw.com.
- C. Hunter Panels, ICC-ES ESR-3174, www.hunterpanels.com.
- D. RMax, ICC-ES ESR-1864, www.rmax.com.
- E. Substitutions: Under provisions of Section 01 25 13. 01630.

2.2 WALL PANEL INSULATION

- A. Panel Insulation: Class A rigid insulation panel composed of a closed cell polyisocyanurate foam core bonded to a premium performance polymer bonded glass mat facer on both sides.
 - 1. Type: ASTM C 1289, Type II, Class 2, Grade 3.
 - 2. Panel Size: 4 feet x 8 feet.
 - 3. Thickness / R Value: ASTM C 518 at 75 degrees F.
 - (a) 1.0 inches / R Value 6.0.
 - (b) 1.5 inches/R Value 9.0.

2.3 PANEL FASTENERS

- A. As manufactured by Hunter Industries, www.hunterpanels.com, Wind-Lock Fasteners, www.wind-lock.com or Rodenhouse Fasteners, www.rodenhouse-inc.com.
- B. Corrosion resistant type with oversized heads and washer plates.
- C. Metal Stud: Hunter #10-Xci SIP - HD.
- D. Substitution: Under provisions of Section 01 25 13.

3. PART 3 EXECUTION

3.1 EXAMINATION

- A. Do not begin installation until exterior walls have been properly prepared.
- B. Verify that all exterior wall assembly construction has been completed to the point where the insulation may correctly be installed.

- C. Verify that mechanical and electrical services in walls have been installed and tested.
- D. Verify that adjacent materials and finishes are dry and ready to receive insulation.
- E. Notify Architect of unsatisfactory preparation before proceeding.

3.2 PREPARATION

- A. Clean surfaces thoroughly prior to installation.
- B. Prepare surfaces using the methods recommended by the manufacturer for achieving the best result for the substrate under the project conditions.

3.3 INSTALLATION

- A. Install in accordance with manufacturer's instructions.
- B. Install in exterior spaces without gaps or voids. Do not compress insulation.
- C. Trim insulation neatly to fit spaces. Insulate miscellaneous gaps and voids.
- D. Fit insulation tight in spaces and tight to exterior side of mechanical and electrical services within plane of insulation.
- E. Install insulation with long dimension perpendicular to framing members.
- F. Offset vertical joints in insulation a minimum of 6 inches.
- G. Stagger insulation and sheathing joints a minimum of 6 inches.
- H. Exposed insulation must be protected from open flame and kept dry at all times.
- I. Fasten insulation to structural base wall as follows:
 - 1. Metal Stud: Minimum 4 thread penetration of steel stud.
 - 2. Space fasteners at 12 inches o.c. at perimeter of panel and at 16 inches o.c. at field of panel.
 - 3. Set fasteners back from edge of panel 3/8 inch.
 - 4. Drive fasteners so that washer plate is tight and flush with surface. Do not overtighten.
 - 5. Coordinate with cladding or wall finish manufacturer for their attachment requirements over insulation panels.
- J. Underlayment to be installed as specified in other sections of this specification.
- K. Exterior finish to be installed as specified in other sections of this specification.
- L. Wall panel insulation is not to be left exposed for extended periods of time. If extended exposure is anticipated in excess of 45 days, all exposed panel surfaces including corners, window and door openings, should be taped with a compatible waterproof tape.

3.4 PROTECTION

- A. Protect installed products until completion of exterior wall finish.
- B. Cover the top and edges of unfinished wall panel work to protect it from the weather and to prevent accumulation of water in the wall system.
- C. Wet panels shall be allowed to completely dry prior to application of underlayment and exterior wall finish.
- D. Repair or replace damaged products before completion of exterior wall finish.

END OF SECTION

SECTION 07 21 16

BLANKET INSULATION

1. PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Batt insulation and vapor barrier in exterior wall construction.
- B. Batt insulation for filling perimeter window and door shim spaces crevices in exterior wall and roof.
- C. Batt sound insulation in interior walls and partitions.

1.2 REFERENCES

- A. ASTM C665 - Mineral Fiber Blanket Thermal Insulation for Light Frame Construction and Manufactured Housing.
- B. ASTM C1320 - Installation of Mineral Fiber Batt and Thermal Insulation for Light Frame Construction.
- C. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials.
- D. CBC - California Building Code, (CCR) California Code of Regulations, Title 24, Part 6.
- E. Business and Professions Code.

1.3 PERFORMANCE REQUIREMENTS

- A. Materials of this Section shall provide continuity of thermal and moisture barrier at building enclosure elements.
- B. Materials of this Section shall provide continuity of sound control where indicated or scheduled.

1.4 REGULATORY REQUIREMENTS

- A. Installation of insulation may only commence if insulation meets mandatory manufacturer certification to the California Energy Commission required by Title 24, Part 6, Section 110.8 of the CBC - California Building Code, (CCR) California Code of Regulations that insulation complies with Title 24, Part 12, Chapter 12-13, Article 3 of the California Quality Standards for Insulating Materials.
- B. Insulation products shall comply with the requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."
- C. Insulation materials to be certified in compliance with Business and Professions Code Section 19165.
- D. Insulation manufacturer to be licensed by the California Department of Consumer Affairs, Bureau of Home Furnishing and Thermal Insulation according to Business and Professions Code, Section 19059.7.

1.5 SUBMITTALS

- A. Submit manufacturer's certificates under provisions of Section 01 33 00 that materials meet or exceed specified regulatory requirements.

2. PART 2 PRODUCTS

2.1 MANUFACTURERS - INSULATION MATERIALS

- A. Certain Teed Corp., www.certainteed.com.

- B. Johns Manville Corp., www.jm.com.
- C. Knauf Insulation, www.knaufinsulation.us.
- D. Owens-Corning Fiberglass Corporation, www.owenscorning.com.
- E. Substitutions: Under provisions of Section 01 25 13.

2.2 MATERIALS

- A. Thermal Batt Insulation, Concealed Wall: ASTM C665 Preformed fiber glass batt, Type II Kraft Faced, Class C, Category 1 "SmartBatt", with stapling flange for attachment to applicable construction. Equivalent continuous roll membrane facing of "MemBrain" Continuous Air Barrier and Smart Vapor Retarder may be utilized in lieu of individual glass fiber batts. Provide R19 at walls.
- B. Thermal Batt Insulation, Exposed Wall: ASTM C665 preformed glass fiber batt, Type III, Class A, with an FSK-25 reflective membrane faced surface that has a flame spread of 25 or less, and a smoke density of 50 or less when tested in accordance with ASTM E-84. Category 1 with stapling flanges for attachment of blanket to applicable construction. Equivalent continuous FSK-25 roll membrane facing may be utilized in lieu of individual faced glass fiber batts. Provide R19 at walls.
- C. Acoustical Batt Sound Insulation, Concealed Wall and Ceiling: ASTM C665 preformed glass fiber batt, Type I unfaced, with flame spread of 25 or less, and a smoke density of 450 or less when tested in accordance with ASTM E84. Provide 3-1/2 inch thickness.
- D. Acoustical Batt Sound Insulation, Exposed Wall and Ceiling: ASTM C665 preformed glass fiber batt, Type III Class A with an FSK-25 reflective membrane faced surface that has a flame spread of 25 or less, and a smoke density of 50 or less when tested in accordance with ASTM E-84. Category 2. Provide 3-1/2 inch thickness.
- E. Insulation to be formaldehyde-free.
- F. Nails or Staples: Steel wire; electroplated; type and size to suit application.
- G. Tape: Bright aluminum self-adhering type, mesh reinforced, 2 inch wide.
- H. Support Wire: 16 gauge steel wire.
- I. Support Rods: 13 gauge, pointed spring steel length as required for stud spacing.
- J. Spindle Fasteners: Steel impale spindle and clip on flat metal base, self adhering backing, length to suit insulation thickness, capable of securely and rigidly fastening insulation in place.

3. PART 3 EXECUTION

3.1 EXAMINATION

- A. Verify that substrate, adjacent materials, and insulation are dry and ready to receive insulation.
- B. Verify that enclosed spaces are ventilated to dissipate humidity.
- C. Maximum relative humidity level of less than 50 percent shall be maintained during installation of insulation.

3.2 INSTALLATION

- A. Install insulation in accordance with insulation manufacturer's instructions and ASTM C1320.
- B. Install batt insulation in exterior walls spaces without gaps or voids.
- C. Fill any small spaces around door frames, window frames, skylight frames, and other wall or roof openings with insulation.

- D. Fill hollow space of steel door frame, steel window frame and other wall or roof frame with insulation.
- E. Fill hollow space created by wall or roof framed headers and jamb spaces with insulation.
- F. Install batt sound insulation in interior walls full height of wall.
- G. Install batt sound insulation above ceilings in areas as indicated. Extend a minimum of 4'-0" beyond face of vertical dividing partitions of space to be insulated where partition terminates at ceiling.
- H. Install batt sound insulation at underside of floor decking between adjacent floor levels.
- I. Trim insulation neatly to fit spaces.
- J. Fit insulation tight in spaces and tight to exterior side of mechanical and electrical services within the plane of insulation. Leave no gaps or voids.
- K. Install with factory applied membrane facing warm side of building spaces.
- L. Lap ends and side flanges of vapor barrier membrane over face of framing members.
- M. Extend vapor barrier on to any adjacent construction and tape seal edge of vapor barrier.
- N. Seal butt ends, lapped flanges, and tears or cuts in membrane with tape or another layer of membrane.
- O. Seal joints in vapor barrier caused by pipes, conduits, electrical boxes, and similar items penetrating vapor barrier.
- P. Tape stapling flange over flange of adjacent blanket to flange of metal stud.
- Q. Friction fit sound insulation between studs and fill as required to completely fill space between the wall finishes.
- R. Where wall finish does not occur, lace 16 gauge support wire through studs at not-to-exceed 16 inches oc vertically at metal studs.
- S. Retain unsupported roof insulation to metal or concrete substrate with spindle fasteners at 24 inches on center.

END OF SECTION

SECTION 07 22 00

ROOF AND DECK INSULATION

1. PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Rigid foam insulation board at roof.
- B. Tapered foam insulation board.
- C. Protection board for roof insulation.
- D. Mechanical fasteners.
- E. Cant strips, saddles, cricketts and tapered edge strips.

1.2 REFERENCES

- A. ASTM C209 - Cellulosic Fiber Insulating Board
- B. ASTM C518 - Steady-State Heat Flux Measurements and Thermal Transmission Properties by Means of the Heat Flow Meter Apparatus.
- C. ASTM C728 - Perlite Thermal Insulation Board.
- D. ASTM C117 – Standard Specification for Glass Mat Gypsum Substrate for Use as Sheathing.
- E. ASTM C1289 - Standard Specification for Rigid Cellular Thermal Insulation Board.
- F. ASTM C1303 - Standard Test Method for Estimating the Long Term Change in the Thermal Resistance of Unfaced Rigid Closed Cell Plastic Foam by Slicing and Scaling Under Controlled Laboratory Conditions.
- G. ASTM D312 - Asphalt Used in Roofing.
- H. ASTM D1622 - Apparent Density of Rigid Cellular Plastics.
- I. ASTM E84 - Surface Burning Characteristics of Building Materials.
- J. FM (Factory Mutual Engineering Corp.) - Roof Assembly Classification.
- K. LLTR- Long Term Thermal Resistance, using techniques from CAN/ULC S770 based upon ASTM C1303.

1.3 REGULATORY REQUIREMENTS

- A. Conform to FM requirements for roof assembly requirements.
- B. Windstorm Rating: FM I-90.

1.4 DELIVERY, STORAGE, AND HANDLING

- A. Deliver, store and protect products to site under provisions of Section 01 61 00.
- B. Store products to protect from environment, clear of ground and moisture.

1.5 ENVIRONMENTAL REQUIREMENTS

- A. Do not install insulation when temperature or weather conditions are detrimental to successful installation.

1.6 SEQUENCING

- A. Sequence work under the provisions of Section 01 11 00.
- B. Sequence work to ensure firestop materials are in place before beginning the Work of this section.

1.7 COORDINATION

- A. Coordinate work under provisions of Section 01 25 13.
- B. Coordinate the work with Section 07 54 23 for installation of roofing materials.

2. PART 2 PRODUCTS

2.1 MANUFACTURERS - INSULATION MATERIALS

- A. Apache Products Co., www.apacheproducts.com.
- B. Atlas Roofing Products, www.atlasroofing.com.
- C. Certainteed Corp., www.certainteed.com.
- D. GAF Materials Corporation, www.gaf.com.
- E. Hunter Panels, www.hunterpanels.com.
- F. RMax Industries, www.rmaxinc.com
- G. Johns Manville Corp., www.jm.com.
- H. Substitutions: Under provisions of Section 01 25 13.

2.2 INSULATION MATERIALS

- A. Rigid Polyisocyanurate Foam Roof Insulation Board: ASTM C1289, Type II, Grade 3 closed-cell HCFC Free "Green" polyisocyanurate foam core conforming to the following:
 - 1. Board Density: ASTM D1622, 2.0 lb/cu ft.
 - 2. Board Size: 48 x 48 inch.
 - 3. Board Thickness: 2.5 inch, double layer.
 - 4. Facing: Factory applied skin of fiberglass on both faces.
 - 5. Thermal Resistance: LLTR, Aged R of 5.7/inch= 28.5.
 - 6. Board Edges: Square.
 - 7. Water Absorption: ASTM C209, less than 1 percent by volume maximum.
 - 8. Flame/Smoke Properties: ASTM E84, 25/450.
 - 9. Tapered Insulation Board: Tapered closed cell insulation of same characteristics as stated above for roof insulation. Minimum one inch in thickness, tapered to ½ inch per foot slope.
- B. Glass Matt Gypsum Protection Board for Roof Insulation: ASTM C1177, glass matt faced gypsum board both sides with non asphaltic heat cured coating one side, conforming to the following:
 - 1. Board Material: Similar to DensDeck Prime as manufactured by G-P Gypsum Co., www.gp.com.

2. Board Thickness: 1/4 inch
3. Board Size: 48 x 96 inch or 48 x 48 inch
4. Board Edges: Square
5. Thermal Resistance: R value of 0.28
6. Flame/Smoke Properties: ASTM E84, 0/0.

2.3 TAPERED EDGE STRIPS/SADDLES/CRICKETTS

- A. ASTM C728 fire resistant expanded perlite, configuration as detailed.

2.4 ACCESSORIES

- A. Insulation Fasteners: Galvanized steel screws, plastic coated, with plastic washers, length and type to suit insulation thickness and substrate. Approved for application by Factory Mutual.
- B. Asphalt Bitumen: ASTM D312, Type III.
- C. Roofing Adhesive: Single component polyurethane adhesive. Approved for application by Factory Mutual. Similar to Insta-Stik manufactured by The Dow Chemical Company, www.dow.com,

3. PART EXECUTION

3.1 EXAMINATION

- A. Verify site conditions under provisions of Section 01 31 00.
- B. Verify that substrate, adjacent materials, and insulation boards are dry and ready to be installed.
- C. Verify substrate surface is flat, free of irregularities.
- D. Verify that roof openings, curbs, pipes, sleeves, ducts, and vents through roof are solidly set.
- E. Beginning of installation means installer accepts existing surfaces.

3.2 ROOF INSULATION INSTALLATION

- A. Place insulation perpendicular to deck flutes with edges over flute surface for support.
- B. Run insulation in straight lines, perpendicular to roof slope with end joints staggered between rows.
- C. Lay insulation with edges in moderate contact without forcing.
- D. Cut insulation neatly around penetrations through roof.
- E. Cut and fit insulation tight to protrusions or interruptions to insulation plane.
- F. Install separate layers of insulation with joints staggered and offset.
- G. Place tapered insulation to required slope.
- H. Trim insulation at roof drains to required slope to form a one inch deep sump area with a diameter of 4 feet.
- I. Mechanically fasten insulation to deck with no less than one fastener for every two square feet of board area in compliance with spacing required by FM for a Windstorm Resistance Classification.

3.3 PROTECTION BOARD INSTALLATION

- A. Lay protection board over rigid insulation with joints staggered.
- B. Install protection board in four continuous beads of roofing adhesive applied by mechanical applicator as required for FM Windstorm Resistance Classification. Provide additional adhesive at edges of all roof penetrations.
- C. Trim surface of protection board where necessary at roof drains to conform to sump configuration and so completed surface is flush.

3.4 SADDLES, CRICKETT AND EDGE STRIP INSTALLATION

- A. Install crickets and saddles, in roofing adhesive to configuration as indicated on drawings.
- B. Install tapered edge strips, 1-1/2 inch thick x 24 inch wide, in roofing adhesive at all roof penetrations and at all intersections of roof with vertical surfaces.

END OF SECTION

SECTION 07 42 13

ALUMINUM METAL PLATE WALL PANELS

PART 1 - GENERAL

1.01 SECTION INCLUDES

- A. Aluminum metal plate solid and perforated wall panels

1.02 RELATED REQUIREMENTS

- A. Section 05 40 00 – Cold-Formed Metal Framing: Wall panel substrates support framing.
- B. Section 06 10 00 – Rough Carpentry: Plywood substrate wall sheathing.
- C. Section 07 25 00 – Weather Barriers: Air and moisture barrier required as part of metal wall panel assembly.
- D. Section 07 62 00 – Sheet Metal Flashing and Trim: Field formed flashings and other sheet metal work.
- E. Section 07 92 00 – Joint Sealants: Perimeter sealant.

1.03 DEFINITION

- A. Metal Plate Wall Panel Assembly: Metal plate wall panels, attachment system components, miscellaneous metal framing, and accessories necessary for a complete weather tight wall system based on AAMA CW-RS-1.

1.04 REFERENCE STANDARDS

- A. AAMA - American Architectural Manufacturers Association (www.aamanet.org)
 - 1. AAMA CW-RS-1 – The Rain Screen Principle and Pressure Equalized Wall Design; 2012
 - 2. AAMA 501.1 – Standard Test Method for Water Penetration of Windows, Curtain Walls and Doors Using Dynamic Pressure; 2005
 - 3. AAMA 501.2 - Quality Assurance and Diagnostic Water Leakage Field Check of Installed Storefronts, Curtain Walls, and Sloped Glazing Systems; 2009
 - 4. AAMA 508 – Voluntary Test Method and Specification for Pressure Equalized Rain Screen Wall Cladding Systems; 2014 [Testing based on 2007 Edition]
 - 5. AAMA 611 - Voluntary Specification for Anodized Architectural Aluminum; 2014
 - 6. AAMA 2605 - Voluntary Specification, Performance Requirements and Test Procedures for Superior Performing Organic Coatings on Aluminum Extrusions and Panels; 2013 [Testing based on 2005 Edition]
- B. ASTM International (American Society for Testing and Materials; www.astm.org)
 - 1. ASTM B117 - Standard Practice for Operating Salt Spray (Fog) Apparatus; 2011
 - 2. ASTM C754 - Standard Specification for Installation of Steel Framing Members to Receive Screw-Attached Gypsum Panel Products; 2015
 - 3. ASTM D523 - Standard Test Method for Specular Gloss; 2014
 - 4. ASTM D2244 – Standard Practice for Calculation of Color Tolerances and Color Differences from Instrumentally Measured Color Coordinates; 2015
 - 5. ASTM D2247 - Standard Practice for Testing Water Resistance of Coatings in 100% Relative Humidity; 2011
 - 6. ASTM D4214 - Standard Test Methods for Evaluating the Degree of Chalking of Exterior Paint Films; 07(2015)
 - 7. ASTM E8/E8M - Standard Test Methods for Tension Testing of Metallic Materials; 2013a
 - 8. ASTM E283 - Standard Test Method for Determining Rate of Air Leakage Through Exterior Windows, Curtain Walls, and Doors Under Specified Pressure Differences Across the Specimen; 04(2012)
 - 9. ASTM E330/E330M - Standard Test Method for Structural Performance of Exterior Windows, Doors, Skylights and Curtain Walls by Uniform Static Air Pressure Difference; 2014
 - 10. ASTM E331 - Standard Test Method for Water Penetration of Exterior Windows, Skylights, Doors, and Curtain Walls by Uniform Static Air Pressure Difference; 00(2009)
 - 11. ASTM E1233/E1233M – Standard Test Method for Structural Performance of Exterior Windows, Doors, Skylights, and Curtain Walls by Cyclic Air Pressure Differential; 2014 [Testing based on 2006 Edition]

- C. TAS - Testing Application Standards; Florida Building Code, 2010
 - 1. TAS 202 – Criteria for Testing Impact and Non-Impact Resistant Building Envelope Components Using Uniform Static Air Pressure Loading; 1994
 - 2. TAS 203 – Criteria for Testing Products Subject to Cyclic Wind Pressure Loading; 1994
- D. NAAMM – National Association of Architectural Metal Manufacturers
- E. SMACNA – Sheet Metal and Air Conditioning Contractor's National Association
- F. PS - Voluntary Product Standard; National Institute of Standards and Technology (NIST)
 - 1. PS-1 – Structural Plywood; 2009

1.05 ADMINISTRATIVE REQUIREMENTS

- A. Coordination: Coordinate panel assemblies with rain drainage, flashing, trim, stud back-up, soffits, and other adjoining work.
- B. Preinstallation Meeting:
 - 1. Attendees:
 - a. Owner.
 - b. Architect.
 - c. Installer.
 - d. Panel manufacturer's representative.
 - e. Structural support installer's.
 - f. Installer's whose work interfaces with or affects wall panels including installers of doors, windows, and louvers.
 - 2. Review and finalize construction schedule.
 - 3. Verify availability of materials, installer's personnel, equipment, and facilities needed to maintain schedule.
 - 4. Review means and methods related to installation, including manufacturer's written instructions.
 - 5. Examine support conditions for compliance with requirements, including alignment and attachment to structural members.
 - 6. Review flashings, special siding details, wall penetrations, openings, and condition of other construction that affects this Work.
 - 7. Review temporary protection requirements for during and after installation of this Work.

1.06 SUBMITTALS

- A. See Section 01 30 00 – Administrative Requirements, for submittal procedures.
- B. Product Data: Submit for each type of product indicated, include construction details, material descriptions, dimensions of individual components and profiles, and finishes for each type of metal plate wall panel and accessory.
- C. Shop Drawings: Submit fabrication and installation layouts of metal plate wall panels; including details of edge conditions, joints, panel profiles, corners, anchorages, attachment system, trim, flashings, closures, and accessories; and special details.
 - 1. Provide distinction between factory-assembled, shop-assembled, and field-assembled work.
 - 2. Provide details of following items at full scale.
 - a. Manufacturer's standard sheet metal trims.
 - b. Components of wall panel construction, anchorage methods, and hardware.
- D. Coordination Drawings: Submit exterior elevations, drawn to scale, that have the following items shown and coordinated with each other, using input from installers of the following items:
 - 1. Girts.
 - 2. Wall-mounted items including doors, windows, louvers, and lighting fixtures.
 - 3. Penetrations of wall by pipes and utilities.
- E. Samples: Submit for each type of exposed finish required, and prepared on samples of size as follows:
 - 1. Aluminum Metal Plate Wall Panels: At least 2 inch by 3 inch.
- F. Test and Inspection Reports: Submit test and inspection reports on each type of wall panel system provided for project based on evaluation of comprehensive tests performed by qualified testing agency.
- G. Maintenance Data: Submit maintenance data for metal plate wall panels.
- H. Warranty: Submit manufacturer warranty and ensure forms have been completed in Owner's name and registered with manufacturer.

1.07 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section with at least five years of documented experience.
- B. Installer: Company specializing in performing work of this section and approved by manufacturer.
 - 1. Install system in strict compliance with manufacturer's installation instructions.
- C. Anodized Finish Applicator: Provide either caustic (traditional) or eco-friendly (acid) etching technologies.
 - 1. Use fully automated, computer-controlled process lines for consistency of finish throughout project.
 - 2. Use documented production line quality control protocols in accordance with AAMA 611 test procedures.
- D. Source Limitations: Obtain each type of metal plate wall panel from single source and from single manufacturer.

1.08 MOCKUPS

- A. Mockups: Provide mockups to verify selections made under sample submittals and to demonstrate aesthetic effects and to establish quality standards for fabrication and installation.
 - 1. Build mockup of typical wall panel assembly as shown on Drawing AB5.7 size 55"W x 20"H, including corner, soffits, supports, attachments, and accessories.
 - a. Include at least four panels to represent a four-way panel joint and showing full thickness.
 - 2. Approval of mockups does not constitute approval of deviation from Contract Documents within mockups unless these deviations are approved by Architect in writing.
 - 3. Subject to compliance with requirements, approved mockups **may** become part of completed Work if undisturbed upon Date of Substantial Completion.

1.09 DELIVERY, STORAGE, AND HANDLING

- A. Deliver materials to site in manufacturer's original, unopened containers and packaging, with labels clearly identifying product name and manufacturer.
- B. Storage and Handling: Store materials in clean, dry, interior area in accordance with manufacturer's instructions.
- C. Deliver panels, components, and other manufactured items without damage or deformation.
- D. Protect panels during transportation, handling, and installation from weather, excessive temperatures and construction operations.
- E. Handle panels in strict compliance with manufacturer's instructions and recommendations, and in a manner to prevent bending, warping, twisting, and surface damage.
 - 1. Store panels vertically with top of panel down, storage of panels horizontally is not permitted.
- F. Store panels covered with suitable weather tight and ventilated covering.
- G. Provide storage of panels to ensure dryness, with positive slope for drainage of moisture.
- H. Do not store panels in contact with other materials that might cause staining, denting, or other surface damage.
- I. Remove strippable protective covering from aluminum panel prior to installation.

1.10 SITE CONDITIONS

- A. Weather Limitations: Proceed with installation only when existing and forecasted weather conditions permit assembly of this Work to be performed according to manufacturer's installation instructions and warranty requirements.
- B. Field Measurements: Verify locations of structural members and wall opening dimensions by field measurements before panel fabrication perforate panels and indicate measurements on Shop Drawings.
 - 1. Coordinate with construction schedule.

1.11 WARRANTY

- A. See Section 01 77 00 - Closeout Submittals, for additional warranty requirements.

- B. Wall System Warranty: Provide wall panel manufacturer warranty, agreeing to correct defects in manufacturing of materials within a one-year period after Date of Substantial Completion.
 - 1. Failures include, but are not limited to, the following:
 - a. Structural failures, including rupturing, cracking, or puncturing.
 - b. Deterioration: Beyond normal weathering of wall system metals and other materials.
- C. Panel Material Warranty: Provide panel material manufacturer warranty, agreeing to repair finish of metal plate wall panels that show evidence of deterioration of factory-applied finishes within specified warranty period.
 - 1. Finish Warranty Period: 10 years for anodize finished materials and 20 years for fluoropolymer finished materials both from Date of Substantial Completion.
 - 2. Warranty Coverage: In accordance with AAMA 2605 for 70 percent PVDF resin on aluminum finish requirements.
 - a. Fading, Loss of Color Retention: Loss of 5 Delta E units (Hunter) or less, in accordance with ASTM D2244.
 - b. Chalking, Chalky White Powder on Panel Surface: Chalking at No. 8 or less for colors, or No. 6 for white, in accordance with ASTM D4214.
 - c. Loss of Adhesion: Loss of 10 percent due to cracking, checking or peeling, or failure to adhere to bare metal.
 - d. Gloss Retention: 50 percent or less in accordance with ASTM D523.
 - e. Humidity Testing, Accelerated: At least 4,000 hours in accordance with ASTM D2247.
 - 3. Warranty Coverage: In accordance with AAMA 611 Class 1 anodized aluminum finish requirements.
 - a. Loss of Adhesion: Resists cracking, crazing, flaking, and blistering when forming and welding completed prior to finishing; post forming or welding voids warranty.
 - b. Fading - Loss of Color Retention: Loss of 5 Delta E units (Hunter) or less, in accordance with ASTM D2244.
 - c. Chalking, Chalky White Powder on Panel Surface: Chalking at No. 8 or less in accordance with ASTM D4214.
 - d. Salt Spray, Accelerated: At least 3,000 hours in accordance with ASTM B117.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

- A. Dri-Design – Aluminum Wall Panel System. (LARR 26079)
 - 1. Address: 12480 Superior Ct., Holland, Michigan 49424.
 - 2. P.O. Box 1286 Holland, Michigan 49422-1286.
 - 3. Phone: (616) 355-2970; Fax: (616) 355-2972; Website: www.dri-design.com.

2.02 PERFORMANCE REQUIREMENTS

- A. Metal Plate Wall Panel Assemblies: Comply with performance requirements without failure due to defective manufacturing, fabrication, installation, or other construction defects.
- B. Design, fabricate, and erect a dry joint, pressure equalized rainscreen aluminum wall panel system without use of sealants, gaskets, or butyl tape, tested as installed in compliance with AAMA 508, and as follows:
 - 1. Cyclic Static Air Pressure Differential: Pass cycled pressure loading at 25 psf in 100 three-second cycles in accordance with ASTM E1233/E1233M.
 - 2. Air Infiltration: Pass when tested at 1.57 psf (25 mph) in accordance with ASTM E283.
 - 3. Water Penetration:
 - a. Static: Pass water penetration test under 25.0 psf positive static air pressure difference for at least 15 minutes with 5 gallons per sf per hour of water applied in accordance with ASTM E331.
 - b. Dynamic: Pass water penetration test under 15.0 psf dynamic pressure difference for at least 15 minutes with 5 gallons per sf per hour of water applied in accordance with AAMA 501.1.
 - 4. Structural: Provide systems tested in accordance with ASTM E330/E330M and certified to be without permanent deformation or failure of structural members.
- C. High Velocity Hurricane Zone (HVHZ): Comply with ASTM E8/E8M test methods and performance requirements of Florida Building Code and Miami-Dade County test protocols TAS-202 and TAS-203 for HVHZ with at least plus 61 psf to minus 80 psf design pressure rating.
 - 1. Application: For aluminum plate thickness of 0.080 inch only.

2.03 MATERIALS

- A. Material Type 1 – Panels (Non-perforated)
 - 1. Aluminum Plate: Alloy and temper as recommended by manufacturer for application and in compliance with manufacturers design requirements.
 - a. Aluminum Material: Tension-leveled, fluoropolymer PVDF painted finish, 3003-H14 manganese alloy.
 - b. Thickness: 0.080 inch.
 - c. Weight: Less than 2 lbs per sf.
 - d. Finish: Two-Coat Fluoropolymer.
- B. Material Type 2 – Panels (Perforated)
 - 1. Aluminum Plate: Alloy and temper as recommended by manufacturer for application and in compliance with manufacturers design requirements.
 - a. Aluminum Material: Tension-leveled, anodized finish, 5005-AQ manganese alloy.
 - b. Thickness: 0.080 inch.
 - c. Weight: Less than 2 lbs per sf.
 - d. Finish: Color Anodized Finish.
 - e. Perforations: 25 or 40 percent. As indicated on drawings.
- C. Panel Depth: 1-1/4 inch, nominal.
- D. Panel Size: As indicated on Drawings.
- E. Panel Joints: As indicated on Drawings.

2.04 FABRICATION

- A. Fabricate and finish wall panels within manufacturer's facilities and fulfill indicated performance requirements demonstrated by laboratory testing.
 - 1. Comply with indicated profiles and with dimensional and structural requirements.
- B. Provide post-finishing of panels, paint aluminum wall panels only after completion of panel fabrication and ensure exposed edges are coated.
- C. Provide post anodizing of panels, anodize aluminum wall panels only after completion of panel fabrication and ensure exposed edges are anodic coated without crazing of surface at formed edges.
- D. Whenever possible, provide en-v by Dri-Design panels for all acceptable panel sizes and/or finishes.

2.05 FINISHES

- A. Comply with NAAMM's - Metal Finishes Manual for Architectural and Metal Products, for recommendations of designating finishes.
- B. Superior Performance Organic Coating System: AAMA 2605 multiple coat, thermally cured polyvinylidene fluoride (PVDF) resin system.
 - 1. Two-Coat Fluoropolymer: AAMA 2605, fluoropolymer finish containing not less than 70 percent PVDF resin by weight in color coat. Prepare, pre-treat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' installation instructions.
- C. Color Anodized Finish: AAMA 611, Architectural Class I, color anodized coating of 0.0007 inch (0.7 mils) minimum thickness.
 - 1. Color: To be selected by architect from manufacturers standard range of colors (excluding Copper).

2.06 ACCESSORIES

- A. Metal Plate Wall Panel Accessories: Provide components required for a complete metal plate wall panel assembly including trim, copings, fascia, mullions, sills, corner units, flashings, and similar items. Match material and finish of panels unless otherwise indicated.
- B. Provide integral drainage system and manufactures standard extrusions at termination of dissimilar materials.
- C. Flashing and Trim: Match material, finish, and color as indicated on drawings and details.
 - 1. Refer to Section 07 62 00.

- D. Panel Fasteners: Designed to withstand design loads, with at least 7/16 inch diameter head and neoprene washer.
 - 1. Aluminum Wall Panel Material: Provide stainless steel fasteners, or coated fastener approved by panel manufacturer or project wall consultant.
- E. Sub-Girts: Galvanized, provide size and gage in accordance with project requirements.
 - 1. Furring Channel: Provide Hat, C, U or Z type as recommended by manufacturer.
 - 2. Flat Strap: At least 14 gage, 0.0747 inch (1.90 mm) thick.
 - 3. Refer to Section 05 40 00.
- F. Substrate Wall Sheathing: Plywood, PS 1, Grade C-D, Exposure I, at least 5/8 inch thick.
 - 1. Refer to Drawings, Section 06 10 00, and Section 07 21 13 for requirements.
- G. Weather Barriers: Provide climate specific weather barrier with performance characteristics for air penetration, water vapor transmission, and water penetration resistance.
 - 1. Refer to Section 07 21 15 for requirements.
- H. Sealants: As recommended by metal panel manufacturer for openings within wall panels and perimeter conditions.
 - 1. Refer to Section 07 92 00 for requirements.

PART 3 - EXECUTION

3.01 EXAMINATION

- A. Examine substrates, and Work areas and conditions with Installer present for compliance with requirements for installation tolerances, wall panel supports, and other conditions affecting performance of this Work.
- B. Examine wall framing to verify that girts, angles, channels, studs, and other structural wall panel support members and anchorage have been installed within alignment tolerances required by wall panel manufacturer.
- C. Verify that weather barrier has been installed over sheathing or substrate to prevent air infiltration or water penetration.
- D. Examine rough-in for components and systems penetrating wall panels to coordinate actual penetration locations relative to wall panel joint locations prior to installation.
- E. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 PREPARATION

- A. Miscellaneous Framing: Install sub girt, base angles, sills, furring, and other wall panel support members and provide anchorage in accordance with ASTM C754 for gypsum panel type substrates and panel manufacturer's installation instructions.

3.03 INSTALLATION

- A. Install wall panels in accordance with manufacturer's installation instructions, including pressure equalized rainscreen installation method and installation guidelines.
 - 1. Wall panels consist of single sheets of metal formed with interlocking gutter and drainage system integral to the panel with single horizontal attachment for dry-joint rainscreen assembly.
 - 2. Use of secondary drainage channels, brackets, support pins, joint sealants or gaskets to manage the drainage of wall panel system is not permitted.
 - 3. Attach wall panels using progressive interlocking method, engaging bottom of panel in top of previous panel working bottom up, and left to right.
 - 4. Install wall panels with single top attachment in pre-punched holes to allow individual panels to move due to thermal expansion.
 - 5. Do not compromise internal gutter.
- B. Install wall panels for orientation, sizes, and locations as indicated on Drawings.
- C. Install wall panels with proper anchorage and other components for this Work securely in place.
- D. Install wall panels with provisions for thermal and structural movement.
- E. Install shims to plumb substrates as necessary for installation of wall panels.

- F. Install weather tight seals at perimeter of wall panel openings.
 - 1. Test for proper adhesion on small unexposed area of solid surfacing prior to use.
- G. Flashing and Trim: Comply with performance requirements, manufacturer's written installation instructions, and SMACNA - Architectural Sheet Metal Manual.
 - 1. Provide concealed fasteners where possible, and set units true to line and level as indicated.
 - 2. Install work with laps, joints, and seams that will be permanently watertight and weather resistant.
 - 3. Install flashing and trim as wall panel Work proceeds.
- H. Install weather tight escutcheons for pipe and conduit penetrating exterior walls.
- I. Metal Protection: Where dissimilar metals will contact each other or corrosive substrates, protect against galvanic action as recommended by wall panel manufacturer.
- J. Install attachment system to support wall panels and with provisions to provide a complete weather tight wall system, including sub girts, extrusions, flashings and trim.
 - 1. Include attachment to supports and trims at locations using dissimilar materials.
 - 2. Do not apply sealants to joints, unless noted otherwise on Drawings or Shop Drawings.
 - 3. Install starter extrusion at base course and at cut panel locations.
- K. Install accessories with positive anchorage to building and weather tight mounting and provisions for thermal expansion, and coordinate installation with flashings and other components.
 - 1. Install components required for a complete wall panel assembly including trim, copings, flashings and other accessory items.
- L. Weather Barrier: Install weather barrier behind wall panels and over substrate.

3.04 TOLERANCES

- A. Shim and align wall panel units with installed tolerances of 1/4 inch in 20 feet, non-cumulative, on level, plumb, and location lines as indicated.

3.05 FIELD QUALITY CONTROL

- A. Testing Agency: Owner will engage a qualified independent testing agency to perform field tests and inspections.
- B. Manufacturer's Field Service: Engage a factory-authorized service representative to test and inspect completed metal wall panel installation, including accessories.
- C. Remove and replace metal wall panels where tests and inspections indicate that they do not comply with specified requirements.
- D. Perform additional tests and inspections, at Contractor's expense, to verify compliance of replaced wall panels or necessary additional work with specified requirements.
- E. Prepare test and inspection reports.

3.06 CLEANING

- A. Upon completion of wall panel installation, clean finished surfaces as recommended by panel manufacturer.
- B. Upon completion of wall panel installation, clear weep holes and drainage channels of obstructions and dirt.

3.07 PROTECTION

- A. Protect installed products from damage during subsequent construction.
- B. Replace wall panels damaged or deteriorated beyond successful repair by finish touchup or similar minor repair procedures.

END OF SECTION

SECTION 07 54 23

THERMOPLASTIC-POLYOLEFIN ROOFING

1. PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Single-ply thermoplastic membrane roofing.
- B. Thermoplastic clad flashing metal.
- C. Flexible membrane base flashings.
- D. Roofing membrane expansion joints.
- E. Counter flashings.
- F. Walkway surface.
- G. Adhesive and accessories.

1.2 REFERENCES

- A. ASTM B370 – Standard Specification for Copper Sheet and Strip for Building Construction.
- B. ASTM D412 - Standard Test Methods for Vulcanized Rubber and Thermoplastic Rubbers and Thermoplastic Elastomers -Tension.
- C. ASTM D624 - Standard Test Method for Tear Strength of Conventional Vulcanized Rubber and Thermoplastic Elastomers.
- D. ASTM D746 - Standard Test Method for Brittleness Temperature of Plastics and Elastomers by Impact.
- E. ASTM D822 - Standard Practice for Conducting Tests on Paint and Related Coatings and Materials Using Filtered Open-Flame Carbon-Arc Exposure Apparatus.
- F. ASTM D1004 - Standard Test Method for Initial Tear Resistance of Plastic Film and Sheeting.
- G. ASTM D1079 – Standard Terminology Relating to Roofing, Waterproofing, and Bituminous Materials.
- H. ASTM D6878 – Standard Specifications for Thermoplastic Polyolefin Based Sheet Roofing.
- I. ASTM E96 - Standard Test Methods for Water Vapor Transmission of Materials.
- J. ASTM E408 – Standard Test Methods for Total Normal Emittance of Surfaces Using Inspection-Meter Techniques.
- K. ASTM E903 – Standard Test Method for Solar Absorptance, Reflectance, and Transmittance of Materials Using Integrating Spheres.
- L. CBC – California Building Code, (CCR) California Code of Regulations, Title 24, Part 6.
- M. CRRC - Cool Roof Rating Council - Product Rating Program CRRC-1.
- N. FM - FM Global - FM 4470 - Approval Standard for Class 1 Roof Coverings.
- O. NRCA - National Roofing Contractors Association: The NRCA Roofing and Waterproofing Manual.
- P. SMACNA – Sheet Metal and Air Conditioning Contractors National Association, Inc., Architectural Sheet Metal Manual.

- Q. UL - Underwriters Laboratories Inc. - UL 790 - Tests for Fire Resistance of Roof Covering Materials.

1.3 DEFINITIONS

- A. Roofing Terminology: ASTM D1079 and the glossary of the NRCA Roofing and Waterproofing Manual for definitions of roofing terms related to this section.

1.4 SYSTEM DESCRIPTION

- A. Thermoplastic Sheet Membrane Conventional Roofing System: Single-ply membrane roofing system, fully adhered, with heat welded seams and white surface color finish.

1.5 PERFORMANCE REQUIREMENTS

- A. Conform to UL and FM for roof assembly requirements.
- B. UL 790: Class B Fire Hazard Classification.
- C. FM 4470: Roof Assembly Classification, of Class 1 Construction, wind uplift requirement of 1-90, in accordance with FM Construction Bulletin 1-28.
- D. Provide an installed single-ply roofing membrane and base flashing system that does not permit the passage of water, and will withstand the wind uplift design pressures listed.

1.6 REGULATORY REQUIREMENTS

- A. Conform to CBC - California Building Code, (CCR) California Code of Regulations, Title 24, Part 6 requirements for a Cool Roof under the Product Rating Program CRRC-1 of the Cool Roof Rating Council.

1.7 SUBMITTALS

- A. Submit product data, samples and instructions under provisions of Section 01 33 00.
- B. Product Data: Submit characteristics on membrane materials, adhesives, seaming materials, and flashing materials.
- C. Samples: Submit samples of membrane materials and accessories for verification of quality.
- D. Manufacturer's Installation Instructions: Submit manufacturer's printed instructions for installation of roof membrane, flashing and accessories.
- E. Submit shop drawings under provisions of Section 01 33 00.
- F. Shop drawings shall show layout, detail of construction and identification of materials. Roofing Material Manufacturer's standard installation details are acceptable when location of detail is properly referenced.
- G. Applicator Qualifications: Submit manufacturer's written acceptance of applicator.

1.8 QUALITY ASSURANCE

- A. Perform roofing Work in accordance with NRCA Roofing and Waterproofing Manual and roofing materials manufacturers printed guidelines.
- B. Perform flashing Work in accordance with the SMACNA Architectural Sheet Metal Manual and roofing materials manufacturers printed guidelines.
- C. Final Inspection: Roofing materials manufacturer representative shall provide a comprehensive final inspection after completion of the roofing system. Provide inspection report to the Architect.

1.9 QUALIFICATIONS

- A. Manufacturer: Company specializing in manufacturing products specified in this section with minimum five years documented experience.
- B. Applicator: Company specializing in performing Work of this section with minimum three years documented experience, factory trained and approved by manufacturer of roofing materials.

1.10 PRE-INSTALLATION MEETINGS

- A. Convene a conference two weeks prior to commencing Work of this section under the provisions of Section 01 31 00.
- B. Review preparation and installation procedures and coordinating and scheduling required with related Work.

1.11 DELIVERY, STORAGE, AND HANDLING

- A. Deliver, store and protect product under the provisions of Section 01 61 00.
- B. Deliver products in manufacturer's original containers, dry, undamaged, with seals and labels intact.
- C. Store products in weather protected environment, clear of ground and moisture.
- D. Store products in a manner to avoid significant or permanent deflection of roof deck.

1.12 ENVIRONMENTAL REQUIREMENT

- A. Do not apply roofing membrane during inclement weather.
- B. Do not apply roofing membrane to damp deck surface or when precipitation is expected or occurring.
- C. Do not expose materials vulnerable to water or sun damage in quantities greater than can be weatherproofed during same day.

1.13 COORDINATION

- A. Coordinate work under the provisions of Section 01 31 00.
- B. Coordinate Work with installation of associated roof penetrations and metal flashings as Work of this section proceeds.
- C. Notify roofing materials manufacturer 72 hours prior to commencing Work to arrange for inspection of roof application.

1.14 WARRANTY

- A. Provide 20 year warranty under the provisions of Section 01 77 00.
- B. Warranty: Manufacturer's No Dollar Limit Warranty covering roof membrane, base flashings and workmanship for the roofing and installation resulting from failure to resist penetration of moisture. Roofing abuse, natural causes or improper maintenance excluded. Warranty to include repair of roof membrane damage due to windstorms less than or equal to 64 mph.
- C. Provide 2 year roofing installer's warranty under provisions of Section 01 77 00.
- D. Roofing Installer's Warranty: Warranty shall cover Work of this section, including installation of all components of roofing system to include roofing membrane, base flashings, fasteners, coatings, sealants, and all penetrations of roofing membrane.

1.15 INSPECTION SERVICE

A. Manufacturer of the roofing materials shall provide the following services:

1. Application start-up inspection.
2. Periodic inspections during applications as required by manufacturer.
3. Final roofing inspection.
4. Certification of materials used and application.

2. PART 2 PRODUCTS

2.1 SINGLE PLY ROOFING - FULLY ADHERED

A. Johns Manville Corp., TPO-1 Adhered Roofing System, ASTM D6878, consisting of a single – ply SRT 60 roofing membrane, CRRC Product ID No. 0662-0001, UL No. R13772, www.jm.com.

B. Other acceptable manufacturers offering equivalent products:

1. Carlisle SynTec Systems, SureWeld TPO, CRRC Product ID No. 0628-0002, UL No. R8103, www.carlisle-syntec.com.
2. Firestone Building Products, Ultra Ply TPO, CRRC Product ID No. 0608-0008, UL No. R9516, www.firestonebpco.com.
3. GAF Materilas Corp., Everguard TPO, CRRC Product ID No. 0676-0001, UL No. R1306, www.gaf.com
4. Gen Flex Roofing Systems, Gen Flex TPO, CRRC Product ID No. 0632-0002, UL No. R9334, www.genflex.com.

C. Substitutions: Under provisions of Section 01 25 13.

2.2 COMPONENTS

A. Membrane: Smooth surface thermoplastic olefin (TPO) composite membrane; reinforced, 0.060 inch thick; white color; conforming to ASTM D6878 and the following criteria:

Properties	Test	Results
Elongation	ASTM D412	25 percent
Tear Strength	ASTM D751	150 lbf
Moisture Vapor Perms	ASTM E96	0.01 typical
Solar Reflectance (albedo X 100)	ASTM E903	0.70 min percent
Emissivity	ASTM E408	0.75 min percent

B. Membrane Adhesive: As recommended by membrane manufacturer. Shall meet South Coast Air Quality Management District (SCAQMD) Rule 1168.

C. Thinner and Cleaner: As recommended by adhesive manufacturer, compatible with sheet membrane.

D. Insulation: Rigid foam insulation as specified in Section 07 22 00.

E. Barrier Board: Glass matte gypsum protection board as specified in Section 07 22 00.

- F. Inside and Outside Corners: Premolded corners, 4 inch x 4 inch flange, same material as membrane; white color.
- G. Flexible Membrane Base Flashings: Same material as membrane; white color.
- H. Flashing Metal: TPO clad 0.0239 inch thick galvanized sheet metal.
- I. Counterflashings: Galvanized sheet metal, as specified in Section 07 62 00.
- J. Prefabricated Control or Expansion Joint Flashing: TPO membrane over polypropylene foam backing rod sized 1.5 x joint width. Seamed to roof membrane.

2.3 ACCESSORIES

- A. Tapered Edge Strips: As specified in Section 07 22 00.
- B. Membrane Primer: Synthetic rubber based primer.
- C. Roofing Nails and Screws: Galvanized or non-ferrous type, size as required to suit application with compatible plastic plates.
- D. Sealants: As recommended by membrane manufacturer. Shall meet South Coast Air Quality Management District (SCAQMD) Rule 1168.
- E. Sealing Mastic: One part, gun grade butyl sealant.
- F. Strip Reglet Devices: Galvanized sheet metal as specified in Section 07 62 00.
- G. Walkway Pads: TPO membrane with textured top surface finish, white color. 0.15 inch thick x 2'-6" wide x 50'-0" long.
- H. Stack Boots: Prefabricated flexible molded TPO boot and collar for pipe stack penetrations through membrane with stainless steel clamping bands. 0.075 inch thick. Size to accommodate round and square tube.
- I. Wood Nailers: Pressure treated wood nailers as specified in Section 06 10 00.
- J. Copper Sheet: ASTM B370, Temper H00 of H01, cold-rolled copper sheet, 16 oz./sq. ft.

3. PART EXECUTION

3.1 EXAMINATION

- A. Coordinate project conditions under the provisions of Section 01 31 00.
- B. Verify surfaces and site conditions are ready to receive Work.
- C. Verify deck is supported and secure.
- D. Verify deck is clean and smooth, free of depressions, waves, or projections, properly sloped to drains and suitable for installation of roof system.
- E. Verify deck surfaces are dry and free of snow or ice.
- F. Verify that barrier board is butted tight together with no joints or gaps more than 1/8 inch wide.
- G. Verify that rigid insulation is butted tight together with no joints or gaps more than 1/4 inch wide.
- H. Verify roof openings, curbs, pipes, sleeves, ducts, and vents through roof are solidly set, and wood nailing strips and reglets are in place.

- I. Beginning of installation means applicator accepts existing conditions.

3.2 INSTALLATION

A. Membrane Application:

1. Roll out membrane and let relax for 30 minutes.
2. Apply adhesive to roof substrate at a rate of one gallon per 60 square feet of membrane.
3. Roll out membrane, free from air pockets, wrinkles, or tears. Firmly press sheet into place without stretching.
4. Roll membrane with weighted roller to ensure complete bonding between membrane and adhesive.
5. Bond sheet to substrate except those areas directly over control or expansion joint.
6. Overlap edges and ends a minimum of 3 inches.
7. Shingle joints of membrane on sloped substrate in direction of drainage.
8. Membrane laps shall be heat welded, continuous, without voids or partial welds. Minimum weld shall be 1-1/2 inches. Welds shall be free of scorch marks.
9. Seal all exposed edges permanently waterproof. Apply uniform bead of sealant to joint edge with TPO caulk.
10. Mechanically attach edge of membrane at junction of vertical surfaces and at edge of roof penetrations with fasteners spaced 12 inches on center.
11. Extend membrane onto vertical surfaces.
12. Seal membrane around roof penetrations.
13. All exposed sheet corners shall be rounded a minimum of 1 inch.

B. Flashings And Accessories:

1. Apply flexible flashings to seal roof membrane to vertical elements.
2. Apply adhesive to vertical surfaces at a rate of one gallon per 60 square feet of membrane.
3. Secure top of flashing membrane to nailing strips at 6 inches on center.
4. Overlap all adjacent flashing sheets by 3 inches.
5. Heat weld all vertical and horizontal seams in flashing membrane, 1-1/2 inch minimum.
6. Extend flashing membrane a minimum of 6 inches onto field roofing membrane.
7. Install prefabricated roofing control and expansion joints to isolate roof into areas as indicated on Drawings. Make joints watertight.
8. Coated metal flashings shall be formed in accordance with construction details and SMACNA guidelines.
9. Coordinate installation of roof drains and related flashings.
10. Install a 30 inch square copper flashing pan at roof drain mechanically attached at 12 inches on center. Seal membrane to flashing pan. Seal flashing pan to roof drain with sealing mastic.

11. Seal flashings and flanges of items penetrating membrane.
12. Seal pipe and tube penetrations with prefabricated flexible boots.

C. Walkway Pads:

1. Install walkway pads at roof access points, roof mounted equipment and related rooftop traffic pathways.
2. Install walkway pads with 2 inch wide joints to permit drainage.
3. Place pads in maximum lengths between field seams of membrane.
4. Heat weld seams at all edges.
5. Apply seam sealant at all welded edges.

3.3 FIELD QUALITY CONTROL

- A. Require site attendance of roofing materials' manufacturers during installation of the Work at indicated intervals.
- B. Test heat welds a minimum of 3 times per day.
- C. Perform pull test on test strip to ensure full-width heat weld.

3.4 CLEANING

- A. Section 01 77 00 - Execution Requirements: Final cleaning.
- B. In areas where finished surfaces are soiled by Work of this section, consult manufacturer of surfaces for cleaning advice and conform to their documented instructions.
- C. Repair or replace defaced or disfigured finishes caused by Work of this section.
- D. Clean and restore all damaged surfaces to their original condition.
- E. Dispose of all excess materials in a manner conforming to current EPA requirements.
- F. Clean finished roof surface after completion. Ensure drainage ways and roof drains are clear and unobstructed.

3.5 PROTECTION OF INSTALLED CONSTRUCTION

- A. Section 01 77 00 - Execution Requirements: Protecting installed construction.
- B. Protect building surfaces against damage from roofing Work.
- C. Where traffic must continue over finished roof membrane, protect surfaces.

END OF SECTION

SECTION 07 62 00

SHEET METAL FLASHING AND TRIM

1. PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Pre-coated coping parapet and cap flashings.
- B. Fascias.
- C. Counter flashing at piping penetrations, vent pipes, and conduits.
- D. Counterflashings over bituminous base flashings.
- E. Counterflashings at roof mounted equipment, curbs and supports.
- F. Counterflashings for roof hatches.

1.2 REFERENCES

- A. ANSI / SPRI ES-1 Wind Design Standard for Edge Systems Used with Low Slope Roofing Systems.
- B. ASTM A653 - Steel Sheet, Zinc-Coated, (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.
- C. ASTM A755 - Steel Sheet, Metallic Coated by the Hot-Dip Process and Prepainted by the Coil-Coating Process for Exterior Exposed Building Products.
- D. ASTM A792 – Steel Sheet, Aluminum-Zinc Alloy. Coated by the Hot-Dip Process, General Requirements.
- E. ASTM A924 - General Requirements for Steel Sheet, Zinc-Coated (Galvanized) by the Hot-Dip Process.
- F. ASTM B32 - Solder Metal.
- G. ASTM B101 - Standard Specifications for Lead-Coated Copper Sheet and Strip for Building Construction.
- H. ASTM D4586 - Asphalt Roof Cement, Asbestos Free.
- I. SMACNA - Architectural Sheet Metal Manual.

1.3 SYSTEM DESCRIPTION

- A. Work of this Section is to physically protect membrane roofing, metal deck, roofing and base flashings, from damage that would permit water leakage to building interior.

1.4 QUALITY ASSURANCE

- A. Applicator: Company specializing in sheet metal flashing work with five years minimum experience.
- B. Perform work in accordance with SMACNA standard details and requirements.
- C. Copings and roof edge flashings shall conform to SPRI ES-1 testing and shall be in compliance with SMACNA Technical Resource Bulletin #5-09.
- D. SPRI Wind Design Standard: Manufacture and install copings and roof edge flashings capable of resisting an ultimate design wind speed of 115 miles per hour.

1.5 SUBMITTALS

- A. Submit shop drawings, product data, and samples under provisions of Section 01 33 00.
- B. Submit shop drawings of sheet metal items indicating profiles, jointing, terminations and installation details. Indicate type and spacing of fasteners.
- C. Submittal of specific plates from the SMACNA Architectural Sheet Metal Manual constitutes acceptable documentation of installation details.
- D. Submit product data for pre-coated galvanized steel.
- E. Submit two samples, 4 x 4 inch in size illustrating metal finish color for pre-coated steel.
- F. Submit product data for flashing accessories.
- G. Submit warranty for water tightness.
- H. Submit warranty for metal finish.

1.6 STORAGE AND HANDLING

- A. Store products under provisions of Section 01 61 00.
- B. Stack preformed material to prevent twisting, bending, or abrasion, and to provide ventilation.
- C. Prevent contact with materials during storage which may cause discoloration, staining, or damage.

1.7 WARRANTY

- A. Provide warranty under provisions of Section 01 77 00.
- B. Provide 2-year warranty coverage for degradation of water tightness and integrity of seals.
- C. Provide 20-year warranty coverage for metal finish from all defects.

2. PART 2 PRODUCTS

2.1 SHEET MATERIALS

- A. Pre-Coated Galvanized Steel: ASTM A755 on zinc-coated galvanized substrate, ASTM A653, Grade 33, G90 zinc coating in accordance with ASTM A924 or ASTM A792, Grade 50, AZ55 aluminum zinc coating; 0.0299 inch thick core steel.

2.2 ACCESSORIES

- A. Lead-Coated Copper: ASTM B101, Temper H00 and H01, cold-rolled copper sheet, coated both sides with lead weighing not less than 12 lb/100 sq. ft. or more than 15 lb./100 sq. ft. total weight of copper sheet with lead applied to both sides.
- B. Fastener: Galvanized steel or stainless steel with soft neoprene washers at exposed fasteners.
- C. Underlayment: Spunbound reinforced polypropylene coated fabric sheet.
 - 1. Premium Grade Feltex as manufactured by SystemComponents Corp., www.systemcomponents.net.
 - 2. Premium Summit Synthetic Underlayment as manufactured by Atlas Roofing Corp., www.atlasroofing.com.
 - 3. Roof Top Guard II Underlayment as manufactured by Underlayment Specialties Plus, www.uspunderlayment.com.

4. Substitutions: Under provisions of Section 01 25 13.

- D. Slip Sheet: 0.05 lb./sq. ft., rosin sized building paper.
- E. Sealant: Type specified in Section 07 92 00.
- F. Bedding Compound: Rubber-asphalt type.
- G. Plastic Cement: ASTM D4586, Type I.
- H. Metal Flashing System: Two piece pre-coated galvanized steel similar to Springlok Flashing System, manufactured by Fry Reglet, www.fryreglet.com, type as indicated. Include fabricated end closures and mitered corners.
- I. Solder for Lead-Coated Copper: ASTM B32, Grade SN 60 percent tin, 40 percent lead.
- J. Solder for Zinc: ASTM B32; 50/50 tin/lead type, with rosin flux.

2.3 FABRICATION

- A. Form sections true to shape, accurate in size, square, and free from distortion or defects.
- B. Fabricate concealed cleats of galvanized steel, ASTM A653, Grade 33, G90 zinc coating, 0.0478 inch thickness, interlockable with sheet.
- C. Fabricate exposed cleats and coverplates of same material as sheet, interlockable with sheet.
- D. Form pieces in longest practical lengths.
- E. Hem exposed edges on underside 1/2 inch. Miter and seam corners.
- F. Form material with flat lock seam.
- G. Solder and seal metal joints. After soldering, remove flux. Wipe and wash solder joints clean.
- H. Fabricate corners from one piece with minimum 18 inch long legs; seam for rigidity, seal with sealant.
- I. Fabricate vertical faces with bottom edge formed outward 1/4 inch and hemmed to form drip.
- J. Fabricate flashings to allow toe to extend 2 inches over roofing surface. Return and brake edges.
- K. Fabricate vent pipe and roof penetration flashings of lead-coated copper with clamping ring.

2.4 FINISH

- A. Kynar 500 or Hylar 5000 shop pre-coated finish with 0.2 mil baked on primer and 0.8 mil baked on topcoat for a 1.0 mil dry film thickness. Color to be selected by Architect from manufacturer's entire range of standard and custom colors.

3. PART 3 EXECUTION

3.1 INSPECTION

- A. Verify roof openings, curbs, pipes, sleeves, ducts, or vents through roof are solidly set, cant strips and reglets are in place, and nailing strips located.
- B. Verify membrane termination and base flashings are in place, sealed, and secure.
- C. Beginning of installation means acceptance of existing conditions.

3.2 PREPARATION

- A. Field measure site conditions prior to fabricating work.
- B. Install starter and edge strips, and cleats before starting installation.
- C. Install surface mounted reglets true to line and level. Seal top with sealant.
- D. Install underlayment with protective slip sheet over parapets, caps, copings, gravel stops and curbs.

3.3 INSTALLATION

- A. Conform to indicated details on the drawings and the recommendations included in the SMACNA Architectural Sheet Metal Manual.
- B. Provide for thermal expansion of exposed sheet metal work. Space movement joints at 10 feet - 0 inches o.c. maximum with no joints within 2 feet - 0 inches of corners.
- C. Form expansion joints of intermeshing hooked flanges filled with sealant.
- D. Insert flashings into reglets to form tight fit. Secure in place with lead wedges at maximum 12 inches on center. Pack remaining spaces with lead wool. Seal flashings into reglets with sealant.
- E. Secure flashings in place using concealed fasteners. Use exposed fasteners only where indicated.
- F. Lap, lock, seam and seal all joints.
- G. Apply plastic cement compound between metal flashings and felt flashings. Apply bituminous coating between dissimilar metals where occurs.
- H. Fit flashings tight in place. Make corners square, surfaces true and straight in planes, and lines accurate to profiles.
- I. Roof-Penetration, Vent Pipe Flashing: Turn lead flashing down inside vent piping. Clamp flashing to other pipes penetrating roof except for vent piping. Seal with elastomeric sealant.
- J. Seal metal joints watertight.

3.4 FIELD QUALITY CONTROL

- A. Conform to SMACNA Architectural Sheet Metal Manual.
- B. Field observation will involve surveillance of Work during installation to ascertain compliance with specified requirements.

END OF SECTION

SECTION 07 71 23

MANUFACTURED GUTTERS AND DOWNSPOUTS

1. PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Galvanized steel gutters.
- B. Steel pipe downspouts.
- C. Precast concrete splash blocks and sheet metal splash pans.

1.2 REFERENCES

- A. ASTM A53 - Pipe, Steel, Black and Hot-Dipped Zinc-Coated Welded and Seamless.
- B. ASTM A123 - Zinc (Hot-Dip Galvanized) Coating on Iron and Steel Products.
- C. ASTM A653 - Steel Sheet, Zinc Coated, (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.
- D. ASTM A755 - Steel Sheet, Metallic Coated by the Hot-Dip Process and Prepainted by the Coil-Coating Process for Exterior Exposed Building Products.
- E. ASTM A792 - Steel Sheet, Aluminum-Zinc Alloy. Coated by the Hot-Dip Process, General Requirements.
- F. ASTM A924 - General Requirements for Steel Sheet, Zinc-Coated (Galvanized) by the Hot-Dip Process.
- G. SMACNA - Architectural Sheet Metal Manual.

1.3 SUBMITTALS

- A. Submit shop drawings, product data, and samples under provisions of Section 01 33 00.
- B. Submit shop drawings of metal items indicating profiles, jointing, terminations, and installation details. Indicate type and spacing of fasteners.
- C. Submittal of specific plates from the SMACNA Architectural Sheet Metal Manual constitutes acceptable documentation of installation details.
- D. Submit product data for pre-coated galvanized steel.
- E. Submit two samples 4 x 4 inch in size illustrating metal finish color for pre-coated steel.
- F. Submit warranty for metal finish.

1.4 QUALITY ASSURANCE

- A. Applicator: Company specializing in sheet metal work with five years minimum experience.
- B. Perform work in accordance with SMACNA standard details and requirements.

1.5 STORAGE AND HANDLING

- A. Store products under provisions of Section 01 61 00.
- B. Stack preformed material to prevent twisting, bending, or abrasion and to provide ventilation.
- C. Prevent contact with materials during storage which may cause discoloration, staining or damage.

1.6 WARRANTY

- A. Provide warranty under provisions of Section 01 77 00.
- B. Provide 20-year warranty coverage for metal finish from all defects.

2. PART 2 PRODUCTS

2.1 MATERIALS

- A. Galvanized Steel: ASTM A653, Grade 33, G90 zinc-coating in accordance with ASTM A924; thickness as specified.
- B. Pre-coated Galvanized Steel: ASTM A755 on zinc-coated galvanized substrate, ASTM A653, Grade 33, G90 zinc coating in accordance with ASTM A924, or ASTM A792, Grade 50, AZ55 aluminum zinc coating, thickness as specified.

2.2 COMPONENTS

- A. Gutters: 0.0299 inch thick.
- B. Downspouts: ASTM A53, Grade B, Schedule 40 steel pipe, standard weight, Type S, one piece without joints, galvanized according to ASTM A53; 1.8 oz./sq. ft.
- C. Splash Blocks: Precast concrete type, of sizes and profiles indicated; minimum 3000 psi at 28 days, with minimum 5 percent air entrainment.
- D. Splash Pans: Same metal as for gutters.

2.3 ACCESSORIES

- A. Anchorage Devices: Meet SMACNA requirements.
- B. End Caps, Downspout Outlets and Strainers, Rain Diverters, Straps, Support Brackets, Joint Fasteners. Profiled to suit gutters and downspouts.
- C. Sealant: Silicone type as specified in Section 07 92 00.

2.4 FABRICATION

- A. Form gutters and downspouts of profiles and sizes indicated.
- B. Field measure site conditions prior to fabricating work.
- C. Fabricate with required connection pieces.
- D. Form sections square, true, and accurate in size, in maximum possible lengths and free of distortion or defects detrimental to appearance or performance.
- E. Hem exposed edges of metal.
- F. Seal metal joints.
- G. Fabricate gutter and downspout accessories; seal watertight.
- H. Form splash pans to size as detailed with rolled edges.

2.5 FINISHING

- A. Kynar 500 or Hylar 5000 shop pre-coated finish on flat sheet metal stock. Finish with 0.2 mil baked on primer and 0.80 mil baked on topcoat for a 1.0 mil dry film thickness. Color to be selected by Architect from manufacturer's entire range of standard colors.
- B. Galvanize assembled steel pipe downspouts after fabrication to minimum 1.25/oz sq ft zinc coating in accordance with ASTM A123.

3. PART 3 EXECUTION

3.1 EXAMINATION

- A. Verify that surfaces are ready to receive work.
- B. Beginning of installation means acceptance of existing conditions.

3.2 INSTALLATION

- A. Install gutters, downspouts, and accessories in accordance with SMACNA requirements.
- B. Join lengths with seams sealed watertight. Flash and seal gutters to downspouts and accessories.
- C. Seal metal joints watertight.
- D. Set splash blocks and pans under downspouts.

END OF SECTION

SECTION 07 72 33

ROOF HATCHES

1. PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Prefabricated roof hatches and smoke vents, with integral support curbs, operable hardware, and counterflashings.
- B. Roof hatch railing system.

1.2 REFERENCES

- A. UL - Underwriters' Laboratories: Fire Hazard Classification.
- B. FM - FM Global: Roof Assembly Classifications.
- C. OSHA - Standards of Occupational Safety and Health Administration.

1.3 SUBMITTALS

- A. Submit product data under provisions of Section 01 33 00.
- B. Provide data on unit construction, sizes, configuration, jointing methods, attachment methods, operation and accessories.
- C. Manufacturer and/or fabricator shall submit a certificate of product compliance with OSHA Standards.

1.4 REGULATORY REQUIREMENTS

- A. Underwriters' Laboratories Inc. (UL) and FM Global (FM) requirements as applicable to fire rated smoke vents.
- B. OSHA regulations as applicable to roof access hatches, 29 CFR 1910.23.

2. PART 2 PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

- A. Acrylight International, www.acralight.com.
- B. Babcock-Davis Hatchways, Inc., www.babcockdavis.com.
- C. Bilco Co., www.bilco.com.
- D. Bristol Fiberlite Industries, www.bristolite.com.
- E. Dur-Red Products, www.dur-red.com.
- F. Lane-Aire, www.lane-aire.com.
- G. Milcor, Inc., www.milcorinc.com.
- H. Nystrom Building Products, www.nystrom.com.
- I. Precision Ladders, LLC, www.precisionladders.com.
- J. Substitutions: Under provisions of Section 01 25 13.

2.2 ROOF HATCHES

- A. Unit: 2'-6" x 3'-0" size, single leaf type.
- B. Curb: 0.0747 inch thick galvanized prime painted steel with one inch rigid insulation; integral cap flashing to receive roof flashing system; extended flange for mounting. Fabricate curbs to maintain a minimum 12 inches above roofing surface.
- C. Cover: 0.0747 inch thick galvanized prime painted steel with 1 inch rigid insulation retained by inner liner. Continuous gasket to provide weatherproof seal.
- D. Hardware: Manufacturer's standard manually operated type with compression spring operators, positive snap latch with turn handles inside and out and padlock hasp inside; automatic hold-open arm with vinyl covered grip handle for easy release; galvanized finish.
- E. Hinges: Manufacturer's recommended type.

2.3 HEAT/SMOKE VENTS

- A. Unit: Sizes shown, single, or double leaf type, labeled as being FM 4430 approved or U.L. 793 listed.
- B. Curb: 0.0747 inch thick galvanized prime painted steel with 1 inch rigid insulation; integral cap flashing to receive roof flashing system; extended flange for mounting.
- C. Cover: 0.0747 inch thick galvanized prime painted steel with 1 inch glass fiber insulation retained by 0.0299 inch thick steel interior liner. Continuous gasket to provide weatherproof seal.
- D. Hardware: Compression spring operators, heavy duty shock absorbers, and manual pull rings for interior and exterior operation; hold-open arm with vinyl covered grip handle for easy release; galvanized finish.
- E. Security Grille: Provide for all units.
- F. Hinges: Manufacturer's recommended type.
- G. Operation: Electric thermal latch positive release mechanism for actuation by smoke detector.
- H. Remote Operation: Rigging system, cables, pulleys and winch, for manual operation at floor level.

2.4 RAILING SYSTEM

- A. Hatch manufacturer's pipe rail safety rail system that meets the requirements of OSHA 1910.23.
- B. Hatch Access Protection: Self-latching hinged gate.
- C. Substitutions: Under provisions of Section 01 25 13.

2.5 HATCH AND VENT FABRICATION

- A. Fabricate free of visual distortions and defects. Weld corners and joints.
- B. Provide for removal of condensation.
- C. Provide weathertight assembly.
- D. Sloped Roofs: Taper curbs to maintain top level.

2.6 FINISH

- A. Shop prime paint all exposed metal.
- B. Site paint metal surfaces under provisions of Section 09 90 00.

3. PART 3 EXECUTION

3.1 INSTALLATION

- A. Install in accordance with manufacturer's instructions. Coordinate with installation of roofing system and related flashings. Provide weather tight installation.
- B. Install heat / smoke vent in compliance with U.L. 793 or FM 4430 listing.
- C. Install remote rigging system for manual winch operation at floor level for heat / smoke vent.
- D. Permanently bolt railing system to roof hatch curb in accordance with manufacturer's instructions.
- E. Apply bituminous paint on metal surfaces of units in contact with cementitious materials and dissimilar metals.

3.2 ADJUSTING

- A. Adjust hinges for smooth operation.
- B. Adjust latching mechanisms for positive engagement.
- C. Adjust smoke vent rigging system for ease of operation.

END OF SECTION

SECTION 07 84 00

FIRESTOPPING

1. PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Penetrations through fire-resistance-rated floor and roof construction including both empty openings and openings containing cables, pipes, ducts, conduits, and other penetrating items.
- B. Penetrations through fire-resistance-rated walls and partitions including both empty openings and openings containing cables, pipes, ducts, conduits, and other penetrating items.
- C. Penetrations through smoke barriers and construction enclosing compartmentalized areas involving both empty openings and openings containing penetrating items.
- D. Sealant joints in fire-resistance-rated construction.
- E. Fireproof firestopping and firesafing materials and accessories.

1.2 REFERENCES

- A. ASTM C920 - Elastomeric Joint Sealants.
- B. ASTM C1193 - Use of Joint Sealants.
- C. ASTM E84 - Test Method for Surface Burning Characteristics of Building Materials.
- D. ASTM E119 - Method for Fire Tests of Building Construction and Materials.
- E. UL - Fire Hazard Classifications.
- F. UL 1479 - Fire Tests of Through-Penetration Firestops.

1.3 DEFINITION

- A. Firestopping (Firesafing): A sealing or stuffing material or assembly placed in spaces between building materials to arrest the movement of smoke, heat, gases, or fire through wall or floor openings.

1.4 SYSTEM DESCRIPTION

- A. F-Rated Through Penetration Firestop Systems: F-ratings as required according to UL 1479, but not less than that equaling or exceeding fire resistance rating of assembly penetrated where the following conditions exist:
 - 1. Penetrations larger than 4 inch nominal pipe size or 16 square inches in overall cross-sectional area.
- B. T-Rated Through Penetration Firestop Systems: T-ratings, in addition to F-ratings, as required according to UL 1479, where the following conditions exist:
 - 1. Through penetrations of fire rated walls above corridor ceilings which are not part of a fire-resistive assembly.
 - 2. Through penetrations of fire rated walls below any ceiling.
 - 3. Penetrations larger than 4 inch nominal pipe size or 16 square inches in overall cross-sectional area.

- C. Penetrations not larger than 4 inch nominal pipe size or 16 square inches in overall cross-sectional area shall have the annular space between the penetrating item and the wall/floor assembly filled with a material which will prevent passage of flame and hot gases sufficient to ignite cotton waste when subjected to ASTM E119 under a minimum positive pressure differential of 0.01 inch water column for the time period at least equal to the fire resistance rating of the wall/floor assembly.
- D. Surface Burning: ASTM E84 with a flame spread/smoke developed rating of 25/450.
- E. Firestop all interruptions and terminations of fire rated assemblies.
- F. For piping penetrations for plumbing and wet-pipe sprinkler systems, provide moisture-resistant through-penetration firestop systems.
- G. For floor penetrations with annular spaces exceeding 4 inches or more in width and exposed to possible loading and traffic, provide firestop systems capable of supporting the floor loads involved either by installing floor plates or by other means.
- H. For penetrations involving insulated piping, provide through-penetration firestop systems not requiring removal of insulation.

1.5 SUBMITTALS

- A. Submit under provisions of Section 01 33 00.
- B. Product Data: Provide data on product characteristics, performance and limitation criteria.
- C. Manufacturer's Installation Instructions: Indicate preparation and installation instructions.
- D. Certification: Submit firestopping manufacturer's certificate that products supplied comply with local regulations controlling use of volatile organic compounds (VOCs) and are nontoxic to building occupants.

1.6 QUALITY ASSURANCE

- A. Through penetration firestop systems to correspond to those penetration firestop system designations listed by UL in their Fire Resistance Directory.

1.7 REGULATORY REQUIREMENTS

- A. Conform to CBC, California Building Code, (CCR) California Code of Regulations, Title 24, Part 2 and UL requirements for fire resistance ratings and surface burning characteristics.
- B. Firestopping products shall contain no detectable asbestos as determined by 40 CFR, Part 763, Subpart F, Appendix A, Section 1, Polarized Light Microscopy.

1.8 SEQUENCING AND SCHEDULING

- A. Coordinate Work under provisions of Section 01 31 00.
- B. Coordinate construction of openings and penetrating items to ensure that through penetration firestop systems are installed per manufacturer's instructions and regulatory requirements.
- C. Do not cover up installations that will become concealed behind other construction until District Inspector and authorities having jurisdiction, if required, have examined each installation.

1.9 ENVIRONMENTAL REQUIREMENTS

- A. Do not apply materials when temperature of substrate material and ambient air is below 60 degrees F.
- B. Maintain this minimum temperature before, during, and for 3 days after installation of materials.
- C. Provide ventilation in areas to receive solvent cured materials.

2. PART 2 PRODUCTS

2.1 FIRESTOPPING, GENERAL

- A. Provide firestopping components that are compatible with each other, substrates of openings, and items penetrating firestopping.
- B. Provide accessories for each firestopping system that are needed to comply with designated fire-resistance-rated systems specified by firestopping manufacturer.

2.2 ACCEPTABLE MANUFACTURERS

- A. AD Fire Protection Systems, Inc., www.adfire.com.
- B. Hilti Construction Chemicals, Inc., www.us.hilti.com.
- C. Minnesota Mining and Mfg. Co., www.3m.com/firestop.
- D. Rector Seal Corporation, www.rectorseal.com.
- E. Specified Technologies, Inc., www.stifirestop.com.
- F. Tremco, www.tremcosealants.com.
- G. United States Gypsum Co., www.usg.com.
- H. Substitutions: Under provisions of Section 01 25 13.

2.3 FILL MATERIALS

- A. Intumescent Wrap: Single-component, elastomeric sheet.
- B. Vinyl Compound: Vinyl-based powder product mixed on site with water to produce a paintable compound with flame-spread and smoke-developed rating of 0 per ASTM E84.
- C. Silicone Foam: Two-component, silicone based liquid elastomer that, when mixed, expands and cures in place to produce a flexible nonshrinking foam.
- D. Silicone Sealant: Moisture-curing, single-component, silicone-based, neutral-curing elastomeric sealant either in a self-leveling or non-sag grade for opening condition.
- E. Fiber Stuffing: Mineral fiber stuffing with a minimum density of 3.5 lbs./cu. ft.

2.4 JOINT SEALANTS

- A. Manufacturer's standard chemically curing elastomeric sealant that complies with ASTM C920.
- B. Provide selections from manufacturer's full range of colors.
- C. Single-Component, Neutral Curing Silicone Sealant: Type S; Grade NS; Class 25; exposure-related use NT; and joint substrate related uses M, G, A, and O, as applicable to substrate assembly condition.

3. PART 3 EXECUTION

3.1 EXAMINATION

- A. Verify site conditions under provisions of Section 01 31 00.
- B. Verify openings are ready to receive the work of this Section.

3.2 PREPARATION

- A. Clean substrate surfaces of dirt, dust, grease, oil, loose material, or other matter which may affect bond of firestopping material.
- B. Remove laitance and form release agents from concrete.
- C. Remove incompatible materials which may affect bond.
- D. Install backing materials to arrest liquid material leakage.

3.3 APPLICATION OF THROUGH-PENETRATION FIRESTOPS

- A. Install material at walls or partition openings which contain penetrating sleeves, piping, ductwork, conduit and other items, requiring firestopping.
- B. Comply with through-penetration firestop manufacturer's installation instructions and drawings pertaining to products and applications required.
- C. Install forming materials and other accessories of types required to support fill materials during their application and in the position needed to produce shapes and depths required to achieve fire ratings.
- D. After installing fill materials, remove combustible forming materials and other accessories not indicated as permanent components of firestop system.
- E. Apply primer and materials in accordance with manufacturer's instructions.
- F. Apply firestopping material in sufficient thickness to achieve rating.

3.4 APPLICATION OF FIRE-RESISTIVE JOINT SEALANT

- A. Comply with ASTM C1193 and manufacturer's installation instructions and drawings pertaining to products and applications required.
- B. Install joint fillers to provide support and at a position required to produce depth to joint widths that allow development of fire-resistance rating required.
- C. Install sealant to completely fill recesses provided. Install sealant at same time as joint filler.
- D. Tool non-sag sealants after application to form smooth uniform bead to configuration required to produce fire-resistance rating.

3.5 FIELD QUALITY CONTROL

- A. Do not cover up installations that will become concealed behind other construction until District Inspector and authorities having jurisdiction if required, have examined each installation.
- B. Where deficiencies are found, repair or replace firestopping to required condition.

3.6 CLEANING

- A. Clean Work under provisions of Section 01 77 00.
- B. Clean adjacent surfaces of firestopping materials.

3.7 PROTECTION OF FINISHED WORK

- A. Protect finished Work under provisions of Section 01 61 00.
- B. Protect adjacent surfaces from damage by material installation.

3.8 SCHEDULES

	LOCATION	UL NO.	F RATING
A.	Stud wall, metallic pipe, and conduit.	WL1001	1 hour
B.	Stud wall, non-metallic pipe, and conduit.	WL2129	1 hour
C.	Concrete and masonry wall, metallic pipe, and conduit.	WJ1028	1 hour
D.	Concrete and masonry wall, non-metallic pipe, and conduit.	WJ2109	1 hour

END OF SECTION

SECTION 07 92 00

JOINT SEALANTS

1. PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Preparing sealant substrate surfaces.
- B. Sealant and backing.

1.2 SUMMARY OF SEALANT LOCATIONS

- A. Joints in horizontal surfaces.
 - 1. Expansion and isolation joints in cast-in-place concrete slabs.
 - 2. Expansion and isolation joints in masonry paving.
 - 3. Joints in precast concrete paving units.
 - 4. Joints in stone paving units.
 - 5. Control and expansion joints in ceramic and quarry tile.
 - 6. Control and expansion joints in soffits, ceilings and overhead surfaces.
 - 7. Joints on underside of precast beams and planks.
 - 8. Perimeter joints in exterior openings.
 - 9. Joints between ceiling surfaces and frames for doors and windows.
 - 10. Joints in flashing and sheet metal.
 - 11. Perimeter joints of plumbing fixtures.
 - 12. Acoustical isolation joints between head and sill of walls and floor and ceiling surfaces.
 - 13. Joints between countertops and wall surfaces.
 - 14. Joints in skylights and framing.
 - 15. Joints between thresholds and floors.
 - 16. Isolation joints in plaster soffits and ceilings.
 - 17. Joints between dissimilar materials and those listed above.
 - 18. Other joints as indicated.
- B. Joints in vertical surfaces:
 - 1. Expansion and isolation joints in cast-in-place concrete.
 - 2. Expansion and isolation joints in masonry.
 - 3. Joints in precast concrete.
 - 4. Expansion and isolation joints in stonework.

5. Control and expansion joints in ceramic and quarry tile.
6. Perimeter joints in exterior openings.
7. Joints in flashing and sheet metal.
8. Perimeter joints of plumbing fixtures.
9. Acoustical isolation joints of walls.
10. Joints between cabinets and walls.
11. Joints between wall surfaces and door and window frames.
12. Joints in skylights and framing.
13. Isolation joints in plaster walls.
14. Joints between dissimilar materials and those listed above.
15. Other joints as indicated.

1.3 REFERENCES

- A. ASTM C834 - Latex Sealing Compounds.
- B. ASTM C919 - Practices for Use of Sealants in Acoustical Applications.
- C. ASTM C920 - Elastomeric Joint Sealants.
- D. ASTM C1193 - Standard Guide for Use of Joint Sealants.
- E. ASTM D1056 - Flexible Cellular Materials - Sponge or Expanded Rubber.
- F. FS TT-S-001657 - Sealing Compound, Single Component, Butyl Rubber Based, Solvent Release Type.
- G. SWRI - (Sealant, Waterproofing and Restoration Institute) - Sealant and Caulking Guide Specification.

1.4 SUBMITTALS

- A. Submit product data under provisions of Section 01 33 00.
- B. Submit product data indicating sealant chemical characteristics, performance criteria, limitations, and color availability.
- C. Submit samples under provisions of Section 01 33 00.
- D. Submit two samples 4 inches long in size illustrating colors selected.

1.5 QUALITY ASSURANCE

- A. Manufacturer: Company specializing in manufacturing the products specified in this Section with minimum five years documented experience.
- B. Applicator: Company specializing in applying the Work of this Section with minimum three years documented experience, approved by sealant manufacturer.
- C. Conform to Sealant, Waterproofing, and Restoration Institute (SWRI) requirements for materials and installation.
- D. Perform Work in accordance with ASTM C1193.

- E. Perform acoustical sealant application work to provide maximum STC values in accordance with ASTM C919.

1.6 ENVIRONMENTAL REQUIREMENTS

- A. Do not install solvent curing sealants in enclosed building spaces.
- B. Do not install sealant when temperature is less than 40 degrees F.
- C. Maintain temperature and humidity recommended by the sealant manufacturer during and after installation.

1.7 OPERATION AND MAINTENANCE DATA

- A. Submit maintenance data under the provisions of Section 01 77 00.
- B. Submit recommended inspection intervals for sealant joints.
- C. Submit instructions for repairing and replacing failed sealant joints.

1.8 WARRANTY

- A. Provide 5 year warranty under provisions of Section 01 77 00.
- B. Include coverage for installed sealants and accessories which fail to achieve air and water seal and exhibit loss of adhesion or cohesion or do not cure.

2. PART 2 PRODUCTS

2.1 MATERIALS

- A. Compatibility: Provide joint sealants, backings, and other related materials that are compatible with one another and with joint substrates under conditions of service and application, as demonstrated by sealant manufacturer, based on testing and field experience.
- B. VOC Content of Interior Sealants: Provide interior sealants and sealant primers that comply with the following limits for VOC content limits when calculated according to South Coast Air Quality Management District (SCAQMD) Rule 1168, and must meet or exceed the requirements for the Bay Area Quality Management District Regulation 8, Rule 5.
 - 1. Sealants: 250 g/L.
 - 2. Sealant Primers for Nonporous Substrates: 250 g/L.
 - 3. Sealant Primers for Porous Substrates: 775 g/L.

2.2 MANUFACTURERS

- A. Manufacturers and their products are listed for each type of sealant. Acceptable manufacturers include the following:
 - 1. Dow Consumer Solutions, www.consumer.dow.com.
 - 2. General Electric Co., www.gesealants.com.
 - 3. Pecora Corp., www.pecora.com.
 - 4. Sika Corp., www.sikausa.com.
 - 5. Sonneborn/ChemRex, www.chemrex.com.
 - 6. Tremco, Inc., www.tremcosealants.com.

7. United States Gypsum Co., www.usg.com.
8. W.R. Meadows, Inc., www.wrmeadows.com.

B. Substitutions: Under provisions of Section 01 25 13.

2.3 SEALANTS

- A. Type A - Acrylic Latex: One-part, non-sag, mildew resistant acrylic emulsion compound complying with ASTM C834, Type S, Grade NS, formulated to be paintable.
 1. Tremco, Inc., Acrylic Latex Caulk.
 2. Pecora Corporation, AC-20.
 3. Sonneborn, Chemrex, Sonolac.
- B. Type B - Butyl Sealant: One-part, non-sag solvent-release-curing sealant complying with FS TT-S-001657 for Type 1 and formulated with a minimum of 75 percent solids.
 1. Tremco, Inc., Tremco Butyl Sealant.
 2. Pecora Corporation, BC-158.
 3. Sonneborn, Chemrex, Multi-Purpose Sealant.
- C. Type C - Silicone Sealant: One-part nonacid-curing silicone sealant complying with ASTM C920, Type S, Grade NS, Class 25.
 1. Dow Consumer Solutions, Dowsil 790.
 2. General Electric Co., Silpruf.
 3. Tremco, Inc., Spectrem 1.
 4. Pecora Corp., 864 or 890.
 5. Sonneborn/Chemrex, Omniseal.
- D. Type D - Non-Sag Polyurethane Sealant: Single component sealant complying with ASTM C920, Type S, Grade NS, Class 25:
 1. Pecora Corp., Dynatrol I-XL.
 2. Tremco, Inc., Vulkem 921.
 3. Sika Corp., Sikaflex 1a.
 4. Sonneborn/ChemRex, Sonolastic NP-1.
- E. Type E - Neutral-Curing Silicone Sealant: One part medium modulus neutral-curing silicone sealant complying with ASTM C920, Type S, Grade NS, Class 25.
 1. Dow Consumer Solutions, Dowsil 795.
 2. General Electric Co., Ultraglaze 4000.
 3. Tremco, Inc., Spectrum 3.
 4. Pecora Corp., 895.

- F. Type F - One-Part Mildew-Resistant Silicone Sealant: Complying with ASTM C920, Type S, Grade NS, Class 25.
 - 1. Dow Consumer Solutions, Dowsil 786.
 - 2. General Electric Co., Sanitary 1700.
 - 3. Tremco, Inc., Tremsil 200.
 - 4. Pecora Corp., 863 or 898 White.
- G. Type G - Multi-Part Pourable Sealant: Complying with ASTM C920, Type M, Grade P, Class 25. Shore A hardness +40.
 - 1. Tremco, Inc., THC900/901.
 - 2. Pecora Corp., Dynatred or Urexpan NR-200.
 - 3. Sika Corporation, Sikaflex 2c NS TG.
 - 4. W.R. Meadows, Pourthane NS/SL.
- H. Type H - Acoustical Sealant: Nondrying, nonhardening permanently flexible conforming to ASTM C834.
 - 1. Pecora Corp., AIS-919 Acoustical Sealant.
 - 2. Tremco, Inc., Tremco Acoustical Sealant.
 - 3. United States Gypsum Co., Sheetrock Acoustical Sealant.

2.4 ACCESSORIES

- A. Primer: Non-staining type, recommended by sealant manufacturer to suit application.
- B. Joint Cleaner: Non-corrosive and non-staining type, recommended by sealant manufacturer; compatible with joint forming materials.
- C. Joint Backing: ASTM D1056; round, closed cell polyethylene foam rod; oversized 30 to 50 percent larger than joint width.
- D. Bond Breaker: Pressure sensitive tape recommended by sealant manufacturer to suit application.

3. PART 3 EXECUTION

3.1 EXAMINATION

- A. Verify that joint openings are ready to receive Work and field measurements are as shown on Drawings and recommended by the manufacturer.
- B. Beginning of installation means installer accepts existing substrate.

3.2 PREPARATION

- A. Clean and prime joints in accordance with manufacturer's instructions. Prime if recommended by manufacturer.
- B. Remove loose materials and foreign matter which might impair adhesion of sealant.
- C. Verify that joint backing and release tapes are compatible with sealant.
- D. Perform preparation in accordance with ASTM C1193.

- E. Protect elements surrounding the Work of this Section from damage or disfiguration.

3.3 INSTALLATION

- A. Install sealant in accordance with manufacturer's instructions.
- B. Measure joint dimensions and size materials to achieve required width/depth ratios.
- C. Install joint backing to achieve a neck dimension no greater than 1/3 the joint width.
- D. Install bond breaker where joint backing is not used.
- E. Apply sealant within recommended application temperature ranges. Consult manufacturer when sealant cannot be applied within these temperature ranges.
- F. Install sealant free of air pockets, foreign embedded matter, ridges, and sags.
- G. Tool joints concave unless otherwise detailed.

3.4 CLEANING AND REPAIRING

- A. Clean work under provisions of Section 01 77 00.
- B. Clean adjacent soiled surfaces.
- C. Repair or replace defaced or disfigured finishes caused by Work of this Section.

3.5 PROTECTION OF FINISHED WORK

- A. Protect sealants until cured.
- B. Sprinkler fine silica sand on sealant of exterior concrete paving joints to reduce tracking of sealant.

3.6 SCHEDULE

<u>Type</u>	<u>Location</u>	<u>Color</u>
A. Type A - Acrylic Latex Cure	All interior joints not otherwise scheduled	To match adjacent surfaces
B. Type B - Butyl	Under thresholds	Black
C. Type C - One-Part Nonacid Curing Silicone	Exterior door, entrance and window frames. Exterior and Interior vertical joints in natural colored concrete and integral colored masonry prefinished metal flashing.	To match adjacent material
D. Type D - Non-Sag Polyurethane Sealant	Exterior door, entrance and window frames. Exterior and Interior vertical joints in painted concrete and masonry.	To match adjacent surface
E. Type E - Neutral-Curing Silicone	Joints within glazed curtain wall system aluminum entrance system glass and glazing.	Translucent
F. Type F - Mildew-Resistant Silicone	Interior joints in ceramic tile and at plumbing fixtures.	White

G. Type G - Multi-part Pourable Urethane	Exterior and interior joints in horizontal surfaces of concrete.	To match adjacent material
H. Type H - Acoustical Sealant	Interior walls between stud track/runner and adjacent construction. Between outlet boxes and gypsum board.	White

END OF SECTION

SECTION 07 95 13

EXPANSION JOINT COVER ASSEMBLIES

1. PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Floor expansion joint cover assemblies.
- B. Wall expansion joint cover assemblies.
- C. Ceiling/soffit expansion joint cover assemblies.
- D. Roof expansion joint cover assemblies.
- E. Fire barrier systems.

1.2 REFERENCES

- A. ASTM A36 - Structural Steel.
- B. ASTM A167 - Stainless Steel and Heat-Resisting Chromium-Nickel Steel Plate, Sheet and Strip.
- C. ASTM A283 - Low and Intermediate Tensile Strength Carbon Steel Plates.
- D. ASTM A786 - Rolled Steel Floor Plates.
- E. ASTM B209 - Aluminum and Aluminum-Alloy Sheet and Plate.
- F. ASTM B221 - Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Shapes, and Tubes.
- G. ASTM C920 - Elastomeric Joint Sealants.
- H. ASTM D2000 - Rubber Properties in Automotive Applications.
- I. ASTM E119 - Fire Tests of Building Construction and Materials.
- J. ASTM E814 - Fire Tests of Through Penetration Fire Stops.
- K. CBC - California Building Code, (CCR) California Code of Regulations, Title 24, Part 2.
- L. NAAMM - National Association of Architectural Metal Manufacturers.
- M. UL - Underwriters Laboratories.

1.3 SUBMITTALS

- A. Submit shop drawings and product data under provisions of Section 01 33 00.
- B. Shop Drawings: Indicate joint and splice locations, miters, layout of the work, affected adjacent construction, and anchorage locations.
- C. Product Data: Provide joint assembly profiles, profile dimensions, anchorage devices, and available colors and finish.

1.4 REGULATORY REQUIREMENTS

- A. Fire Performance - Determined by ASTM E119 and ASTM E814 including hose stream test of full-rated period by UL 263.

- B. Fire-Resistive Joint Systems - Shall have been tested in accordance with CBC California Building Code, CCR, Title 24, Section 713.
- C. Loading Characteristics - Floor covers capable of withstanding a minimum point load of 2,000 lbs. without damage or permanent deformation.

1.5 DELIVERY, STORAGE AND HANDLING

- A. Deliver, store and protect products to site under provisions of Section 01 61 00.
- B. Deliver materials to site in as large as possible sections and assemblies.
- C. Provide temporary protective cover for finished metal surfaces.

2. PART 2 PRODUCTS

2.1 MANUFACTURERS

- A. Balco Metalines, www.balcousa.com.
- B. Conspec Systems, Inc., www.c-sgroup.com.
- C. Nystrom Building Products, www.nystrom.com.
- D. JointMaster, www.inprocop.com.
- E. M.H. Powell Co., www.seismicjoints.com.
- F. MM Systems Corporation, www.mmsystemscorp.com.
- G. Watson Bowman Acme, www.wbacorp.com.
- H. Substitutions: Under provisions of Section 01 25 13.

2.2 MATERIALS

- A. Structural Steel Shapes: ASTM A36.
- B. Steel Plates: ASTM A283, Grade C.
- C. Rolled Steel Plates: ASTM A786.
- D. Aluminum Extrusions: ASTM B221, 6063-T5 alloy.
- E. Aluminum Sheet and Plate: ASTM B209, 6061-T6 alloy.
- F. Stainless Steel: ASTM A167, Type 304.
- G. Extruded Preformed Seals: ASTM D2000, formed to fit frames.
- H. Elastomeric Sealant: ASTM C920.
- I. Water Barrier: PVC and thermoplastic rubber classified under ASTM D2000.
- J. Fire Barrier: High temperature insulation with metallic cover tested for required dynamic structural movement without fatigue. Component of joint cover tested in accordance with ASTM E119, CBC, California Building Code, (CCR) California Code of Regulations, Title 24, Section 713, and ASTM E814 including hose stream test.
- K. Abrasive Grit: Two component epoxy combined with aluminum oxide grit.

L. Threaded Fasteners: Stainless steel.

M. Backing Paint: Asphaltic type.

2.3 FABRICATION

- A. Aluminum cover plate, aluminum frame construction, with resilient elastomeric filler strip, designed to permit plus or minus 50 percent joint movement with full recovery, flush and recess mounted.
- B. Back paint components in contact with cementitious materials.
- C. Galvanize embedded ferrous metal anchors and fastening devices.
- D. Shop assemble components and package with anchors and fittings.
- E. Provide joint components in single length wherever practical. Minimize site splicing.
- F. Miter corners and changes in direction with hairline joints.
- G. Fabricate fire barrier and provide fire-resistant sealant required for fire-resistant installation in accordance with UL listing.

2.4 FINISHES

- A. Comply with NAAM Metal Finishes Manual.
- B. Clear Anodized Finish: AA-C22A41; medium matte etched finish with 0.7 mil thick anodic coating.
- C. Preformed Seals: Color as selected from manufacturer's entire range of available colors.
- D. Elastomeric Sealant: As selected from manufacturer's entire range of available colors.
- E. Stainless Steel: NAAMM-M32, mechanical finish, medium satin.
- F. Abrasive Grit: Color as selected from manufacturer's entire range of available colors.
- G. Factory Primed Concealed Surfaces: Shop coat of manufacturer's standard primer, minimum 2.0 mils thick.

3. PART 3 EXECUTION

3.1 EXAMINATION

- A. Verify existing conditions under provisions of Section 01 31 00.
- B. Verify that joint preparation and affected dimensions are acceptable.

3.2 PREPARATION

- A. Provide anchoring devices for installation and embedding.
- B. Provide templates and rough-in measurements.

3.3 INSTALLATION

- A. Install components and accessories in accordance with manufacturer's instructions.
- B. Align work plumb and level, flush with adjacent surfaces.
- C. Rigidly anchor to substrate to prevent misalignment. Locate not less than 3 inches from ends and at no more than 24 inches on center.

- D. Allow adequate free movement for thermal expansion and contraction of metal.
- E. Install preformed seals with minimum number of end joints.
- F. Heat seal field splice of preformed seals to watertight condition.
- G. Install secondary seals in continuous lengths without field splices.
- H. Install fire barrier in accordance with manufacturer's instructions and UL listing.

3.4 PROTECTION OF FINISHED WORK

- A. Protect finished Work under provisions of Section 01 61 00.
- B. Do not permit traffic over unprotected floor joint surfaces.
- C. Provide removable stripable coating to protect finish surface.

3.5 JOINT COVER SCHEDULE

	<u>JOINT LOCATION</u>	<u>MANUFACTURER</u>	<u>MODEL NUMBER</u>
A.	Interior Floor Joint	C/S Expansion	SJPF-400
B.	Interior Floor/Wall Joint	C/S Expansion	SJPFW-400
C.	Exterior Pavement Joint	C/S Expansion	AL-400 HD
D.	Interior Wall Joint	C/S Expansion	ASM-400
E.	Interior Wall Joint (Fire Rated)	C/S Expansion	ASM-200-FB
F.	Interior Wall/Ceiling Joint	C/S Expansion	SCC-400
G.	Interior Wall/Ceiling Joint (Fire Rated)	C/S Expansion	ASMC-200-FB
H.	Exterior Wall Joint	C/S Expansion	SF-400/ASM-400S/2VFR-200
I.	Ceiling Joint	C/S Expansion	ASM-400
J.	Exterior Wall Transition	C/S Expansion	SRJW-400
K.	Fire Rated Joint	C/S Expansion	SF-400 1 hr rated
L.	Roof Joint	C/S Expansion or Roofing Manufacturer	BRJ-400 EJ
M.	Roof/Wall Joint	C/S Expansion or Roofing Manufacturer	BRJW-400 EJ
N.	Double Parapet	C/S Expansion	SRJ-400

END OF SECTION

SECTION 08 11 13

HOLLOW METAL DOORS AND FRAMES

1. PART 1 GENERAL

1.1 WORK INCLUDED

- A. Non-rated and fire rated rolled steel doors and frames.
- B. Interior and exterior light frames.
- C. Louvers.

1.2 REFERENCES

- A. ANSI A250.8 - Recommended Specification for Standard Steel Doors and Frames.
- B. ANSI A250.3 - Test Procedure and Acceptance Criteria for Factory-Applied Finish Painted Steel Surfaces for Steel Doors and Frames.
- C. ANSI A250.10 - Test Procedure and Acceptance Criteria for Prime Painted Steel Surfaces for Steel Doors and Frames.
- D. ASTM A653 - Steel Sheet, Zinc Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.
- E. ASTM C665 - Standard Specification for Mineral-Fiber Blanket Thermal Insulation.
- F. ASTM A924 - General Requirements for Steel Sheet, Zinc-Coated (Galvanized) by the Hot-Dip Process.
- G. ASTM E136 - Standard Test Method for Behavior of Materials in a Vertical Tube Furnace.
- H. CEC - California Energy Commission.
- I. NFPA 80 - Fire Doors and Windows.
- J. SDI-105 - Recommended Erection Instructions for Steel Frames.
- K. DHI - Door and Hardware Institute.
- L. CBC - California Building Code, (CCR) California Code of Regulations, Title 24, Part 2 and Part 6.
- M. UL 9 - Fire Tests of Window Assemblies.
- N. UL 10C - Fire Tests of Door Assemblies.

1.3 QUALITY ASSURANCE

- A. Conform to requirements of ANSI A250.8.
- B. Fire rated door and frame construction to conform to UL 9 and UL 10C.
- C. Installed frame and door assembly to conform to NFPA 80 for fire rated class indicated on Drawings.
- D. Installed exterior frame and door assembly to be weather tight.
- E. Manufacturer shall have both fabrication and assembly plant located within the continental United States or Canada. Products that are either fabricated or assembled outside the continental United States or Canada are not acceptable.

1.4 PERFORMANCE REQUIREMENTS

- A. Thermal Performance: Glazed exterior borrowed lite, sidelite and transom lite frames shall have an overall minimum U-value of 0.71 as rated in accordance with the default table method approved by the California Energy Commission (CEC). Provide Certificate NRCC-ENV-05-E, from the Nonresidential Compliance Manual documenting compliance with the CBC, California Building Code, (CCR) California Code of Regulations, Title 24, Part 6, Section 110, Table 110.6-A.
- B. Solar Heat Gain Coefficient: Glazed exterior borrowed lite, sidelite and transom lite frames shall have an overall maximum solar heat gain coefficient of 0.73 as rated in accordance with default table method approved by the California Energy Commission (CEC). Provide Certificate NRCC-ENV-05-E, from the Nonresidential Compliance Manual documenting compliance with the CBC, California Building Code, (CCR) California Code of Regulations, Title 24, Part 6, Section 110, Table 110.6-B.

1.5 REGULATORY REQUIREMENTS

- A. Conform to CBC, California Building Code, (CCR) California Code of Regulations, Title 24, Part 2 for fire rated frames and doors.
- B. Conform to CBC, California Building Code, (CCR) California Code of Regulations, Title 24, Part 6, for U-value and solar heat gain coefficient.

1.6 SUBMITTALS

- A. Submit shop drawings under provisions of Section 01 33 00.
- B. Indicate frame configuration, anchor types and spacings, location of cutouts for hardware, reinforcement, and finish.
- C. Indicate door elevations, internal reinforcement, closure method, and cut outs for glazing and louvers.
- D. Submit two samples of exterior frame profile at mullion intersection.
- E. Submit Certificate NRCC-ENV-05-E, from the Nonresidential Compliance Manual documenting compliance with the CBC, California Building Code, (CCR) California Code of Regulations, Title 24, Part 6, Section 110, Table 110.6-A and 110.6-B.

1.7 DELIVERY, STORAGE AND PROTECTION

- A. Deliver, store, protect, and handle products under provisions of Section 01 61 00.
- B. Store products on site under cover.
- C. Place products on at least 4 inch wood sills to prevent rust and damage.
- D. Protect doors and frames with resilient packaging.

1.8 SEQUENCING AND SCHEDULING

- A. Sequence Work under the provisions of Section 01 11 00.
- B. Schedule Work under the provisions of Section 01 32 16.
- C. Schedule delivery of all doors and frames so as not to delay progress of other trades.

2. PART 2 PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

- A. Curries Mfg., Inc., www.curries.com.

- B. DCI Hollow Metal, www.dcihollowmetal.com.
- C. Fleming, www.flemingdoor.com.
- D. Krieger Steel Products Company, www.kriegersteel.com.
- E. Republic Builders Products Corporation, www.republicdoor.com.
- F. Security Metal Products, www.secmet.com.
- G. Steelcraft, www.steelcraft.com.
- H. Stiles Custom Metal, Inc., www.hollowmetal.com.
- I. Titan Metal Products, Inc., www.titanmetalinc.com.
- J. Substitutions: Under provisions of Section 01 25 13.

2.2 DOORS AND FRAMES

- A. Provide reinforcing steel with a minimum post-consumer recycled content of 50 percent.
- B. Exterior Doors: ANSI A250.8, Level 3, extra heavy-duty, Model 2, continuous welded seam, beveled edges, minimum 0.053 inch thick faces.
- C. Interior Doors: ANSI A250.8, Level 2 heavy duty, Model 1, beveled edges, minimum 0.042 inch thick faces.
- D. Exterior Frames: ANSI A250.8, Level 3, 0.067 inch thick material, core thickness.
- E. Interior Frames: ANSI A250.8, Level 2, 0.053 inch thick material, core thickness.

2.3 DOOR CORE

- A. Exterior Core: Polystyrene insulation.
- B. Interior Door Core: Impregnated cardboard honeycomb.

2.4 ACCESSORIES

- A. Louvers: Roll formed steel, prime coated, inverted 'Y' blade, sightproof, with countersink, tamperproof fasteners.
- B. Rubber Silencers: Resilient rubber as supplied by Section 08 71 00.
- C. Glazing Stops: Rolled steel channel shape, mitered corners; prepared for countersink style tamperproof screws at door installations, square butt at light frames.
- D. Mineral-Fiber Insulation: ASTM C665, Type 1, without membrane facing; slag or rock wool fibers; with maximum flame spread and smoke developed indexes of 25 and 50; passing ASTM E136 for combustion characteristics.

2.5 FRAME ANCHORS

- A. Masonry Anchors: Adjustable T-strap, 0.053 inch thick steel, corrugated, 2 inch x 10 inch size. Fire rated frames to have UL listed perforated strap anchor permanently anchored to frame.
- B. Metal Stud Anchor: Z type anchor, welded to frame, 0.053 inch thick steel, UL listed as required for fire rating.
- C. Wood Stud Anchor: U-shaped anchor, welded to frame, 1 inch wide, 0.053 inch thick steel, with 2 pre-punched holes in nailing flange. UL listed as required for fire rating.

- D. Existing Wall Anchor: 0.053 inch thick pipe spacer with 2 inch x 0.053 inch thick steel plate sized to accommodate a 3/8 diameter countersunk flathead expansion anchor. UL listed as required for fire rating.
- E. Floor Clip: Angle anchor, full width of frame, 0.067 inch thick steel.

2.6 PROTECTIVE COATINGS

- A. Rubberized Coating: Corrosion proofing and sound deadener compound. Equivalent to Rust-Oleum Professional Grade Rubberized Undercoating, www.rustoleum.com.
- B. Primer: Clean and treat with three stage iron phosphate process. Provide baked-on shop coat of EPA compliant gray synthetic rust - inhibitive enamel primer meeting acceptance criteria of ANSI 250.10.
- C. The frame underneath the glazing stops and the inside of the glazing stop area shall be treated for maximum paint adhesion and prime painted with a rust inhibitive primer prior to installation of the frame.

2.7 HARDWARE REINFORCEMENT

- A. Fabricate frames and doors with hardware reinforcement plates welded in place.
- B. Hinge reinforcing shall be full width of frame profile.
- C. Provide spacers for all thru-bolted hardware.
- D. Reinforcement components shall be the following minimum thickness:

1. Hinge (door and frame)	3/16 inch
2. Mortise Lock or Deadbolt	0.093 inch
3. Bored Lock or Deadbolt	0.093 inch
4. Flush Bolt Front	0.093 inch
5. Surface Bolt	0.093 inch
6. Surface Applied Closer	0.093 inch
7. Hold Open Arm	0.093 inch
8. Pull Plates and Bars	0.067 inch
9. Surface Exit Device	0.093 inch
10. Floor Checking Hinge	0.167 inch
11. Pivot Hinge	0.167 inch

2.8 FABRICATION

- A. When shipping limitations so dictate, frames for large openings shall be fabricated in sections designed for splicing.
- B. All spliced joints shall occur on the interior side of exterior frames.
- C. Fabricate frames as full profile welded units.
- D. All face, rabbet and soffit joints between abutting members shall be continuously welded and finished smooth when exposed to exterior.
- E. Corner joints shall have all contact edges closed tight, with faces mitered and continuously welded.

- F. Frames with multiple openings shall have mullion members fabricated with no visible seams or joints. All face, rabbet and soffit joints between abutted members shall be continuously welded and finished smooth when exposed to exterior.
- G. Provide 3/8 inch back bend return on frames where gypsum board wall material occurs whether on one or both sides.
- H. Mullions for Double Doors: Removable type supplied by Section 08 71 00.
- I. Dust cover boxes or mortar guards of 0.016 inch thick steel shall be provided at all hardware mortises on frames.
- J. Reinforce frames wider than 48 inches with roll formed, 0.093 inch thick steel channels fitted tightly and welded into frame head, inverted U-shape profile.
- K. Prepare frame for silencers except for frames which receive weatherstripping. Provide three single rubber silencers for single doors on strike side, and two single silencers on frame head at double doors without mullions.
- L. Provide steel spreader temporarily attached to feet of both jambs as a brace during shipping and handling. Spreader is not to be used for installation purposes.
- M. Attach fire rated label to each frame and door unit.
- N. Close top edge of exterior door flush with inverted steel channel closure. Weld all joints watertight.

2.9 MANUFACTURING TOLERANCE

- A. Manufacturing tolerance shall be maintained within the following limits:

1. Frame width	+1/16 inch -1/32 inch
2. Frame height	+3/64 inch
3. Frame face	+1/32 inch
4. Frame stop	+1/32 inch
5. Frame rabbet	+1/64 inch
6. Frame depth	+1/32 inch
7. Frame throat	+1/16 inch
8. Door width and height	+3/64 inch
9. Door thickness	+1/16 inch
10. Hardware location	+1/32 inch
11. Door flatness	+1/16 inch

2.10 FINISH

- A. Primer: Baked on rust-inhibitive enamel.
- B. Finish: Site paint under provisions of Section 09 90 00.
- C. Coat inside of frame profile for frames installed in masonry construction with rubberized undercoating to a thickness of 1/16 inch. Coating may be factory or site applied. Do not apply coating to fire rated frames.

3. PART 3 EXECUTION

3.1 INSTALLATION

- A. Install frames in accordance with SDI-105.
- B. Install doors in accordance with DHI.
- C. Install fire doors and frames in accordance with NFPA 80.
- D. Installation of exterior doors and frames to be weathertight and waterproof.
- E. Seal penetration of all surface applied screws on exterior face of frames at glass stops and hardware attachments.
- F. Coordinate installation with electrically controlled locks.
- G. Coordinate with wall construction and details for anchor placement. Provide anchors as follows:
 - 1. Frames up to 7'-6" height - 4 anchors each jamb.
 - 2. Frames 7'-6" to 8'-0" height - 5 anchors each jamb. Plus an additional anchor for each 2' or fraction thereof over 8'-0".
 - 3. Frames for Double Doors: Minimum of 2 anchors in head approximately 12 inches from each jamb.
 - 4. Borrowed Lite Frames: 2 anchors each jamb plus 1 for each 18 inches or fraction thereof over 3'-0". Minimum 2 anchors in head and sill approximately 12 inches from each jamb plus 1 for each 30 inches of length or fraction thereof.
 - 5. Floor anchors - 1 anchor each jamb for interior doors. Where wall construction will not allow placement of floor anchor, provide one additional jamb anchor as close to floor as possible.
 - 6. Existing wall anchors shall be welded to provide non-removable condition. Welded bolt head to be ground, dressed and finished smooth.
- H. Frames installed in masonry walls to be fully grouted with masonry grout.
- I. Exposed field welds to be finished smooth and touched up.
- J. Primed or painted surfaces which are scratched or marred shall be touched up.
- K. Hardware to be applied in accordance with hardware manufacturer's templates and instructions.
- L. Coordinate installation of glass and glazing.
- M. Install door louvers.
- N. Install roll formed steel reinforcement channels between two abutting frames. Anchor to structure and floor.
- O. Solidly pack mineral-fiber insulation into frames installed in exterior walls that are not solid grouted. For vertical and horizontal frame mullions that are inaccessible after frame assembly place insulation into frame before joining members together.

3.2 INSTALLATION TOLERANCES

A. Edge clearance for swinging doors shall not exceed the following:

- | | |
|--|----------|
| 1. Between door and frame at head and jamb | 1/8 inch |
| 2. Between edge of pair of doors | 1/8 inch |
| 3. At door sill with threshold (From bottom of door to top of threshold) | 3/8 inch |
| 4. At door sill with no threshold | 1/2 inch |
| 5. At door bottom and rigid floor covering per NFPA 80 | 1/2 inch |
| 6. At door bottom and nominal floor covering per NFPA 80 | 5/8 inch |

B. Frame installation tolerance shall not exceed the following:

- | | |
|------------------------|--------------|
| 1. Squareness | + -1/16 inch |
| 2. Alignment | + -1/16 inch |
| 3. Plumbness | + -1/16 inch |
| 4. Diagonal Distortion | + -1/32 inch |

END OF SECTION

SECTION 08 14 00

WOOD DOORS

1. PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Flush faced wood doors non-rated.

1.2 REFERENCES

- A. ANSI/WDMA - Wood Door Manufacturers Association I.S. 1-A-04-Architectural Wood Flush Doors.
- B. CBC - California Building Code, (CCR) California Code of Regulations, Title 24, Part 2.
- C. NWWDA I.S.1 - Industry Standard For Wood Flush Doors (Includes Standards I.S.1.1 through I.S.1.7).
- D. WI - Woodwork Institute North American Architectural Woodwork Standards 3.0.

1.3 QUALITY ASSURANCE

- A. Conform to requirements of The WI North American Architectural Woodwork Standards, Section 9 Custom Grade except where otherwise indicated.
- B. All wood doors and the installation of wood doors shall be monitored for compliance under the scope of the WI Certified Compliance Program (CCP).
- C. Issue a WI Certified Compliance Certificate prior to delivery of doors certifying that doors meet all requirements of WI Grade specified.
- D. After completion issue a WI Certified Compliance Certificate for Installation.

1.4 SUBMITTALS

- A. Submit shop drawings under provisions of Section 01 33 00. Shop drawings shall bear the WI Certified Compliance Label on the first page of each set.
- B. Submit samples under provisions of Section 01 33 00.

1.5 DELIVERY, STORAGE, AND PROTECTION

- A. Protect products under provisions of Section 01 61 00.
- B. Package, deliver, and store doors in accordance with WI requirements as set forth in Section 2 of The WI North American Architectural Woodwork Standards.

1.6 WARRANTY

- A. Provide manufacturer's standard lifetime warranty for interior doors under provisions of Section 01 77 00 for solid core doors.

2. PART 2 PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS, FLUSH FACED DOORS

- A. Algoma Hardwoods, www.algomahardwoods.com.
- B. Door America-American Building Supply, Inc., www.dooramerican.com.
- C. Eggers Industries, www.eggiersindustries.com.

- D. Haley Architectural Doors, www.haleybros.com.
- E. Oshkosh Door Co., www.oshkoshdoor.com.
- F. Marshfield Door Systems, Inc., www.marshfelddoors.com.
- G. V.T. Industries, www.vtindustries.com.
- H. Substitutions: Under provisions of Section 01 25 13.

2.2 ACCEPTABLE MANUFACTURERS, STILE AND RAIL DOORS

- A. Algoma Hardwoods, www.algomahardwoods.com.
- B. Door America-American Building Supply, Inc., www.dooramerican.com.
- C. Eggers Industries, www.eggersindustries.com.
- D. Pinecrest, www.pinecrestinc.com.
- E. Simpson Door Co., www.simpsondoor.com.
- F. Sun-Dor-Co., www.sundorco.com.
- G. The Maiman Co., www.maiman.com.
- H. Marshfield Door Systems, Inc., www.marshfelddoors.com.
- I. Substitutions: Under provisions of Section 01 25 13.

2.3 DOOR CONSTRUCTION

- A. Lumber Materials: FSC - Forest Stewardship Council certified sustainable harvested wood.
- B. Solid Non-rated Core: Solid wood block, framed block glued, or solid particleboard.
- C. Hollow Core: NWWDA I.S.1; mesh or cellular core including lock blocks, vertical edge bands, and top and bottom rails.
- D. Solid, Special Function Core: Labeled fire performance type, UL 10C, Category A. Intumescent seals concealed by outer stile in matching veneer.
- E. Construction: WI, Custom grade, ANSI/WDMA extra heavy duty, 5 ply, manufactured as an edge bonded, sanded core assembly, laminated in a one-step, hot pressed operation. Cold-press method is not acceptable.
- F. Flush Interior Door Veneer:
 - 1. Red Oak species; plain sliced with slip matched grain, for transparent stain finish. Satin sheen. Factory finish. Color as selected.

2.4 ADHESIVES

- A. Interior Doors: WI Type I.

2.5 FABRICATION

- A. Fabricate non-rated wood doors to requirements of The WI North American Architectural Woodwork Standards, Section 9, in the WI Grade specified.
- B. Premachine doors for finish hardware.

3. PART 3 EXECUTION

3.1 INSTALLATION

- A. Install doors in accordance with The WI North American Architectural Woodwork Standards Section 9.
- B. Conform to WI and NFPA requirements for fit tolerances.
- C. Adjust doors for smooth and balanced movements.

3.2 INSTALLATION TOLERANCES

- A. Edge clearance for swinging doors shall not exceed the following as required by WI and NFPA 80:

1. Between door and frame at head and jamb	1/8 inch
2. Between edge of pair of doors	1/8 inch
3. Diagonal distortion	1/8 inch
4. At door sill with threshold. (From bottom of door to top of threshold)	3/8 inch
5. At door sill with no threshold	1/2 inch
6. At door bottom and rigid floor covering per NFPA 80	1/2 inch
7. At door bottom and nominal floor covering per NFPA 80	5/8 inch

END OF SECTION

SECTION 08 31 00

ACCESS DOORS AND FRAMES

1. PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Non-rated access doors and frames.
- B. Wall and ceiling locations.
- C. Installation schedule.

1.2 REFERENCES

- A. UL - Underwriters Laboratories.

1.3 QUALITY ASSURANCE

- A. Manufacture fire rated access doors and frames to conform to UL requirements.
- B. Provide labels indicating rating.

1.4 SUBMITTALS

- A. Submit product data under provisions of Section 01 33 00.
- B. Include sizes, types, finishes, scheduled locations, and details of adjoining work.

2. PART 2 PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

- A. Elmdor Manufacturing Co., www.elmdorstoneman.com.
- B. Karp Associates Inc., www.karpinc.com.
- C. J.L. Industries, www.jlindustries.com.
- D. MIFAB, www.mifab.com.
- E. Milcor Incorporated, www.milcorinc.com.
- F. Nystrom Incorporated, www.nystrom.com.
- G. Substitutions: Under provisions of Section 01 25 13.

2.2 ACCESS UNITS

- A. Fire Rated Wall and Ceiling Units: Equivalent to Milcor Flush Panel Universal Fire Rated access door, Model UFR, with sandwich type door panel with 1-1/2 hour B label fire rating.
- B. Non-Rated Wall Units: Equivalent to Milcor Flush Panel Style M and MS.
- C. Non-Rated Gypsum Board Ceiling Units: Equivalent to Milcor recessed panel Style ATR.
- D. Non-Rated Plaster Ceiling and Wall Units: Equivalent to Milcor flush panel Style K.
- E. Non-Rated Applied Acoustic Tile Ceiling Units: Equivalent to Milcor recessed panel Style AT.
- F. Size: As required for proper access.

2.3 FABRICATION

- A. Fire Rated Units: Fabricate frame of 0.0538 inch thick steel and door panels 0.0329 inch thick steel pans insulated with non-combustible filler.

- B. Non-Rated Units: Fabricate frames of 0.0538 inch thick steel and door panels of 0.0329 inch thick steel.
- C. Weld, fill, and grind joints to assure flush and square unit.
- D. Hardware: Continuous type steel hinges with stainless steel pin, cylinder lock with latch, two keys for each unit.
- E. Anchors: Provide masonry anchors where required for wall construction.

2.4 FINISH

- A. Prime coat units with baked on electrostatic primer.
- B. Stainless steel.
- C. Site paint primed metal surfaces under provision of Section 09 90 00.

3. PART 3 EXECUTION

3.1 INSPECTION

- A. Verify rough openings for door and frame are correctly sized and located.
- B. Beginning of installation means acceptance of existing conditions.

3.2 INSTALLATION

- A. Install frame plumb, level, and flush in wall and ceiling openings.
- B. Position to provide convenient access to concealed work requiring access.
- C. Secure rigidly in place in accordance with manufacturer's instructions.
- D. Install sealant material around units as specified in Section 07 92 00.

3.3 INSTALLATION SCHEDULE

- A. Provide access doors in locations and in sizes required for all mechanical, plumbing and electrical equipment for proper adjustment, maintenance and general access required by code.
- B. Provide access doors in the following quantities:
 - 1. 30 non-rated, flush panel, prime painted wall access doors.
 - 2. 30 non-fire rated, flush panel, stainless steel wall access doors.
 - 3. 30 non-fire rated, recessed panel, gypsum board ceiling access doors.
 - 4. 30 non-fire rated, recessed panel, applied acoustic tile ceiling access doors.
- C. Install prime painted units at all locations except at toilets, kitchens, showers and similar spaces.
- D. Install stainless steel units at all toilets, kitchens, showers, and similar spaces.

END OF SECTION

SECTION 08 33 23

OVERHEAD COILING DOORS

1. PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Standard overhead coiling doors; fire rated and non-fire rated manual or electric operated; pre-finished finish.
- B. Non-fire rated overhead coiling counter service doors, crank operation, stainless steel finish.

1.2 REFERENCES

- A. ASTM A480 - Flat Rolled Stainless Heat Resisting Steel Plate, Sheet, and Strip.
- B. ASTM A653 - Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron, Alloy-Coated (Galvannealed) by the Hot-Dip Process.
- C. ASTM A924 - General Requirements for Steel Sheet, Zinc-Coated (Galvanized) by the Hot-Dip Process.
- D. UL - Underwriters' Laboratories, Inc.
- E. NFPA 80 - Fire Doors and Windows.

1.3 SUBMITTALS

- A. Submit shop drawings and product data under provisions of Section 01 33 00.
- B. Provide pertinent dimensioning, general construction, component connections and details, anchorage methods, hardware location, and installation details.
- C. Submit manufacturer's installation instructions under provisions of Section 01 33 00.

1.4 REGULATORY REQUIREMENTS

- A. Fire-Rated Door Assemblies: Shall comply with NFPA 80 and be listed and labeled by a qualified testing agency, for fire-protection ratings indicated, based on testing according to NFPA 252.
- B. Smoke Control: In corridors and smoke barriers, doors shall be listed and labeled with the letter "S" on the fire-rating label by a qualified testing agency for smoke- and draft-control based on testing according to UL 1784. Equip each fire-rated door with smoke-seal perimeter gaskets for smoke and draft control as required for door listing and labeling.

1.5 OPERATION AND MAINTENANCE DATA

- A. Submit manufacturer's operation and maintenance data under provisions of Section 01 77 00.

2. PART 2 PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS - OVERHEAD COILING DOORS

- A. Atlas Door Corp./Cornell Iron Works, www.cornelliron.com.
- B. The Cookson Company, www.cooksondoor.com.
- C. Lawrence Roll-Up Doors, Inc., www.lawrencedoors.com.
- D. Overhead Door Corp., www.overheaddoor.com.
- E. Raynor, www.raynor.com.

- F. Wayne Dalton Corp., www.wayne-dalton.com.
- G. Windsor Door, www.windsordoor.com.
- H. Substitutions: Under provisions of Section 01 25 13.

2.2 ACCEPTABLE MANUFACTURERS - ACOUSTIC AND RATED OVERHEAD COILING DOORS

- A. McKeon Door, www.mckeondoors.com.
- B. Substitutions: Under provisions of Section 01 25 13.

2.3 ACCEPTABLE MANUFACTURERS - COUNTER SERVICE DOORS

- A. Atlas Door Corp./Cornell Iron Works, www.cornelliron.com.
- B. The Cookson Co., www.cooksondoor.com.
- C. Lawrence Roll-Up Doors, Inc., www.lawrencedoors.com.
- D. Overhead Door Corp., www.overheaddoor.com.
- E. Raynor, www.raynor.com.
- F. The Peelle Co., www.peelldoor.com.
- G. Wayne Dalton Corp., www.wayne-dalton.com.
- H. Substitutions: Under provisions of Section 01 25 13.

2.4 MATERIALS - OVERHEAD COILING DOORS (OUTDOOR EQUIP./TRASH ENCLOSURES)

- A. Curtain: Minimum 0.0269 inch thick flat slats of steel, ASTM A653, Commercial Steel, Type A, G60 galvanized coating in accordance with ASTM A924; 2-1/4 inches nominal width x required length; ends of alternate slats fitted with endlocks to act as wearing surface in guides and to prevent lateral movement; bottom fitted with angles to provide reinforcement and positive contact with floor in closed position.
- B. Curtain Guides: Formed steel channels and angles for required sizes and configurations.
- C. Roller Shaft (Counterbalance): Steel pipe and helical steel spring system capable of producing sufficient torque to assure easy operation of curtain from any position; adjustable spring tension.
- D. Housing: 0.020 inch thick galvanized steel; internally reinforced to maintain rigidity and form.
- E. Weatherstripping: Water and rot proof, resilient type; located along jamb edges, bottom of curtain, and within housing.
- F. Hardware: As specified in Section 08 71 00.
- G. Manual Operation: Hand lift on bottom bar.

2.5 MATERIALS - INSULATED OVERHEAD COILING DOORS

- A. Insulated Curtain: Minimum 0.0269 inch thick flat slats of steel with backpanels, ASTM A653, commercial steel, Type A, G60; galvanized coating in accordance with ASTM A924; 2-7/8 inches wide x required length; ends of alternate slats fitted with endlocks to act as wearing surface in guides and to prevent lateral movement; bottom fitted with aluminum extrusion to provide reinforcement and positive contact with floor in closed position. Slats to be filled with foamed-in-place polyurethane insulation.
- B. Curtain Guides: Formed steel channels and angles for required sizes and configurations.

- C. Roller Shaft (Counterbalance): Steel pipe and helical steel spring system capable of producing sufficient torque to assure easy operation of curtain from any position; adjustable spring tension.
- D. Housing: 0.020 inch thick galvanized steel; internally reinforced to maintain rigidity and form.
- E. Weatherstripping: Water and rot proof, resilient type; located along jamb edges, bottom of curtain, and within housing.
- F. Hardware: As specified in Section 08 71 00.
- G. Chain Hoist Operation: Continuous hand chain hoist with gear reduction.
- H. Electric Operator: UL Approved in accordance with UL 325; side mounted 460 volt, three phase 60 Hz supply to one (1) hp electric motor; adjustable friction clutch, double shoe brake system actuated by independent full line voltage solenoid controlled by motor starter; fully enclosed positive gear driven limit switch; fully enclosed magnetic cross line reversing starter.
 - 1. Control Station: Standard three button (open-close-stop) control for each operator; surface mounted. Locate on interior (can) side.
 - 2. Safety Device: Located at bottom of doors, with width; electro-mechanical type; wired to reverse door upon striking object; neoprene or rubber covered to provide weather seal.

2.6 ACOUSTICAL AND FIRE RATED DOORS (KITCHEN AND THEATER)

- A. Basis for design: Acoustical fire and smoke rated doors shall be Auto-Set System Model FSFD-STC-HC-G as manufactured by McKeon Door Company. Door shall be certified by and accredited acoustical testing laboratory and approved with a minimum 34 STC rating.
- B. Curtain: Shall be assembled of interlocking galvanized steel slats. Slats shall have endlocks locking each end of the all alternate slats to act as a wearing surface and maintain slat alignment. Curtain shall be formed of 20-gauge front and back panels slats. The void of the curtain slats shall be filled with acoustical insulation and the front and back panel slats must have a positive interlock. Slats with snap-in back panels are not acceptable.
 - 1. Slats: Shall be of a cross section not less than 3" wide by 1 7/16" deep.
- C. Bottom Bar: Shall consist of two (2) angles, each not less than 2" x 2" x 1/8" steel formed to fit slats. Bottom bar shall be provided with continuous form fitted acoustical seals.
- D. Guides: Each guide assembly shall be fabricated of a minimum 3" x 3" steel support angle or tube, a 3" x 4" inner guide angle and a 4" x 4" outer guide angle. Support tubes shall be constructed with a slip joint at the top to provide for thermal expansion and guide angles shall be provided with slotted holes to allow for thermal expansion.
 - 1. Acoustical Seals: Provide acoustical seals as required to maintain the minimum 34 STC rating.
- E. Mounting Brackets: Fabricated of hot rolled 3/16" steel plate minimum, brackets shall be provided to house ends of the counterbalance barrel assembly.
- F. Hood: Shall be provided to entirely enclose curtain and counterbalance barrel assembly. Hood shall be fabricated 22-gauge galvanized steel and designed to match brackets. Top and bottom shall be bent and reinforced for stiffness.
 - 1. Sound Baffle: Provide self-adjusting internal sound baffle with integral external acoustical seals as required to maintain the minimum 34 STC rating.
- G. Counterbalance Assembly: Acoustical fire door shall be counterbalanced by means of adjustable steel helical torsion springs attached to shaft enclosed in pipe with required mounting blocks or rings for attachment of curtain. Grease sealed bearings or self-lubricating graphite bearings shall be attached to the spring barrel which shall be fabricated of hot formed structural quality carbon steel seamless pipe.

- H. Electric Motor Operator: Fire door shall be provided with a compact power unit designed and built by the door manufacturer. Operator shall be equipped with an adjustable screw-type limit switch to break the circuit at termination of travel. High efficiency planetary gearing running in an oil bath, shall be furnished together with a centrifugal governor, magnetic operated brake and a fail-safe magnetic release device, completely housed to protect against damage, dust and moisture. An efficient overload protection device, which will break the power circuit and protect against damage to the motor windings shall be integral with the unit. Operator is to be housed in a NEMA Type 1 enclosure.
1. Motor: Shall be intermediate duty, thermally protected, ball bearing type with a Class A or better insulation. Horsepower of motor is to be 1/3 hp minimum or of manufacturer's recommended size, whichever is greater.
 2. Starter: Shall be size "0" magnetic reversing starter, across the line type with mechanical and electrical interlocks, with 10-amp continuous rating and 24 volt control circuit. Reducer: Planetary gear type, 80% efficiency minimum.
 3. Brake: Magnetically activated, integral within the operator's housing.
 4. Control Station: Provide flush mount key switch control station marked open, close and stop.
- I. Self-Closing Mechanism: The fire door is to be designed with a centrifugal governor as an integral part of the operator's construction. The automatic release mechanism shall be activated by a fusible link, smoke detector or fire alarm. When activated the door is released and begins to close due to gravitational force. The speed of the door is governed by a centrifugal governor, designed to match the normal operating speed of the door, at a rate of not greater than 9" per second or less than 6" per second.
- J. Magnetic Release with 10 Second Time Delay: A fail-safe magnetic release device shall be built into the operator as an integral part of the release mechanism. When power is interrupted to the release mechanism by the smoke detector or fire alarm, the door shall begin to self-close. In the event of power failure the time delay shall prevent the fire door from closing for a period of 10 seconds. Once the 10 seconds have lapsed, the fire door shall self-close. Once power has been restored to the release mechanism the automatic reset time delay as well as the fire door shall automatically reset themselves.
- K. Obstruction Sensing Safety Edge: The fire door shall be designed with an obstruction sensing safety edge. In the event that the safety edge meets an obstruction during the normal closing operation, the door shall stop, reverse and return to the open position. In the event the safety edge meets an obstruction during the self-closing operation, the door shall come to rest on the obstruction and once the obstruction has been removed the fire door shall continue to the fully closed position.
- L. Easy Trip Test Feature: The fire door shall be designed so that it may be trip tested simply by cutting power to the operator. By turning the power switch off, the door shall self-close. Once the fire door has satisfactorily closed, it shall be reset simply by turning the power back on. No ladders or tools shall be needed to reset the door or the time delay unit.
- M. True Test Panel: Fire doors shall be provided with a True Test panel. The test panel shall activate all the fire doors to close via gravity not power and shall be in accordance with NFPA Bulletin 80. Only one test panel shall be required to test all the fire doors on this project.
- N. Finish: After completion of fabrication, clean all metal surfaces to remove dirt and chemically treat to provide for powder coat adhesion. Provide powder coat finish of color as selected by architect from manufacturer's standard RAL powder coat selection chart.

2.7 MATERIALS - COUNTER SERVICE DOORS

- A. Curtain: ASTM A480, 0.031 inch thick Type 304 stainless steel flat slats fitted with endlocks to maintain proper alignment; stainless steel angle bottom bar with lift handles and slide bolts to lock curtain closed at each jamb.
- B. Frame: ASTM A480, 0.063 inch thick Type 304 stainless steel frame, hood and fascia with grooves formed into jambs for retaining curtain; 0.078 inch thick Type 304 stainless steel sill.

- C. Roller Shaft (Counterbalance): Steel pipe and helical steel spring system capable of producing sufficient torque to assure easy operation of curtain from any position; adjustable spring tension.
- D. Operation: Crank operated.

2.8 FIRE LABELED ASSEMBLIES

- A. Labeled Assemblies: Shall have automatic magnetic release linked to smoke detection system. Equivalent to Overhead Door Corp., Fire Sentinel Model FS-C+ with uninterruptable power supply option. Complete assembly shall bear a UL Label for Frame and Fire Door Assembly Rating of 1-1/2 "B".

2.9 FINISH

- A. Overhead Coiling Doors: Galvanized steel factory primed and pre-finished in powder-coat paint finish in color selected by Architect.
- B. Counter Service Doors: Stainless steel, No. 4 finish.

3. PART 3 EXECUTION

3.1 INSTALLATION

- A. Install overhead coiling doors, and counter service doors in accordance with manufacturer's instructions. Coordinate installation with electric service.
- B. Fit, align, and adjust door assemblies level and plumb; provide smooth operation.
- C. Install fire-rated doors in compliance with NFPA 80.
- D. Test door closing when activated by smoke-detector fire-release system. Reset door-closing mechanism after successful test.

3.2 INSTALLATION (ACOUSTICAL AND FIRE RATED DOORS)

- A. Perform installation using only factory approved and certified representatives of the door manufacturer.
- B. Install door assemblies at locations shown in perfect alignment and elevation, plumb, level, straight and true.
- C. Adjust door installation to provide uniform clearances and smooth non-binding operation.
- D. Install wiring in accordance with applicable local codes and the National Electrical Code Standard. Materials shall be UL listed.
- E. Test door closing sequence when activated by the building's fire alarm system. Reset door after successful test.

END OF SECTION

SECTION 08 34 00 - BULLET RESISTANT DOORS AND FRAMES**PART 1 - GENERAL****1.1 RELATED DOCUMENTS**

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY**A. Section Includes:**

- 1. Bullet resistant hollow metal door and frame assemblies tested in accordance with UL752 and in compliance with the following:
 - a. Level 3: .44 Magnum Lead Semi-Wadcutter Gas Checked: 3 shots.

B. Related Sections:

- 1. Division 08 Section "Glazing" for glass view panels in bullet resistant doors.
- 2. Division 08 Sections "Door Hardware" and "Access Control Hardware" for door hardware for bullet resistant doors and frames.
- 3. Division 09 Section "Interior Painting" for field painting hollow metal doors and frames.
- 4. Division 26 "Electrical" Sections for electrical connections including conduit and wiring for door controls and operators installed on frames with factory installed electrical knock out boxes.
- 5. Division 28 Section "Access Control" for access control devices installed at door openings and provided as part of a security access system.

C. Codes and References: Comply with the version year adopted by the Authority Having Jurisdiction.

- 1. ANSI/SDI A250.8 - Recommended Specifications for Standard Steel Doors and Frames.
- 2. ANSI/SDI A250.4 - Test Procedure and Acceptance Criteria for Physical Endurance for Steel Doors, Frames, Frames Anchors and Hardware Reinforcing.
- 3. ANSI/SDI A250.6 - Recommended Practice for Hardware Reinforcing on Standard Steel Doors and Frames.
- 4. ANSI/SDI A250.10 - Test Procedure and Acceptance Criteria for Prime Painted Steel Surfaces for Steel Doors and Frames.
- 5. ANSI/SDI A250.11 - Recommended Erection Instructions for Steel Frames.
- 6. ASTM A1008 - Standard Specification for Steel Sheet, Cold-Rolled, Carbon, Structural, High-Strength Low-Alloy and High-Strength Low-Alloy with Improved Formability.

7. ASTM A653 - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.
8. ANSI/BHMA A156.115 - Hardware Preparation in Steel Doors and Frames.
9. ANSI/SDI 122 - Installation and Troubleshooting Guide for Standard Steel Doors and Frames.
10. ANSI/NFPA 80 - Standard for Fire Doors and Fire Windows; National Fire Protection Association.
11. NFPA 252 - Standard Methods of Fire Tests of Door Assemblies; National Fire Protection Association.
12. UL 10C (1998) - Positive Pressure Fire Tests of Door Assemblies; UL 1784 (2001) - Standard for Air Leakage Tests of Door Assemblies.
13. UL752: Bullet Resistant Equipment.
14. TM5-855-1 - Fundamentals of Design for Conventional Weapons; Department of the Army.
15. TM5-1300 - Structures to Resist the Effects of Accidental Explosions.

1.3 SUBMITTALS

- A. Product Data: For each type of product indicated. Include construction details, material descriptions, core descriptions, hardware reinforcements, profiles, anchors, fire-resistance rating, and finishes.
- B. Templates: Door hardware supplier is to furnish templates, template reference number and/or physical hardware to the steel door and frame supplier in order to prepare the doors and frames to receive the finish hardware items.
- C. Shop Drawings: Include the following:
 1. Elevations of each door design.
 2. Details of doors, including vertical and horizontal edge details and metal thicknesses.
 3. Frame details for each frame type, including dimensioned profiles and metal thicknesses.
 4. Locations of reinforcement and preparations for hardware.
 5. Details of each different wall opening condition.
 6. Details of anchorages, joints, field splices, and connections.
 7. Details of accessories.
 8. Details of moldings, removable stops, and glazing.
 9. Details of preparations for power, signal, and control systems.
- D. Samples for Verification:
 1. Samples are only required by request of the architect and for manufactures that are not current members of the Steel Door Institute.

1.4 QUALITY ASSURANCE

- A. Manufacturers Qualifications: Obtain bullet resistant door and frame assemblies through one source from a single manufacturer with a minimum **[5]** years of documented experience

producing bullet resistant door and frame type work similar to that indicated for this Project and that have a proven record of successful in-service performance.

- B. Bullet resistant door and frame assemblies to be certified by an independent laboratory to applicable UL standards.
 - 1. Provide bullet resistant assemblies with minimum UL752, Level [3] rating.
- C. Fire-Rated Door Assemblies: Assemblies complying with NFPA 80 that are listed and labeled by a qualified testing agency, for fire-protection ratings indicated, based on testing at positive pressure according to NFPA 252 (neutral pressure at 40" above sill) or UL 10C.
 - 1. Oversize Fire-Rated Door Assemblies Construction: For units exceeding sizes of tested assemblies provide certification by a qualified testing agency that doors comply with standard construction requirements for tested and labeled fire-rated door assemblies except for size.
 - 2. Temperature-Rise Limit: Where indicated and at vertical exit enclosures (stairwell openings) and exit passageways, provide doors that have a maximum transmitted temperature end point of not more than 450 deg F above ambient after 30 minutes of standard fire-test exposure.
- D. Smoke-Control Door Assemblies: Comply with NFPA 105.
- E. Pre-Installation Conference: Conduct conference in compliance with requirements in Division 01 Section, "Project Meetings" with attendance by representatives of Supplier, Installer, and Contractor to review proper methods and procedures for installing bullet resistant doors and frames and to verify installation of electrical knockout boxes and conduit at frames with electrified or access control hardware.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Deliver bullet resistant hollow metal work palletized and crated to provide protection during transit and Project-site storage. Do not use non-vented plastic.
- B. Deliver welded frames with two removable spreader bars across bottom of frames, tack welded to jambs and mullions.
- C. Store bullet resistant hollow metal work under cover at Project site. Place in stacks of five units maximum in a vertical position with heads up, spaced by blocking, on minimum 4-inch-high wood blocking. Do not store in a manner that traps excess humidity.
 - 1. Provide minimum 1/4-inch space between each stacked door to permit air circulation. Door and frames to be stacked in a vertical upright position.

1.6 PROJECT CONDITIONS

- A. Field Measurements: Verify actual dimensions of openings by field measurements before fabrication.

1.7 COORDINATION

- A. Coordinate installation of anchorages for bullet resistant hollow metal frames. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors. Deliver such items to Project site in time for installation.

1.8 WARRANTY

- A. Provide manufacturer's written 5 year warranty against defects in materials and workmanship upon final completion and acceptance of Work in this section.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. CECO Door Products (C).
 - 2. Curries Company (CU).
 - 3. Security Metal Products (SMP).
- B. Substitutions: Material from alternate bullet resistant door and frame fabricators will not be accepted on jobsite without prior written and sample approval in accordance with requirements specified in Division 01.

2.2 MATERIALS

- A. Cold-Rolled Steel Sheet: ASTM A 1008/A 1008M, Commercial Steel (CS), Type B; suitable for exposed applications.
- B. Metallic-Coated Steel Sheet: ASTM A 653/A 653M, Commercial Steel (CS), Type B; with minimum G60 metallic coating.
- C. Frame Anchors: ASTM A 653/A 653M, Commercial Steel (CS), Commercial Steel (CS), Type B; with minimum G60 metallic coating.

2.3 BULLET RESISTANT HOLLOW METAL DOORS

- A. General: Provide 1-3/4 inch doors of type and design indicated, not less than thickness indicated; fabricated with smooth surfaces, without visible joints or seams on exposed faces unless otherwise indicated. Comply with ANSI/SDI A250.8.
 - 1. Design: Flush panel.
 - 2. Core Construction: Manufacturer's standard bullet resistant door core construction designed and tested for the specified UL752 standard Level rating.
 - a. Fire Door Core: As required to provide fire-protection level specified.
 - 3. Level/Model: Level 3 and Physical Performance Level A (Extra Heavy Duty), Minimum 14 gage (0.067-inch -thick steel, Model 2 (Fully welded, seamless face and edges).
 - 4. Vertical Edges: Vertical edges to have the face sheets joined by a continuous weld extending the full height of the door. Welds are to be ground, filled and dressed smooth. Beveled Edge, 1/8 inch in 2 inches.
 - 5. Top and Bottom Edges: Reinforce tops and bottoms of doors with a continuous steel channel not less than 12 gage (0.105-inch -2.7 mm), extending the full width of the door and welded to the face sheet. Finish top and bottom to provide a smooth flush condition.
 - 6. Surface Applied Hardware Reinforcements: Fabricate according to ANSI/SDI A250.6 with reinforcing plates from same material as door face sheets.

2.4 BULLET RESISTANT HOLLOW METAL FRAMES

- A. General: Provide frames of the type and profile indicated, not less than thickness indicated; to comply with ANSI/SDI A250.8.
 - 1. Fabricate frames with mitered corners.
 - 2. Fabricate frames with "closed and tight" mitered, full depth continuously welded seams, finished smooth with no visible seam unless otherwise indicated. Knock down type frames are not permitted.
 - 3. Minimum 14 gage (0.067-inch -thick steel sheet.
- B. Fire rated frames: Fabricate frames in accordance with NFPA 80, listed and labeled by a qualified testing agency, for fire-protection ratings indicated.
- C. Surface Applied Hardware Reinforcements: Fabricate according to ANSI/SDI A250.6 Table 4 with reinforcement plates from same material as frames.

2.5 FRAME ANCHORS

- A. Jamb Anchors:

1. Masonry Type: Adjustable strap-and-stirrup anchors to suit frame size, not less than 16 gage thickness, with corrugated or perforated straps not less than 2 inches wide by 10 inches long.
- B. Floor Anchors: Floor anchors to be provided at each jamb. Formed from same material as frames, not less than 14 gage (0.067-inch -thick).
- C. Mortar Guards: Provide minimum 26 gage mortar guards welded to the back of each hardware cutout.

2.6 FABRICATION

- A. Fabricate bullet resistant hollow metal work to be rigid and free of defects, warp, or buckle. Accurately form metal to required sizes and profiles, with minimum radius for thickness of metal. Where practical, fit and assemble units in manufacturer's plant. When shipping limitations so dictate, frames for large openings are to be fabricated in sections for splicing or splining in the field by others.
- B. Tolerances: Fabricate bullet resistant hollow metal work to tolerances indicated in ANSI/SDI A250.8.
- C. Bullet Resistant Hollow Metal Doors:
 1. Exterior Doors: Provide weep-hole openings in bottom of exterior doors to permit moisture to escape.
 2. Astragals: Provide overlapping astragals on one leaf of pairs of doors where required for bullet resistance level standard or by NFPA 80 for fire-performance rating. Extend minimum 3/4 inch beyond edge of door on which astragal is mounted.
 3. Continuous Hinge Reinforcement: Provide welded continuous 12 gage strap for continuous hinges specified in hardware sets in Division 08 Section, "Door Hardware".
- D. Bullet Resistant Hollow Metal Frames: Where frames are fabricated in sections due to shipping or handling limitations, provide alignment plates or angles at each joint, fabricated of same thickness metal as frames.
 1. Welded Frames: Full depth continuously weld frame seams; grind, fill, dress, and make smooth and flush.
 - a. Welded frames are to be provided with two steel spreaders temporarily attached to the bottom of both jambs to serve as a brace during shipping and handling. Spreader bars are for bracing only and are not to be used to size the frame opening.
 2. High Frequency Hinge Reinforcement: Provide 12 gage angle reinforcements for butt type hinges on every door and frame assembly.
 3. Continuous Hinge Reinforcement: Provide welded continuous 12 gage straps for continuous hinges specified in hardware sets in Division 08 Section, "Door Hardware".

4. Electrical Knock Out Boxes: Factory weld 18 gage electrical knock out boxes to frame for electrical hardware preps; this includes but not limited to electric through wire transfer hardware, electrical raceways and wiring harnesses, door position switches, electric strikes, magnetic locks, and jamb mounted card readers as noted in door hardware sets in Division 08 Section, "Door Hardware".
 - a. Provide electrical knock out boxes as required for Project.
 - b. Conduit to be coordinated and installed in the field (Division 26) from middle hinge box and strike box to door position box.
 - c. Electrical knock out boxes to comply with NFPA requirements and fit electrical door hardware as specified in hardware sets in Division 08 Section, "Door Hardware".
 - d. Electrical knock out boxes for continuous hinges should be located in the center of the vertical dimension on the hinge jamb.
5. Floor Anchors: Weld anchors to bottom of jambs and mullions with at least four spot welds per anchor.
6. Jamb Anchors: Provide number and spacing of anchors as follows:
 - a. Masonry Types: Locate anchors not more than 18 inches from top and bottom of frame. Space anchors not more than 32 inches o.c. and as follows:
 - 1) Four anchors per jamb plus 1 additional anchor per jamb for each 24 inches or fraction thereof above 84 inches high.
- E. Surface Hardware Preparation: Factory prepare bullet resistant hollow metal work to receive template mortised hardware; include cutouts, reinforcement, mortising, drilling, and tapping according to the Door Hardware Schedule and templates furnished as specified in Division 08 Section, "Door Hardware."
 1. Locate hardware as indicated, or if not indicated, according to ANSI/SDI A250.8.
 2. Reinforce doors and frames to receive non-template, mortised and surface-mounted door hardware.
 3. Comply with applicable requirements in ANSI/SDI A250.6 and ANSI/DHI A115 Series specifications for preparation of bullet resistant hollow metal work for hardware.
 4. Coordinate locations of conduit and wiring boxes for electrical connections with Division 26 Sections.

2.7 STEEL FINISHES

- A. Prime Finish: Doors and frames to be cleaned, and chemically treated to insure maximum finish paint adhesion. Surfaces of the door and frame exposed to view to receive a factory applied coat of rust inhibiting shop primer.
 1. Shop Primer: Manufacturer's standard, fast-curing, lead and chromate free primer complying with ANSI/SDI A250.10 acceptance criteria; recommended by primer manufacturer for substrate; compatible with substrate and field-applied coatings despite prolonged exposure.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
- B. General Contractor to verify the accuracy of dimensions given to door and frame manufacturer for existing openings or existing frames (strike height, hinge spacing, hinge back set, etc.).
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Remove welded-in shipping spreaders installed at factory. Restore exposed finish as required to make repaired area smooth, flush, and invisible on exposed faces.
- B. Prior to installation, adjust and securely brace welded bullet resistant hollow metal frames for squareness, alignment, twist, and plumbness.
- C. Tolerances shall comply with SDI-117 "Manufacturing Tolerances Standard Steel Doors and Frames."
- D. Drill and tap doors and frames to receive non-template, mortised, and surface-mounted door hardware.

3.3 INSTALLATION

- A. General: Install bullet resistant hollow metal work plumb, rigid, properly aligned, and securely fastened in place; comply with Drawings and manufacturer's written instructions.
- B. Bullet Resistant Hollow Metal Frames: Install bullet resistant hollow metal frames of size and profile indicated. Comply with ANSI/SDI A250.11.
 - 1. Set frames accurately in position, plumbed, aligned, and braced securely until permanent anchors are set. After wall construction is complete, remove temporary braces, leaving surfaces smooth and undamaged. Shim as necessary to comply with installation tolerances.
 - a. At fire-protection-rated openings, install frames according to NFPA 80.
 - b. Where frames are fabricated in sections because of shipping or handling limitations, field splice at approved locations by welding face joint continuously; grind, fill, dress, and make splice smooth, flush, and invisible on exposed faces.
 - c. Install door silencers in frames before grouting.
 - 2. Floor Anchors: Provide floor anchors for each jamb and mullion that extends to floor, and secure with post-installed expansion anchors.

3. Masonry Walls: Coordinate installation of frames to allow for solidly filling space between frames and masonry with appropriate mortar.
 4. Grout Requirements: Do not grout head of frames unless reinforcing has been installed in head of frame.
- C. Bullet Resistant Hollow Metal Doors: Fit bullet resistant hollow metal doors accurately in frames, within clearances specified below. Shim as necessary.
1. Non-Fire-Rated Standard Steel Doors:
 - a. Jambs and Head: 1/8 inch plus or minus 1/16 inch.
 - b. Between Edges of Pairs of Doors: 1/8 inch plus or minus 1/16 inch.
 - c. Between Bottom of Door and Top of Finish Floor (No Threshold): Maximum 3/4 inch.
 2. Fire-Rated Doors: Install doors with clearances according to NFPA 80.

3.4 ADJUSTING AND CLEANING

- A. Final Adjustments: Check and readjust operating hardware items immediately before final inspection. Leave work in complete and proper operating condition. Remove and replace defective work, including bullet resistant hollow metal work that is warped, bowed, or otherwise unacceptable.
- B. Remove grout and other bonding material from bullet resistant hollow metal work immediately after installation.
- C. Prime-Coat Touchup: Immediately after erection, sand smooth rusted or damaged areas of prime coat and apply touchup of compatible air-drying, rust-inhibitive primer.

END OF SECTION 08 34 00

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SECTION 08 36 16

SECTIONAL OVERHEAD DOORS

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Commercial sectional doors.

1.2 RELATED SECTIONS

- A. Section 05 50 00 - Metal Fabrications.
- B. Section 09 90 00 - Painting and Coating.
- C. Section 26 05 00 - Common Work Results for Electrical.

1.3 REFERENCES

- A. ASTM International (ASTM):
 - 1. ASTM A 653/A 653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.
 - 2. ASTM C 518 - Standard Test Method for Steady-State Thermal Transmission Properties by Means of the Heat Flow Meter Apparatus.
 - 3. ASTM E 283 - Standard Test Method for Determining the Rate of Air Leakage Through Exterior Windows, Curtain Walls, and Doors Under Specified Pressure Differences Across the Specimen.

1.4 SUBMITTALS

- A. Submit under provisions of Section 01 30 00 - Administrative Requirements.
- B. Product Data: Manufacturer's data sheets on each product to be used, including:
 - 1. Preparation instructions and recommendations.
 - 2. Storage and handling requirements and recommendations.
 - 3. Installation methods.
- C. Performance Standards: Provide test data validating the following:
 - 1. Door Section: Gloss retention, fade resistance, FDA compliance, cold crack performance, load to rebound, dent resistance impact.
 - 2. Drive Train: Spring cycle life, track, hinges, rollers, cable assembly, cable strength.
 - 3. Door Assembly: Thermal performance, deflection, wind load.
- D. Shop Drawings:
 - 1. Provide drawings indicating track details, head and jamb conditions, spring shafts, anchorage, accessories, finish colors, patterns and textures, operator mounts and other related information.
 - 2. Regulatory Requirements and Approvals: Provide shop drawings in compliance with local Authority having Jurisdiction (AHJ).

- E. Certifications:
 - 1. Submit manufacturer's certificate that products meet or exceed specified requirements.
 - 2. Submit installer qualifications.
- F. Selection Samples: For each finish product specified, two complete sets of color chips representing manufacturer's full range of available colors and patterns.
- G. Verification Samples: For each finish product specified, two samples, minimum size 6 inches (150 mm) square, representing actual product, color, and patterns.

1.5 QUALITY ASSURANCE

- A. Installer Qualifications: Utilize an installer having demonstrated experience on projects of similar size and complexity, and trained and authorized by the door manufacturer to perform the work of this section.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Store products in manufacturer's unopened packaging until ready for installation.

1.7 PROJECT CONDITIONS

- A. Maintain environmental conditions (temperature, humidity, and ventilation) within limits recommended by manufacturer for optimum results. Do not install products under environmental conditions outside manufacturer's recommended limits.

1.8 WARRANTY

- A. Provide manufacturer's standard warranty against defects in material and workmanship, as further described with each model in Part 2 of this Section.
- B. Manufacturer's Warranty for ControlHoist 2.0 Commercial Operators Door and Operator Warranty Package: Provide manufacturer's standard warranty.
 - 1. Warranty electrical operator and component parts against defects in material and workmanship for three (3) years.

PART 2 PRODUCTS

2.1 MANUFACTURERS

- A. Acceptable Manufacturer: Raynor, which is located at: 1101 East River Rd. P. O. Box 448; Dixon, IL 61021-0448; Toll Free Tel: 800-4-RAYNOR; Tel: 815-288-1431; Fax: 888-598-4790; Email: [request info \(thegarage@raynor.com\)](mailto:request info (thegarage@raynor.com)); Web: <http://www.raynor.com>
- B. Substitutions: Under provisions of Section 01 25 13.

2.2 SECTIONAL RAIL AND STYLE ALUMINUM DOORS

- A. AlumaView as manufactured by Raynor Garage Doors:
 - 1. Doors:
 - a. Operation:
 - 1) Provide doors designed for electric motor operation.
 - b. Jamb Construction:
 - 1) Steel jambs with self-tapping fasteners.
 - 2) Masonry jambs with anchor bolt fasteners.

- c. Structural Performance Requirements:
 - 1) Wind Load (Model AV 300 only): Florida Building Code Product Approval #FL16225 large missile impact.
 - d. International Energy Conservation Code (IECC) Requirements:
 - 1) Air Infiltration: Maximum air leakage of 0.4 cfm/ft² is required. Testing shall be performed in accordance with DASMA 105 test procedure.
 - 2) Provide an air leakage rating of 0.24 cfm/ft² with optional IECC Compliance Package.
2. Sections:
- a. AlumnaView AV300:
 - 1) Material: 3 inches (76 mm) thick, 6063-T6 aluminum alloy stiles and rails joined together with 5/16 inch (8 mm) diameter screws. Glazing fill the spaces between stiles and rails. Combined dimension of two adjoining intermediate meeting rails 5 inches (127 mm). Bottom rail height 6-1/2 inches (165 mm). Top rail height 6-1/2 inches (165 mm). End stiles 3-3/8 inches (86 mm) or 6-1/2 inches (165 mm) wide as determined by overall door width. Center stiles 3-5/8 inches (92 mm) wide.
 - 2) Finish: Aluminum frame extrusions and filler panels finish coated.
 - a) ArmorBrite Powdercoat finish, color as selected by Architect.
 - b. Seals: Bottom of door to have flexible U-shaped vinyl seal retained in aluminum rail.
 - 1) Bulb-type joint seal between sections.
 - 2) Blade seal on top section to prevent airflow above header.
 - c. Trussing: Doors designed to withstand specified windload. Deflection of door in horizontal position to be maximum of 1/120th of door width.
3. Windows: Locations to comply with door elevation drawings.
4. Impact Rated Glazing: Provide as follows.
- a. 1 inch thick Tinted Glazing per Section 08 80 00.
5. Mounting: Sections mounted in door opening using:
- a. Between-Jamb Bracket Mounting: sections mounted between door jambs, seal against exterior perimeter seal installed along vertical and top horizontal edges of jambs.
 - b. Lap Jamb Angle Mounting: section overlap door jambs by 1 inch (25 mm) on each side of door opening.
6. Track:
- a. Material: Hot-dipped galvanized steel (ASTM A 653), fully adjustable for adequate sealing of door to jamb or weatherseal.
 - b. Configuration Type:
 - 1) Configuration Type: Vertical Lift.
 - c. Track Size:
 - 1) Size: 3 inches (76 mm).
 - d. Mounting:
 - 1) Floor-to-Shaft Angle-Mount consisting of continuous angle extending from the floor, past header, completely up to door shaft for use with steel or masonry jambs. Continuous angle size not less than 3-1/2 inches by 5 inches by 1/8 inches (89 by 127 by 3.2 mm) on 3-inch track.
 - e. Finish:
 - 1) Galvanized.

7. Counterbalance:
 - a. Counterbalance System: Provided with aircraft-type, galvanized steel lifting cables with minimum safety factor of 5. Torsion Springs consisting of heavy-duty oil-tempered wire torsion springs on a continuous ball-bearing cross-header shaft.
 - 1) Spring Cycle Requirements: Standard 10,000 cycles.
 8. Hardware:
 - a. Hinges and Brackets: Fabricated from galvanized steel.
 - b. Track Rollers: 3 inches (76.2 mm) diameter consistent with track size, with hardened steel ball bearings.
 - c. Perimeter Seal: Provide complete weather stripping system to reduce air infiltration. Weather stripping shall be replaceable.
 - 1) For angle mounted doors provide angle clip-on seal.
 9. Warranty: Warranty defects in material and workmanship - five years from date of installation. Warranty window components against defects in material and workmanship for three years from date of installation. Hardware and spring components against defects in material and workmanship for one year (or cycle life of the springs) from date of installation.
- B. ControlHoist 2.0 as manufactured by Raynor Garage Doors:
1. Model:
 - a. Raynor ControlHoist 2.0 Optima:
 - 1) Type: Trolley.
 - 2) Motor Horsepower Rating: Continuous 1/2 HP.
 - 3) Electrical Requirements: 115 volt single phase.
 - 4) Duty Cycle: 30 cycles/hour or 300 cycles/day.
 - 5) Control Wiring: Solid state circuitry with provisions for connection of safety edge to reverse, external radio control hook-up and maximum run timer. Provisions for timers to close, monitored reversing devices, mid stop and lock bar sensor capability.
 - a) Provide three button momentary contact "open-stop", constant pressure on close (can be changed to momentary to close).
 - b) Custom wiring.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Do not begin installation until substrates have been properly prepared. Verify that site conditions are acceptable for installation of doors, operators, controls and accessories. Ensure that openings are square, flush and plumb.
- B. If substrate preparation is the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.

3.2 PREPARATION

- A. Clean surfaces thoroughly prior to installation.
- B. Prepare surfaces using the methods recommended by the manufacturer for achieving the best result for the substrate under the project conditions.

3.3 INSTALLATION

- A. General: Install door, track and operating equipment complete with all necessary accessories and hardware according to shop drawings, manufacturer's instructions.
- B. Lubricate bearings and sliding parts, and adjust doors for proper operation, balance, clearance and similar requirements.

3.4 PROTECTION

- A. Clean installed products in accordance with manufacturer's instructions prior to Owner's acceptance. Remove and legally dispose of construction debris from project site.
- B. Remove temporary coverings and protection of adjacent work areas. Repair or replace installed products damaged prior to or during installation.
- C. Lubricate bearings and sliding parts, assure weather tight fit around door perimeter and adjust doors for proper operation, balance, clearance and similar requirements. Protect installed products until completion of project.
- D. Repair or replace damaged products before Substantial Completion.

END OF SECTION

SECTION 08 41 13

ALUMINUM-FRAMED ENTRANCES AND STOREFRONTS

1. PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Aluminum doors, frames and glazed lights.
- B. Glass.
- C. Anchors, brackets, and attachments.
- D. Perimeter sealant.

1.2 REFERENCES

- A. ASTM A36 - Structural Steel.
- B. ASTM B221 - Aluminum-Alloy Extruded Bar, Rod, Wire, Shape, and Tube.
- C. ASTM E283 - Rate of Air Leakage through Exterior Windows, Curtain Walls and Doors.
- D. ASTM D2000 - Classification System for Rubber Products.
- E. ASTM D2287 - Nonrigid Vinyl Chloride Polymer and Copolymer molding and Extrusion Compounds.
- F. AAMA TIR-A8 - Structural Performance of Composite Thermal Barrier Framing System.
- G. AAMA 505 - Dry Shrinkage and Composite Performance Thermal Cycling Test Procedure.
- H. AAMA 701.2 - Voluntary Specification for Pile Weatherstripping.
- I. AAMA SFM-1 - Aluminum Storefront and Entrance Manual.
- J. NAAMM - Metal Finishes Manual.
- K. CBC - California Building Code, (CCR) California Code of Regulations, Title 24, Part 2 and Part 6.
- L. CEC - California Energy Commission.

1.3 PERFORMANCE

- A. System to provide for expansion and contraction within system components caused by a cycling temperature range of 120 degrees F without causing detrimental effects to system or components.
- B. Thermal break to be provided in accordance with AAMA TIR-A8 and be tested by AAMA 505.
- C. Design and size members to withstand dead loads and live loads caused by pressure and suction of wind as calculated in accordance with the CBC, California Building Code.
- D. Limit mullion deflection to 1/175, or flexure limit of glass with full recovery of glazing materials, whichever is less for spans up to 13'-6" with a deflection of 1/240 for spans greater than 13'-6".
- E. Drain water entering joints, condensation occurring in glazing channels, or migrating moisture occurring within system, to exterior.
- F. Limit air infiltration through assembly to 0.06 cu. ft./min./sq. ft. as measured in accordance with ASTM E283.

- G. System to Accommodate, without Damage to System or Components, or Deterioration of Perimeter seal: Movement within system; movement between system and perimeter framing components; dynamic loading and release of loads; and deflection of structural support framing.
- H. Thermal Performance: Glazed exterior borrowed lite, sidelite and transom lite frames shall have an overall minimum U-value of 0.71 as rated in accordance with the default table method approved by the California Energy Commission (CEC). Provide Certificate NRCC-ENV-05-E, from the Nonresidential Compliance Manual documenting compliance with the CBC, California Building Code, (CCR) California Code of Regulations, Title 24, Part 6, Section 110, Table 110.6-A.
- I. Solar Heat Gain Coefficient: Glazed exterior borrowed lite, sidelite and transom lite frames shall have an overall maximum solar heat gain coefficient of 0.73 as rated in accordance with default table method approved by the California Energy Commission (CEC). Provide Certificate NRCC-ENV-05-E, from the Nonresidential Compliance Manual documenting compliance with the CBC, California Building Code, (CCR) California Code of Regulations, Title 24, Part 6, Section 110, Table 110.6-B.

1.4 SUBMITTALS

- A. Submit shop drawings and product data under provisions of Section 01 33 00.
- B. Include system and component dimensions; components within assembly; framed opening requirements and tolerances; anchorage and fasteners; glass and infills; door hardware requirements; and affected related work.
- C. Submit manufacturer's installation instructions under provisions of Section 01 33 00.
- D. Submit samples under provisions of Section 01 33 00.
- E. Submit two samples, 12 x 12 inches in size, illustrating prefinished aluminum surface.
- F. Submit Certificate NRCC-ENV-05-E, from the Nonresidential Compliance Manual documenting compliance with the CBC, California Building Code, (CCR) California Code of Regulations, Title 24, Part 6, Section 116, Table 116-A and 116-B.

1.5 REGULATORY REQUIREMENTS

- A. Conform to CBC, California Building Code, (CCR) California Code of Regulations, Title 24, Part 6, for U-value and solar heat gain coefficient.
- B. Conform to CBC - California Building Code, (CCR) California Code of Regulations, Title 24, Part 2, for loads, seismic zoning and other governing criteria.

1.6 QUALITY ASSURANCE

- A. Perform work in accordance with AMA SFM-1.

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Deliver, store, and handle system components under provisions of Section 01 61 00.

1.8 WARRANTY

- A. Provide a lifetime warranty for door corners under provisions of Section 01 77 00.
- B. Warranty shall include coverage for distortion, dislocation and deformation.

2. PART 2 PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

- A. Arcadia, www.arcadiainc.com.
- B. Basis of Design and Permit Approval: See below under description of products.
 - 1. Exterior - Arcadia, Inc. Products TC-670 (2-1/4" x 6") and TC-470 (2-1/4" x 4-1/2"): www.arcadiainc.com.
 - 2. Interior - Arcadia, Inc. Product AF450 (2" x 4-1/2").
- C. Other Acceptable Manufacturers (Substitutions):
 - 1. Substitutions: See Section 01 60 00 - Product Requirements.
 - (a) Substitution may or may not be accepted after Architect and Owner review with complete evaluation for content and schedule impact.
 - (b) Substitutions shall include all costs for redesign with consequential changes by other Contractor trades along with the Architect and related approvals by governing agencies.
 - (1) Revisions to shop drawings illustrating the proposed changes is not considered adequate for DSA review and approval.
 - (2) A minimum fee of \$10,000.00 for DSA review processing by the Architect will need to be included for DSA review of any substituted system other than the basis of design.
 - (3) An additional minimum allowance of \$10,000.00 is required for Architects time to review the substituted system prior to submitting for governing agency approval.
 - (4) The indicated fee amounts are minimums. These are subject to increase pending Architect and Agency reviews of the proposed substitution.
 - (c) Substitutions may be acceptable, based on Architect's review and approval, for submittal to DSA. If substituted manufacturer cannot reproduce DSA design and approval in a timely manner, then they shall be subject to a time and material back charge for any delays in the project. Architect approval is required prior to DSA submittal and DSA approval is required prior to installation.
- D. Substitutions: Under provisions of Section 01 25 13.

2.2 MATERIALS

- A. Extruded Aluminum: ASTM B221; Alloy G.S. 10A-T5.
- B. Brackets and Reinforcements: High strength aluminum.
- C. Steel Sections: ASTM A36; shapes to suit mullion sections.
- D. Fasteners: Stainless steel, aluminum.
- E. Compression Weatherstripping: Replaceable gaskets of molded neoprene that are silicone compatible and comply with ASTM D2000 or molded PVC; complying with ASTM D 2287.
- F. Sliding Weatherstripping: Replaceable wool, polypropylene or nylon woven pile; nylon fabric or aluminum strip backing; comply with AAMA 701.2.

2.3 FABRICATED COMPONENTS

- A. Frames: 2 1/4 x 4 1/2 inch profile, flush glazing stops.
- B. Square.
- C. Square.
- D. Heavy Duty Wide Stile - WS512HD: 1-3/4 inches thick, 5 inch wide top rail, 5 inch wide vertical stiles, 10 inch wide bottom rail (nominal dimensions); square glazing strips.
- E. Reinforced Mullion: As detailed.

2.4 GLASS AND GLAZING MATERIALS

- A. Glass and Glazing Materials: As specified in Section 08 80 00 and as indicated on drawings.

2.5 HARDWARE

- A. Door Hardware: As specified in Section 08 71 00.
- B. Provide door hardware as scheduled for doors and applications indicated.

2.6 FABRICATION

- A. Fabricate doors and frames allowing for minimum clearances and shim spacing around perimeter of assembly, yet enabling installation.
- B. Rigidly fit and secure joints and corners with internal reinforcement. Weld top and bottom rails of doors to reinforcement clips. Make joints and connections flush, hairline, and weatherproof.
- C. Develop drainage holes with moisture pattern to exterior.
- D. Prepare components to receive anchor devices. Fabricate anchorage items.
- E. Arrange fasteners, attachments, and jointing to ensure concealment from view.
- F. Prepare components with internal reinforcement for door hardware and door operator hinge hardware.
- G. Reinforce framing members for imposed loads.

2.7 FINISHES

- A. Color Anodized Finish: NAAMM AA-M12-C22 A42/44, colored anodic coating, dark bronze.
- B. Apply bituminous paint to separate dissimilar metals and metal surfaces in contact with cementitious or dissimilar materials.

2.8 SEALANT MATERIALS

- A. Sealant and Backing Materials: As specified in Section 07 92 00.

3. PART 3 EXECUTION

3.1 INSPECTION

- A. Verify wall openings and adjoining materials are ready to receive Work of this Section.
- B. Beginning of installation means acceptance of existing conditions.

3.2 INSTALLATION

- A. Install doors, frames, glazing and hardware in accordance with manufacturer's instructions and AAMA SFM-1.
- B. Use anchorage devices per architectural details to securely attach frame assembly to structure.
- C. Attach to structure to permit adjustment to accommodate construction tolerances and other irregularities.
- D. Align assembly plumb and level, free of warp or twist. Maintain assembly dimensional tolerances, aligning with adjacent work.
- E. Install sill flashings.
- F. Pack fibrous insulation in shim spaces at perimeter of assembly to maintain continuity of thermal barrier.
- G. Install sealant and backing materials as specified in Section 07 92 00.
- H. Install hardware using templates provided. Refer to Section 08 71 00 for installation requirements.
- I. Install glass in accordance with Section 08 80 00, using exterior dry method of glazing.
- J. Adjust operating hardware.

3.3 TOLERANCES

- A. Variation from Plane: 0.03 inches per foot maximum or 0.25 inches per 30 feet, whichever is less.
- B. Misalignment of Two Adjoining Members Abutting in Plane: 0.015 inches.

3.4 CLEANING

- A. Wash down exposed surfaces using a solution of mild detergent in warm water, applied with soft, clean wiping cloths. Take care to remove dirt from corners. Wipe surfaces clean.
- B. Remove excess sealant by moderate use of mineral spirits or other solvent acceptable to sealant manufacturer.

END OF SECTION

SECTION 08 51 13

ALUMINUM WINDOWS

1. PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Extruded aluminum windows with fixed and operating sash.
- B. Glass and glazing.
- C. Operating hardware and insect screens.
- D. Perimeter sealant.

1.2 REFERENCES

- A. AAMA 101 - Voluntary Specifications for Aluminum Prime Windows and Sliding Glass Door.
- B. ASTM B221 - Aluminum-Alloy Extruded Bar, Rod, Wire, Shape, and Tube.
- C. ASTM E283 - Rate of Air Leakage through Exterior Windows, Curtain Walls, and Doors.
- D. ASTM E330 - Structural Performance of Exterior Windows, Curtain Walls, and Doors by Uniform Static Air Pressure Difference.
- E. ASTM E331 - Water Penetration of Exterior Windows, Curtain Walls, and Doors by Uniform Static Air Pressure Difference.
- F. ASTM E547 - Water Penetration of Exterior Windows, Curtain Walls, and Doors by Cyclic Static Air Pressure Differential.
- G. CBC - California Building Code, (CCR) California Code of Regulations, Title 24, Part 6.
- H. CEC - California Energy Commission.
- I. FS RR-W-365A - Wire Fabric (Insect Screening).
- J. NFRC - National Fenestration Rating Council.
- K. NAAMM - National Association of Architectural Metal Manufacturers.
- L. SIGMA - Sealed Insulating Glass Manufacturers Association.

1.3 PERFORMANCE REQUIREMENTS

- A. Comply with air infiltration, water penetration and structural performance requirements indicated in AAMA 101 for the type, grade and performance class of window units required.
- B. Provide current certified AAMA test report that reflects the window configuration and type specified.
- C. Test each type and size of required window unit through a recognized testing laboratory or agency, in accordance with ASTM E330 for structural performance, with ASTM E283 for air infiltration and with both ASTM E331 and ASTM E547 for water penetration. Provide certified test results.
- D. Thermal Performance: Overall U-value of .71 as rated in accordance with the National Fenestration Rating Council's (NFRC) 100 Rating Procedure or in accordance with default table method approved by the California Energy Commission (CEC). Provide certified test results.

- E. Air Leakage: Infiltration rates shall not exceed 0.3 cfm/ft. squared of window area when tested according to The National Fenestration Rating Council's (NFRC) 400 Rating Procedure or ASTM E283 at a pressure differential of 6.24 pounds/ft. squared. Provide certified test results.
- F. Solar Heat Gain Coefficient (SHGC): The SHGC shall be rated in accordance with The National Fenestration Rating Council's (NFRC) 200 Rating Procedure or in accordance with the default table method approved by the California Energy Commission (CEC). Provide certified test results.

1.4 SUBMITTALS

- A. Submit shop drawings and product data under provisions of Section 01 33 00.
- B. Include wall opening and component dimensions; wall opening tolerances required; anchorage and fasteners; affected related work; installation requirements.
- C. Submit manufacturer's installation instructions under provisions of Section 01 33 00.
- D. Submit samples under provisions of 01 33 00.
- E. Submit manufacturer's certificate under provisions of 01 33 00 that window units meet or exceed specified requirements.

1.5 QUALITY ASSURANCE

- A. Label to be permanently affixed to frame listing certified U-value, certifying organization and rating procedure.
- B. Label to be temporarily affixed to frame certifying that U-value, SHGC, and air infiltration requirements of California Building Code (CBC), California Code of Regulations (CCR), Title 24, Part 6, Section 110 have been met.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Deliver, store and protect window units under provisions of Section 01 61 00.
- B. Provide wrapping or strippable coating to protect prefinished aluminum surfaces.

1.7 WARRANTY

- A. Provide five year manufacturer's and SIGMA warranty under provisions of Section 01 77 00.
- B. SIGMA Warranty: Include coverage of insulated glass units from seal failure, interpane dusting or misting, and replacement of same.
- C. Manufacturers Warranty: Include coverage for materials and finish.

2. PART 2 PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

- A. Horizontal Sliding Windows: CW-PG30-HS class, grade, type.
 - 1. EFCO Corporation, 3500 Series, www.efcocorp.com.
 - 2. Graham Architectural Products, 200 Series, www.grahamwindows.com.
 - 3. Kawneer Company, Inc., 8400 Series, www.kawneer.com.
 - 4. Wausau Windows, 410 Series, www.wausauwindow.com.
- B. Substitutions: Under provisions of Section 01 25 13.

2.2 MATERIALS

- A. Extruded Aluminum: ASTM B221, 6063 alloy, T5 or T6 temper.

2.3 FABRICATED COMPONENTS

- A. Frames: Nominal 2 inches wide x 1 inches deep profile, of non- thermally broken, flush glass stops of snap-on type with capped sill ends.
- B. Horizontal Sliding Window: Sash verticals to telescope into sash horizontals; corners to be of screw spline construction. Aluminum extrusion wall thickness for frame sections; 0.062 inch, sill; 0.094 inch. Locking device; Continuous interlock at meeting rail.
- C. Insect Screens: FS RR-W-365A, Type VIII, woven aluminum mesh; 16/18 mesh size; fitted taught in tubular aluminum frame. Miter and reinforce frame corners; provide with manufacturer's standard retainer.
- D. Fasteners: Stainless steel.

2.4 GLASS AND GLAZING MATERIALS

- A. Glass and Glazing Materials: Specified in Section 08 80 00.
- B. Glass: Clear sealed insulated units of laminated glass.

2.5 SEALANT MATERIALS

- A. Sealant and Backing Material: As specified in Section 07 92 00.

2.6 FABRICATION

- A. Fabricate windows allowing for minimum installation clearances and shim spacing around perimeter of assembly, yet enabling installation.
- B. Rigidly fit joints and corners. Accurately fit and secure corners tight. Make corner joints flush, hairline, and weatherproof. Seal corner joints with sealant.
- C. Develop drainage holes with moisture pattern to exterior.
- D. Prepare components to receive anchor devices. Fabricate anchorage items.
- E. Prepare components with internal reinforcement for operating hardware.
- F. Provide internal reinforcement in mullions to maintain rigidity.
- G. Shop glaze window units in accordance with manufacturer's instructions.

2.7 FINISHES

- A. Color Anodized Finish: NAAMM AA-M12-C22-A42/44. Color to be dark bronze.
- B. Apply one coat of rubberized paint to concealed aluminum and steel surfaces in contact with cementitious or dissimilar materials. Rust-Oleum Professional Grade Rubberized Undercoating www.rustoleum.com.

3. PART 3 EXECUTION

3.1 INSPECTION

- A. Verify wall openings are ready to receive Work of this Section.
- B. Beginning of installation means acceptance of existing conditions.

3.2 INSTALLATION

- A. Install window frames, glass, glazing, and hardware in accordance with manufacturer's instructions.
- B. Use anchorage devices per architectural details to securely attach frame to structure.
- C. Align window frame plumb and level, free of warp or twist. Maintain dimensional tolerances, aligning with adjacent work.
- D. Pack fibrous insulation in shim spaces at perimeter to maintain continuity of thermal barrier.
- E. Install sealant and backing materials as specified in Section 07 92 00.
- F. Adjust operable hardware for smooth operation and tight fit of sash.

3.3 CLEANING

- A. Remove protective material from prefinished aluminum surfaces.
- B. Wash down exposed surfaces using a solution of mild detergent in warm water. Rinse with clean water, and wipe dry with soft, clean wiping cloths. Take care to remove dirt from corners. Wipe surfaces clean.
- C. Remove excess sealant by moderate use of mineral spirits or other solvent acceptable to sealant manufacturer.

END OF SECTION

SECTION 08 56 59 – BULLET RESISTANT TRANSACTION WINDOWS**PART 1 GENERAL****1.1 REFERENCE**

- A. Underwriters Laboratory UL 752-Standard for Bullet Resisting Equipment & ASTM E119-98-Standard Test Methods for Fire Tests of Building Construction and Materials, NIJ Standard 0108.01-(National Institute of Justice) Standard for Ballistic Resistant Protective Materials, ASTM B 209/B 209M- Standard Specification for Aluminum and Aluminum Alloy Sheet and Plate, ASTM A 666-Standard Specification for Annealed or Cold-Worked Austenitic Stainless Steel Sheet, Strip, Plate and Flat Bar..

1.2 SUBMITTALS

- A. The following shall be submitted by the manufacturer in accordance with Sections 13070 and any Special Contract Requirements and coordinate with Sections 01340: Submit for approval prior to fabrication: samples, product data (including preparation, storage and installation methods), cuts & anchor spacing, reinforcement & location , product specifications, shop drawings, test reports (current UL Listing Verification & UL 752 Test Results as provided by Underwriters Laboratories), and printed data in sufficient detail to indicate compliance with the contract documents.
- B. Manufacturer's Instructions for installation and cleaning of TSS Arched Transaction Window Assemblies. All required submittals shall be approved prior to installation.

1.3 DESIGN PERFORMANCE

- A. Through the design, manufacturing techniques and material application the TSS Arched Transaction Window shall be of the "non-ricochet" type. This design is intended to permit the encapture and retention of an attacking projectile lessening the potential of a random injury or lateral penetration. This assembly shall provide single or multiple transaction positions utilizing the "natural voice" baffle configuration. This design shall employ offset vertical standing vision panels and 5" baffles to complete the "natural voice" design as well as to protect against angled ballistic penetrations. Each transaction position shall have a stainless steel dip tray as shown on the drawings. Components must be manufactured in strict accordance with the specifications, design and details. All vision panels and baffles shall be cut to size with all exposed edges polished. Necessary holes shall be pre drilled and tapped where required. Stainless Steel assembly screws and acrylic spacers shall be provided. Clear anodized angles and channels shall be provided in field lengths. Anchor screws shall be provided by the installer.
- B. No field alterations to the construction of the units fabricated under the acceptable standards shall be allowed unless approved by the manufacturer and the architect. Standard manufacturing tolerances shall be +/- 1/16".
- C. Materials shall meet or exceed UL 752 requirements.

1.4 QUALITY ASSURANCE

- A. Manufacturer shall be a Company that specializes in manufacturing products of the specified type with a minimum of five years experience. Installer shall be a Company that specializes in product type specified and Certified for the installation by the manufacturer. Manufacturer shall provide a Mock-up, if required, for evaluation of surface preparation and application workmanship and color/finish to the Architect for approval prior to start of work.

1.5 DELIVERY, STORAGE & HANDLING

- A. Handle the materials with care to prevent damage. Store materials inside and under cover, stack flat and off floor. Project conditions (temperature, humidity, and ventilation) shall be within the maximum limit recommendations set by manufacturer. Do not install products that are under conditions outside these limits.

1.6 WARRANTY

- A. All materials shall be warranted against defects for a period of 1 year for the date of receipt at the project site. Certificates of manufacturer's standard limited warranty shall be provided at project completion.

PART 2 PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

- A. Products shall be manufactured by: Total Security Solutions, Inc, 170 National Park Drive, Fowlerville, MI 48836, 800-513-1468. Attn: Sales Department, bgeorge@tssbulletproof.com. Web: www.tssbulletproof.com. No substitutions shall be accepted.

2.2 BULLET RESISTANT ARCHED TRANSACTION WINDOW

- A. Product shall be: TSS Arched Transaction Window: The Arched Window System consists of custom prefabricated bullet resistant panels with secure air passage as required for voice transmission. Aluminum frame, with a plastic laminate base and recessed cash tray. All accessories for installation are included. Available finishes include clear anodized or powder coated.

- B. Glazing Panels shall be as follows:

- 1) Bullet-Resisting Glazing Material Options:

Bullet Resistant Level 3

- 1 1/4" LP 1250 Laminated
- TSS 003 L/S

c. Cash tray: Brushed Stainless Steel Counter - Recessed

- 1) Cash tray to be 18 ga. stainless steel, # 4 finish, 16" x 10" from the outside edge of flanges with a clear opening

d. Provide Deal Tray: TSS RECESSED DEAL TRAY WITH BULLET TRAP Model TSS RCDT-BT, 16 inches by 10 inches from the outside edge of flanges with a clear open depth under the glazing no less than 1-3/4 inch. Fabricate of a minimum 18 gauge stainless steel and with a No. 4 finish.).

PART 3 EXECUTION

3.1 PREPARATION

- A. Prior to installing the bullet resistive material, the contractor shall verify that all supports have been installed as required by the contract documents and architectural drawings, and approved shop/CAD drawings, if required. Installer shall notify architect of any unsatisfactory preparation that is responsibility of another installer.
- B. Clean and prepare all surfaces per manufacturers recommendations for achieving the best results for the substrate under the project conditions.

3.2 INSTALLATION

- A. Do not begin installation until openings have been verified and surfaces properly prepared in accordance with Drawings. Install in accordance with manufacturer's instructions and UL 752. Set all equipment plumb. All product shall be installed per installation instructions provided by Total Security Solutions, if warranty is to be issued.
- B. TSS Arched Transaction Window shall arrive on site as a completed unit. Unit shall be installed in provided opening (wall/door), secured to structure (anchors by others).

3.3 POST APPLICATION

- A. TSS Arched Transaction Window shall be installed in accordance with manufacturer's printed recommendations, including adhering to anchoring and finishing details.
- B. Inspection and Cleaning: Verify installation is complete and complies with manufacturer's requirements. Clean product and accessories, removing excess sealant, labels and protective covers.
- C. Touch-up, repair or replace damaged products before Substantial Completion.
- D. Product Warranty: Applicable warranty shall be issued to owner upon final release of completed project.

END OF SECTION

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SECTION 08 71 00

DOOR HARDWARE

1. PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Hardware for doors.
- B. Thresholds.
- C. Gasketting.
- D. Keying and key cabinet.

1.2 REFERENCES

- A. ADA - Americans with Disabilities Act Standards for Accessible Design.
- B. ANSI - American National Standards Institute.
- C. BHMA - Builders' Hardware Manufacturers Association.
- D. CBC - California Building Code, (CCR) California Code of Regulations, Title 24, Part 2, California State Accessibility Standards.
- E. DHI - Door and Hardware Institute.
- F. DSA - Division of the State Architect.
- G. NFPA 80 - Fire Doors and Windows.
- H. UL - Underwriters Laboratories.

1.3 COORDINATION

- A. Coordinate work of this Section with other directly affected Sections involving manufacturer of any internal reinforcement for door hardware.

1.4 QUALITY ASSURANCE

- A. Manufacturers: Companies specializing in manufacturing door hardware with minimum five years experience. Obtain each kind of hardware from only one manufacturer.
- B. Hardware Supplier: Company specializing in supplying commercial door hardware with five years documented experience.
- C. Hardware Installer: Company specializing in the installation of commercial door hardware with five years documented experience.
- D. Hardware Supplier Personnel: Employ an Architectural Hardware Consultant (AHC) to assist in the work of this Section.

1.5 REGULATORY REQUIREMENTS

- A. Fire-Rated Openings: Comply with CBC Section 716 and NFPA Standard No. 80. Provide only hardware tested and listed by UL for the type and size of each door required, which complies with the requirements of the door and frame labels.
 - 1. Where exit devices are required on fire-rated doors, provide supplementary marking on door UL label indicating "Fire Door to be Equipped with Fire Exit Hardware", and provide UL Label on exit device indicating "Fire Exit Hardware".
 - 2. Exit device shall be compliant with State Fire Marshall Standard 12-10-3, Section 12-10-302.
- B. Conform to applicable requirements of the Americans with Disabilities Act Standards for Accessible Design regarding accessibility requirements for door and entrance hardware.
- C. Doors and doorways that are part of an accessible route shall comply with CBC Sections 11B-404.
- D. The clear opening width for a door shall be 32 inches minimum. For a swinging door it shall be measured between the face of the door and the stop, with the door open 90 degrees. There shall be no projections into the opening below 34 inches and 4 inches maximum projections into the opening between 34 inches and 80 inches above the finish floor or ground. Door closers and stops shall be permitted to be 78 inches minimum above the finish floor or ground. CBC Section 11B-404.2.3.
- E. Handles, pulls, latches, locks, and other operable parts on accessible doors shall comply with CBC Section 11B-309.4 and shall be operable with one hand and not require tight grasping, pinching, or twisting of the wrist. Operable parts of such hardware shall be 34 inches minimum and 44 inches maximum above the finish floor or ground. Where sliding doors are in the fully open position, operating hardware shall be exposed and usable from both sides. CBC Section 11B-404.2.7.
- F. The force for pushing or pulling open a door shall be as follows: CBC Section 11B-404.2.9.
 - 1. Interior hinged doors, sliding or folding doors, and exterior hinged doors: 5 lbs. (22.2N) maximum.
 - 2. Required fire doors: the minimum opening force allowable by the DSA Authority, not to exceed 15 lbs. (66.7N) maximum. These forces do not apply to the force required to retract latch bolts or disengage other devices that hold the door in a closed position.
 - 3. The force required for activating any operable parts, such as lever hardware, or disengaging other devices shall be 5 lbs. (22.2N) maximum to comply with CBC Section 11B-309.4.
- G. Door closing speeds shall be as follows: CBC Section 11B-404.2.8.
 - 1. Closer shall be adjusted so that the required time to move a door from an open position of 90 degrees to a position of 12 degrees from the latch is 5 seconds minimum.
 - 2. Spring hinges shall be adjusted so that the required time to move a door from an open position of 70 degrees to the closed position is 1.5 seconds minimum.
- H. Thresholds shall comply with CBC Section 11B-404.2.5.
- I. Floor stops shall not be located in the path of travel and 4 inches maximum from walls.
- J. Hardware (including exit devices) shall not be provided with "Night Latch" (NL) function for any accessible doors or gates unless the following conditions are met: (Such conditions must be clearly demonstrated and indicated in the specifications)
 - 1. Such hardware has a 'dogging' feature.
 - 2. It is dogged during the time the facility is open.
 - 3. Such 'dogging' operation is performed only by employees as their job function (non-public use).

- K. Pair of doors: Limit swing of one leaf to 90 degrees so that a clear floor space is provided beyond the arc of the swing for the wall-mounted tactile sign. CBC Section 11B-703.4.2.

1.6 SUBMITTALS

- A. Submit schedule under provisions of Section 01 33 00.
- B. Submit schedule at earliest possible date along with essential product data where acceptance of hardware schedule must precede fabrication of other work.
- C. Organize hardware schedule into "hardware sets" indicating complete designations of every item required for each door or opening. Include the following:
 - 1. Type, style, function, size and finish of each hardware item. Use BHMA finish codes as per ANSI A156.18.
 - 2. Name and manufacturer of each item.
 - 3. Fastenings and other pertinent information.
 - 4. Location of hardware set cross-referenced to indications on Drawings both on floor plans and in door and frame schedule.
 - 5. Explanation of all abbreviations, symbols, codes, etc., contained in schedule.
 - 6. Mounting locations for hardware.
 - 7. Door and frame sizes and materials.
- D. Provide product data on specified hardware.
- E. Keying Schedule: Submit separate detailed schedule indicating clearly how the Owner's final instructions on keying of locks has been fulfilled.
- F. Furnish hardware templates to each fabricator of doors, frames, and other work to be factory-prepared for the installation of hardware.

1.7 OPERATION AND MAINTENANCE DATA

- A. Submit operation and maintenance data under provisions of Section 01 77 00.
- B. Include data on operating hardware, lubrication requirements, and inspection procedures related to preventative maintenance.

1.8 DELIVERY, STORAGE, AND HANDLING

- A. Deliver products to site and to other Sections under provisions of Section 01 61 00.
- B. Store and protect products under provisions of Section 01 61 00.
- C. Package hardware items individually; label and identify package with door opening code to match hardware schedule.
- D. Deliver keys to Owner by security shipment direct from hardware supplier.

1.9 WARRANTY

- A. Provide five year warranty for closers, two year warranty for all other hardware under provisions of Section 01 77 00.

1.10 MAINTENANCE MATERIALS

- A. Provide special wrenches and tools applicable to each different or special hardware component.
- B. Provide maintenance tools and accessories supplied by hardware component manufacturer.

2. PART 2 PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

<u>Item</u>	<u>Manufacturer</u>	<u>Acceptable Substitute</u>	
A. Continuous Hinges	Ives	McKinney	Hager
B. Butt Hinges	Ives	McKinney	Hager
C. Locksets	Schlage	Owners standard	
D. Cylinders	Assa	Owners standard	
E. Exit Devices	Von Duprin	Owners standard	
F. Surface Closers	LCN	Owners standard	
G. Push/Pull Plates	Trimco	Rockwood	Ives
H. Auto Flush Bolts	Trimco	Rockwood	Ives
I. Coordinators	Trimco	Rockwood	Ives
J. Silencers	Trimco	Rockwood	Ives
K. Protection Plates	Trimco	Rockwood	Ives
L. Stops and Holders	Trimco	Rockwood	Ives
M. Overhead Stops	Glynn Johnson	Rixson	ABH
N. Mounting Brackets	Zero	Or equal	
O. Gate Boxes	Keedex	Or equal	
P. Gate Closers	Locinox	Or equal	
Q. Fire Dept Padlocks	Knox	Or equal	
R. Key Cabinets	Lund	Telkee	KCS
S. Thresholds/Sweeps/Seals	Pemko	Reese	NGP

2.2 MATERIALS

- A. Locksets: Mortise type. 16 gage curved steel, bronze or brass strikes with 2 inch deep box construction, with curved lips of sufficient length to clear trim and protect clothing.
 - 1. Comply with requirements of local security ordinances.
 - 2. Locks shall be of such construction that when locked, the door may be opened from within by using lever and without the use of a key or special knowledge.
 - 3. Lock series and design: Schlage L series 06N lever.

- B. Butt Hinges: Outswinging exterior doors shall have non-removable (NRP) pin. Hinge open widths shall be minimum, but of sufficient size to permit door to swing 180 degrees. Furnish hinges with stainless steel pins and ball bearings.
 - 1. Furnish 3 hinges per leaf to 7'-5" height. Add one for each additional 2 foot height.
 - 2. Provide 5 inch heavy weight hinges on doors over 3'-4" width.
- C. Continuous Hinges: Hinge open widths shall be minimum, but of sufficient size to permit door to swing 180 degrees. Where necessary to maintain door clearance at jamb trim, frame conditions, door reveals and similar conditions, furnish wide throw hinges as approved by the Architect. Where door is indicated as having fire resistance rating, provide UL listed and labeled hardware.
- D. Panic Hardware: Furnish exit devices with sex bolts at wood doors. Lever handle trim shall match locksets. Device shall bear UL label for fire and or panic as may be required.
 - 1. Provide glass bead kits of proper thickness where the rail assembly of the exit device crosses a lite.
- E. Surface Door Closers: Full rack and pinion type with removable non-ferrous case. Provide closers with sex bolts and grommets at wood doors. Place closers inside building, stairs, rooms, etc. Closers shall be non-handed, non-sized and adjustable. Closers shall be installed to permit door to swing 180 degrees.
 - 1. Flush transom offset brackets shall be used where parallel arm closers are listed for doors with fixed panels over.
 - 2. Provide drop brackets, shoe supports, and blade stop spacers as required at narrow top rails.
- F. Protection Plates: Fabricate either kick, armor, or mop plates with four beveled edges, height called for in schedule by width of door less 2 inches. Furnish with machine or wood screws of bronze or stainless steel to match other hardware.
- G. Floor Stops: Floor mounted door stops are prohibited where located in the path of travel. Where provided, install maximum 4 inches from wall surface.
- H. Seals: Solid neoprene to be MIL Spec. R6855-CL III, Grade 40. Sponge neoprene to be MIL Spec. R6130, Type II, Group C. UL label shall be applied on all rated doors.
- I. Silencers: Furnish silencers for interior hollow metal frames, 3 for single doors, 2 for pairs of doors. Omit where sound or light seals occur, or for fire-resistive-rated door assemblies.
- J. Thresholds: Change in level between 1/4 inch and 1/2 inch shall be beveled with a slope no greater than 1 unit vertical to 2 units horizontal (50 percent slope). The floor or landing shall not be more than 1/2 inch lower than the threshold of the doorway.

2.3 KEYING

- A. Contact the District Locksmith with Oxnard Union High School District (805-385-2518) for keying requirements. Keying system shall be coordinated with the Owner and approved by Owner's representative in writing. Furnish construction key system in accordance with lock manufacturers' standard. Where interchangeable core systems are used, provide temporary cores for construction keying.
- B. Key system shall be Assa Twin Maximum, I/C core cylinder with sidebar.
- C. For protection of the Owner, cylinders shall be keyed at the factory of the cylinder manufacturer where permanent records are maintained. Stamp keys "DO NOT DUPLICATE".
- D. Permanent keys and cylinder cores shall be delivered only to Owner's representative. Owner to install permanent cores and return construction cores for credit.

2.4 KEY CABINETS

- A. Key Cabinet: Sheet steel construction, .047 inch thick, piano hinged door with lock keyed to building system; manufactured by Lund Equipment Company, Bath, Ohio; or equal from Key Control System, Bechtelsvill, Pennsylvania; and Telkee, Inc., Glen Riddle, Pennsylvania. Model number as shown in schedule.
- B. Cabinet Size: Size for project keys plus 10 percent growth.
- C. Horizontal metal strips for keyhook labeling with plastic strip cover over paper labels.
- D. Provide book index.
- E. Finish: Baked enamel finish, color as selected.

2.5 LOCK BOX

- A. Model No. 3200 lock box manufactured by the Knox Company, www.knoxbox.com.
- B. Surface or recess mounted as required.
- C. Polyester powder coated finish in black color.
- D. UL listed tamper switch.

2.6 FINISHES

- A. Generally to be BHMA 626 Satin Chromium.
- B. Areas using BHMA 626 shall have push, pulls and kick plates of BHMA 630, Satin Stainless Steel, unless otherwise noted.
- C. Factory paint door closers to match other hardware, unless otherwise noted.
- D. Aluminum items to be finished AL unless otherwise noted.

2.7 FASTENERS

- A. Screws for strikes, face plates and similar items shall be flathead, countersunk type; provide machine screws for metal and standard wood screws for wood.
- B. Screws for butt hinges shall be flathead, countersunk, full-thread type.
- C. Fastening of closer bases or closer shoes to doors shall be by means of sex bolts and spray painted to match closer finish.
- D. Provide expansion anchors for attaching hardware items to concrete or masonry.
- E. All exposed fasteners shall have a phillips head.
- F. Finish of exposed screws to match surface finish of hardware or other adjacent work.

2.8 OTHER MATERIAL

- A. All other materials not specifically described, but required for a complete and proper finish hardware installation shall be selected by Architect as required at no additional cost.

3. PART 3 EXECUTION

3.1 INSPECTION

- A. Verify that doors and frames are ready to receive work and dimensions are as instructed by the manufacturer.
- B. Verify that power supply is available to power operated devices.
- C. Beginning of installation means acceptance of existing conditions.

3.2 INSTALLATION

- A. Pre-Installation Meetings: Initiate and conduct with supplier, installer, and related trades, coordinate materials and techniques, and sequence complex hardware items and systems installation. Include manufacturers' representatives of locks, panic hardware, and door closers in the meetings. Convene at least one week prior to commencement of related work.
- B. Install hardware in accordance with manufacturer's instructions and requirements of DHI.
- C. Wherever cutting and fitting is required to install hardware onto or into surfaces which are later to be painted or finished in another way, coordinate removal, storage and reinstallation or application of surface protection with finishing work specified in Division 9. Do not install surface-mounted items until finishes have been completed on the substrate.
- D. Set units level, plumb and true to line and location. Adjust and reinforce the attachment substrate as necessary for proper installation and operation.
- E. Drill and countersink units which are not factory-prepared for anchorage fasteners. Space fasteners and anchors in accordance with industry standards.
- F. Set exterior door thresholds with full-width bead of elastomeric sealant on each point of contact with floor, providing a continuous weather seal. Anchor thresholds with stainless steel countersunk screws.
- G. If handle of door is changed during construction, make necessary changes in hardware at no additional cost.
- H. Mount lock box in accordance with manufacturers' instructions. Connect to building security system. Mount at 4'-0" from finished grade to center of box.

3.3 ADJUST AND CLEAN

- A. Adjust and check each operating item of hardware and each door, to ensure proper operation or function of every unit. Replace units which cannot be adjusted to operate freely and smoothly as intended for the application made.
- B. Clean adjacent surfaces soiled by hardware installation.
- C. Final Adjustment: Wherever hardware installation is made more than one month prior to acceptance or occupancy of a space or area, return to the work during the week prior to acceptance or occupancy, and make final check and adjustment of all hardware items in such space or area. Clean operating items as necessary to restore proper function and finish of hardware and doors. Adjust door control devices to compensate for final operation of heating and ventilating equipment.
- D. Instruct Owner's Personnel in proper adjustment and maintenance of hardware finishes, during the final adjustment of hardware.

- E. Continued Maintenance Service: Approximately six months after the completion of the project, the Contractor, accompanied by the Finish Hardware Installer, shall return to the project and re-adjust every item of hardware to restore proper function of doors and hardware. Consult with and instruct Owner's personnel in recommended additions to the maintenance procedures. Replace hardware items which have deteriorated or failed due to faulty design, materials or installation of hardware units. Prepare a written report of current and predictable problems (of substantial nature) in the performance of the hardware.

3.4 HARDWARE LOCATIONS

- A. Lockset: 34 to 44 inches above finished floor. Verify manufacturers' template with door design.
- B. Panic Device: 36 to 44 inches above finished floor. Verify manufacturers' template with door design.
- C. Push Plate: 42 inches from bottom of door to center of plate.
- D. Pull Plate: 42 inches from bottom of door to center of pull.
- E. Floor Stop: 4 inches maximum distance from any adjacent wall surface.
- F. Conform to CBC, CCR, Title 24, Part 2, and ADA regarding positioning requirements for accessibility.

3.5 FIELD QUALITY CONTROL

- A. Architectural Hardware Consultant (AHC) to inspect installation and certify that hardware and its installation have been furnished and installed in accordance with manufacturer's instructions and as specified herein.

3.6 SCHEDULE

- A. Legend of listed manufacturers. The last column in the Schedule of Door Hardware refers to the manufacturer listed in the following schedule:

ASA	Assa
BYO	By Others
GLY	Glynn Johnson
IVE	Ives
KEE	Keedex
KNX	Knox
LCN	LCN
LOC	Locinox
LUN	Lund
PEM	Pemko
SCH	Schlage
TRM	Trimco
VON	Von Duprin
ZER	Zero

- B. The items listed in the following schedule shall conform to the requirements of the foregoing specification.
- C. The Door Schedule on the Drawings indicates which hardware set is used with each door.

D. Schedule of Door Hardware:

HW-1

Each pair door to have

2	CONTINUOUS HINGE	700-EPT	630	IVE
2	POWER TRANSFER	EPT-10	689	VON
1	REMOVABLE MULLION	KR4954 x MT54	689	VON
1	EXIT DEVICE	AX-PA-LD-RX-LC-98EO (INACTIVE)	626	VON
1	EXIT DEVICE	AX-PA-LD-98EO	626	VON
1	ELECTRIC TRIM	AD-300-993R-50-MT-RHO-JD	626	BYO
1	MORTISE CYLINDER	8852IC	626	ASA
2	PERMANENT CORE	88600IC x RED CORE	626	ASA
2	SURFACE CLOSER	4040XP-EDA	689	LCN
2	OVERHEAD STOP	100S	630	GLY
1	MULLION SEAL	5110	BLK	PEM
1 SET	DOOR SEALS	BY FRAME MFR	---	---
2	DOOR SWEEP	57V	628	PEM
1	THRESHOLD	PER SILL DETAIL	628	PEM

Note: AD-300 hardware shown for door prep templating only

Note: Furnished and installed by Section 281300 Electronic Access Control

HW-2

Each single door to have

4	HINGE	3CB1HW - 4.5 x 4.5	652	IVE
1	POWER TRANSFER	EPT-10	689	VON
1	EXIT DEVICE	AX-PA-LD-98EO	626	VON
1	ELECTRIC TRIM	AD-300-993R-50-MT-RHO-JD	626	BYO
1	PERMANENT CORE	88600IC x RED CORE	626	ASA
1	ELECTRIC STRIKE	6300	630	VON
1	POWER SUPPLY	PS902	602	SCH
1	SURFACE CLOSER	4040XP-EDA	689	LCN
1	KICK PLATE	K0050 - 10 x 2 LDW x B4E	630	TRM
1	FLOOR STOP	1214	626	TRM
3	SILENCERS	1229A	GRY	TRM

Note: AD-300 hardware shown for door prep templating only

Note: Furnished and installed by Section 281300 Electronic Access Control

HW-3

Each single door to have

4	HINGE	3CB1HW - 4.5 x 4.5	652	IVE
1	LOCKSET	L9070T x 06N	626	SCH
1	PERMANENT CORE	88600IC x RED CORE	626	ASA
1	SURFACE CLOSER	4040XP-REG x 4040XP-18TJ x ST1630	689	LCN
1	KICK PLATE	K0050 - 10 x 2 LDW x B4E	630	TRM
1	OVERHEAD STOP	100HP	630	GLY
3	SILENCERS	1229A	GRY	TRM

HW-4

Each single door to have

4	HINGE	3CB1HW - 4.5 x 4.5	652	IVE
1	LOCKSET	L9070T x 06N	626	SCH
1	PERMANENT CORE	88600IC x RED CORE	626	ASA
1	SURFACE CLOSER	4040XP-H	689	LCN
1	KICK PLATE	K0050 - 10 x 2 LDW x B4E	630	TRM
1	FLOOR STOP	1214	626	TRM
3	SILENCERS	1229A	GRY	TRM

HW-5

Each single door to have

1	CONTINUOUS HINGE	700	630	IVE
1	LOCKSET	L9071T x 06N	626	SCH
2	PERMANENT CORE	88600IC x RED CORE	626	ASA
1	SURFACE CLOSER	4040XP-H	689	LCN
1	FLOOR STOP	1214	626	TRM
1 SET	DOOR SEALS	BY FRAME MFR	---	---

HW-6

Each single door to have

4	HINGE	3CB1HW - 4.5 x 4.5	652	IVE
1	PRIVACY	L9440 x 06N x L583-363 x L283-722	626	SCH
1	SURFACE CLOSER	4040XP-REG	689	LCN
1	KICK PLATE	K0050 - 10 x 2 LDW x B4E	630	TRM
1	MOP PLATE	KM050 - 6 x 1 LDW x B4E	630	TRM
1	WALL BUMPER	1270CVPV	626	TRM
1	COAT HOOK	3071	626	TRM
3	SILENCERS	1229A	GRY	TRM

HW-7

Each pair door to have

2	CONTINUOUS HINGE	700-EPT	630	IVE
2	POWER TRANSFER	EPT-10	689	VON
1	REMOVABLE MULLION	KR4954 x MT54	689	VON
1	EXIT DEVICE	AX-PA-LD-RX-LC-98EO (INACTIVE)	626	VON
1	EXIT DEVICE	AX-PA-LD-98EO	626	VON
1	ELECTRIC TRIM	AD-300-993R-50-MT-RHO-JD	626	BYO
1	MORTISE CYLINDER	8852IC	626	ASA
2	PERMANENT CORE	88600IC x RED CORE	626	ASA
2	SURFACE CLOSER	4040XP-EDA x ST1944	689	LCN
2	KICK PLATE	K0050 - 10 x 2 LDW x B4E	630	TRM
2	OVERHEAD STOP	100S	630	GLY
1	MULLION SEAL	5110	BLK	PEM
1 SET	DOOR SEALS	2893V HEAD & JAMBS	628	PEM
2	DOOR SWEEP	57V	628	PEM
1	THRESHOLD	PER SILL DETAIL	628	PEM

Note: Install door seals before closer

Note: AD-300 hardware shown for door prep templating only

Note: Furnished and installed by Section 281300 Electronic Access Control

HW-8

Each single door to have

1	CONTINUOUS HINGE	700-EPT	630	IVE
1	POWER TRANSFER	EPT-10	689	VON
1	EXIT DEVICE	AX-PA-LD-98EO	626	VON
1	ELECTRIC TRIM	AD-300-993R-50-MT-RHO-JD	626	BYO
1	PERMANENT CORE	88600IC x RED CORE	626	ASA
1	SURFACE CLOSER	4040XP-EDA x ST1944	689	LCN
1	KICK PLATE	K0050 - 10 x 2 LDW x B4E	630	TRM
1	OVERHEAD STOP	100S	630	GLY
1 SET	DOOR SEALS	2893V HEAD & JAMBS	628	PEM
1	DOOR SWEEP	57V	628	PEM
1	THRESHOLD	PER SILL DETAIL	628	PEM

Note: Install door seals before closer and rim strike

Note: Adjust exit device backset to allow for jamb seal

Note: AD-300 hardware shown for door prep templating only

Note: Furnished and installed by Section 281300 Electronic Access Control

HW-9

Each single door to have

4	HINGE	3CB1HW - 4.5 x 4.5	652	IVE
1	POWER TRANSFER	EPT-10	689	VON
1	ELECTRIC LOCKSET	AD-300-MS-50-MT-RHO-JD	626	BYO
1	PERMANENT CORE	88600IC x RED CORE	626	ASA
1	SURFACE CLOSER	4040XP-REG x 4040XP-18TJ x ST1630	689	LCN
1	KICK PLATE	K0050 - 10 x 2 LDW x B4E	630	TRM
1	OVERHEAD STOP	100HP	630	GLY
3	SILENCERS	1229A	GRY	TRM

Note: AD-300 hardware shown for door prep templating only

Note: Furnished and installed by Section 281300 Electronic Access Control

HW-10

Each single door to have

1	CONTINUOUS HINGE	700-EPT	630	IVE
1	POWER TRANSFER	EPT-10	689	VON
1	ELECTRIC LOCKSET	AD-300-MS-50-MT-RHO-JD	626	BYO
1	PERMANENT CORE	88600IC x RED CORE	626	ASA
1	LOCK ASTRAGAL	5000-T	626	TRM
1	SURFACE CLOSER	4040XP-EDA	689	LCN
1	OVERHEAD STOP	100S	630	GLY
1 SET	DOOR SEALS	BY FRAME MFR	---	---
1	DOOR SWEEP	57V	628	PEM
1	THRESHOLD	PER SILL DETAIL	628	PEM

Note: AD-300 hardware shown for door prep templating only

Note: Furnished and installed by Section 281300 Electronic Access Control

HW-11

Each single door to have

4	HINGE	3CB1HW - 4.5 x 4.5	652	IVE
1	POWER TRANSFER	EPT-10	689	VON
1	ELECTRIC LOCKSET	AD-300-MS-50-MT-RHO-JD	626	BYO
1	PERMANENT CORE	88600IC x RED CORE	626	ASA
1	SURFACE CLOSER	4040XP-HEDA	689	LCN
1	KICK PLATE	K0050 - 10 x 2 LDW x B4E	630	TRM
1	FLOOR STOP	1214	626	TRM
3	SILENCERS	1229A	GRY	TRM

Note: AD-300 hardware shown for door prep templating only

Note: Furnished and installed by Section 281300 Electronic Access Control

HW-12

Each single door to have

4	HINGE	3CB1HW - 4.5 x 4.5	652	IVE
1	POWER TRANSFER	EPT-10	689	VON
1	ELECTRIC LOCKSET	AD-300-MS-70-MT-RHO-JD	626	BYO
1	PERMANENT CORE	88600IC x RED CORE	626	ASA
1	SURFACE CLOSER	4040XP-REG	689	LCN
1	KICK PLATE	K0050 - 10 x 2 LDW x B4E	630	TRM
1	FLOOR STOP	1214	626	TRM
1 SET	SMOKE SEALS	S88 HEAD & JAMBS	BLK	PEM

Note: AD-300 hardware shown for door prep templating only

Note: Furnished and installed by Section 281300 Electronic Access Control

HW-13

Each single door to have

4	HINGE	3CB1HW - 4.5 x 4.5	652	IVE
1	LOCKSET	L9070T x 06N	626	SCH
1	PERMANENT CORE	88600IC x RED CORE	626	ASA
1	SURFACE CLOSER	4040XP-REG x 4040XP-18TJ x ST1630	689	LCN
1	KICK PLATE	K0050 - 10 x 2 LDW x B4E	630	TRM
1	OVERHEAD STOP	100HP	630	GLY
3	SILENCERS	1229A	GRY	TRM

HW-14

Each single door to have

1	CONTINUOUS HINGE	700	630	IVE
1	LOCKSET	L9071T x 06N	626	SCH
2	PERMANENT CORE	88600IC x RED CORE	626	ASA
1	SURFACE CLOSER	4040XP-SHCUSH x 4040XP-30	689	LCN
1 SET	DOOR SEALS	BY FRAME MFR	---	---

HW-15

Each pair door to have

2	CONTINUOUS HINGE	700-EPT	630	IVE
2	POWER TRANSFER	EPT-10	689	VON
1	REMOVABLE MULLION	KR4954 x MT54	689	VON
1	EXIT DEVICE	AX-PA-LD-RX-LC-98EO (INACTIVE)	626	VON
1	EXIT DEVICE	AX-PA-LD-98EO	626	VON
1	ELECTRIC TRIM	AD-300-993R-50-MT-RHO-JD	626	BYO
1	MORTISE CYLINDER	8852IC	626	ASA
2	PERMANENT CORE	88600IC x RED CORE	626	ASA
2	SURFACE CLOSER	4040XP-EDA x ST1944	689	LCN
2	KICK PLATE	K0050 - 10 x 2 LDW x B4E	630	TRM
2	FLOOR STOP	1209	626	TRM
1	MULLION SEAL	5110	BLK	PEM
1 SET	DOOR SEALS	2893V HEAD & JAMBS	628	PEM
2	DOOR SWEEP	57V	628	PEM
1	THRESHOLD	PER SILL DETAIL	628	PEM

Note: Install door seals before closer

Note: AD-300 hardware shown for door prep templating only

Note: Furnished and installed by Section 281300 Electronic Access Control

HW-16

Each single door to have

3	HINGE	3CB1HW - 4.5 x 4.5	652	IVE
1	POWER TRANSFER	EPT-10	689	VON
1	ELECTRIC LOCKSET	AD-300-MS-50-MT-RHO-JD	626	BYO
1	PERMANENT CORE	88600IC x RED CORE	626	ASA
1	SURFACE CLOSER	4040XP-REG	689	LCN
1	KICK PLATE	K0050 - 10 x 2 LDW x B4E	630	TRM
1	MOP PLATE	KM050 - 6 x 1 LDW x B4E	630	TRM
1	WALL BUMPER	1270CVPV	626	TRM
3	SILENCERS	1229A	GRY	TRM

Note: AD-300 hardware shown for door prep templating only

Note: Furnished and installed by Section 281300 Electronic Access Control

HW-17

Each single door to have

4	HINGE	3CB1HW - 4.5 x 4.5	652	IVE
1	LOCKSET	L9070T x 06N	626	SCH
1	PERMANENT CORE	88600IC x RED CORE	626	ASA
1	SURFACE CLOSER	4040XP-SHCUSH	689	LCN
1	KICK PLATE	K0050 - 10 x 2 LDW x B4E	630	TRM
3	SILENCERS	1229A	GRY	TRM

HW-18

Each single door to have

4	HINGE	3CB1HW - 4.5 x 4.5	652	IVE
1	LOCKSET	L9080T x 06N	626	SCH
1	PERMANENT CORE	88600IC x RED CORE	626	ASA
1	SURFACE CLOSER	4040XP-SCUSH	689	LCN
1	KICK PLATE	K0050 - 10 x 2 LDW x B4E	630	TRM
3	SILENCERS	1229A	GRY	TRM

HW-19

Each pair door to have

8	HINGE	3CB1HW - 4.5 x 4.5	652	IVE
1	REMOVABLE MULLION	KR4954 x MT54	689	VON
1	EXIT DEVICE	AX-PA-LD-98L-2 x 996L-06	626	VON
1	EXIT DEVICE	AX-PA-LD-98EO	626	VON
1	MORTISE CYLINDER	8852IC	626	ASA
2	RIM CYLINDER	8852IC-H	626	ASA
3	PERMANENT CORE	88600IC x RED CORE	626	ASA
2	SURFACE CLOSER	4040XP-HEDA	689	LCN
2	KICK PLATE	K0050 - 10 x 2 LDW x B4E	630	TRM
2	FLOOR STOP	1214	626	TRM
1	MULLION SEAL	5110	BLK	PEM
2	SILENCERS	1229A	GRY	TRM

HW-20

Each single door to have

4	HINGE	3CB1HW - 4.5 x 4.5	652	IVE
1	LOCKSET	L9071T x 06N	626	SCH
2	PERMANENT CORE	88600IC x RED CORE	626	ASA
1	SURFACE CLOSER	4040XP-H	689	LCN
1	KICK PLATE	K0050 - 10 x 2 LDW x B4E	630	TRM
1	FLOOR STOP	1214	626	TRM
3	SILENCERS	1229A	GRY	TRM

HW-21

Each single door to have

1	CONTINUOUS HINGE	700	630	IVE
1	LOCKSET	LV9080T x 06N	626	SCH
1	PERMANENT CORE	88600IC x RED CORE	626	ASA
1	LOCK ASTRAGAL	5000-T	626	TRM
1	KICK PLATE	K0050 - 10 x 2 LDW x B4E	630	TRM
1	OVERHEAD STOP	900F	630	GLY
1 SET	DOOR SEALS	2893V HEAD & JAMBS	628	PEM
1	DOOR SWEEP	57V	628	PEM
1	THRESHOLD	PER SILL DETAIL	628	PEM

Note: Install door seals before overhead stop

HW-22

Each pair door to have

2	CONTINUOUS HINGE	700	630	IVE
1 SET	AUTO FLUSH BOLT	3820 x 3810	626	TRM
1	DUST PROOF STRIKE	3910	626	TRM
1	EXIT DEVICE	AX-PA-LD-9875L-NL x 996L-NL-06	626	VON
1	MORTISE CYLINDER	8852IC	626	ASA
1	PERMANENT CORE	88600IC x RED CORE	626	ASA
1	SURFACE CLOSER	4040XP-SHCUSH x ST1595	689	LCN
2	KICK PLATE	K0050 - 10 x 1 LDW x B4E	630	TRM
1	OVERHEAD STOP	900F	630	GLY
1	ASTRAGAL	357 x TB	600	PEM
1 SET	DOOR SEALS	2893V HEAD & JAMBS	628	PEM
2	DOOR SWEEP	57V	628	PEM
1	THRESHOLD	PER SILL DETAIL	628	PEM

Note: Install door seals before closer and overhead stop

HW-23

Each single door to have

4	HINGE	3CB1HW - 4.5 x 4.5	652	IVE
1	LOCKSET	L9070T x 06N	626	SCH
1	PERMANENT CORE	88600IC x RED CORE	626	ASA
1	KICK PLATE	K0050 - 10 x 2 LDW x B4E	630	TRM
1	FLOOR STOP	1214	626	TRM
3	SILENCERS	1229A	GRY	TRM

HW-24

Each single door to have

4	HINGE	3CB1HW - 4.5 x 4.5	652	IVE
1	PRIVACY	L9440 x 06N x L583-363 x L283-722	626	SCH
1	SURFACE CLOSER	4040XP-EDA	689	LCN
1	KICK PLATE	K0050 - 10 x 2 LDW x B4E	630	TRM
1	FLOOR STOP	1214	626	TRM
1	COAT HOOK	3071	626	TRM
3	SILENCERS	1229A	GRY	TRM

HW-25

Each single door to have

4	HINGE	3CB1HW - 4.5 x 4.5	652	IVE
1	LOCKSET	L9071T x 06N	626	SCH
2	PERMANENT CORE	88600IC x RED CORE	626	ASA
1	SURFACE CLOSER	4040XP-HEDA	689	LCN
1	KICK PLATE	K0050 - 10 x 2 LDW x B4E	630	TRM
1	FLOOR STOP	1214	626	TRM
3	SILENCERS	1229A	GRY	TRM

HW-26

Each single door to have

4	HINGE	3CB1HW - 4.5 x 4.5	652	IVE
1	LOCKSET	L9070T x 06N	626	SCH
1	PERMANENT CORE	88600IC x RED CORE	626	ASA
1	SURFACE CLOSER	4040XP-HEDA	689	LCN
1	KICK PLATE	K0050 - 10 x 2 LDW x B4E	630	TRM
1	FLOOR STOP	1214	626	TRM
3	SILENCERS	1229A	GRY	TRM

HW-27

Each single door to have

4	HINGE	3CB1HW - 4.5 x 4.5	652	IVE
1	EXIT DEVICE	AX-PA-LD-98L-2 x 996L-06	626	VON
2	RIM CYLINDER	8852IC-H	626	ASA
2	PERMANENT CORE	88600IC x RED CORE	626	ASA
1	SURFACE CLOSER	4040XP-HEDA	689	LCN
1	KICK PLATE	K0050 - 10 x 2 LDW x B4E	630	TRM
1	FLOOR STOP	1214	626	TRM
3	SILENCERS	1229A	GRY	TRM

HW-28

Each single door to have

4	HINGE	3CB1HW - 4.5 x 4.5	652	IVE
1	LOCKSET	L9070T x 06N	626	SCH
1	PERMANENT CORE	88600IC x RED CORE	626	ASA
1	SURFACE CLOSER	4040XP-REG	689	LCN
1	KICK PLATE	K0050 - 10 x 2 LDW x B4E	630	TRM
1	MOP PLATE	KM050 - 6 x 1 LDW x B4E	630	TRM
1	WALL BUMPER	1270CVPV	626	TRM
3	SILENCERS	1229A	GRY	TRM

HW-29

Each single door to have

4	HINGE	3CB1HW - 4.5 x 4.5	652	IVE
1	LOCKSET	L9456T x 06N x L583-363 x L283-722	626	SCH
1	PERMANENT CORE	88600IC x RED CORE	626	ASA
1	SURFACE CLOSER	4040XP-SCUSH	689	LCN
1	KICK PLATE	K0050 - 10 x 2 LDW x B4E	630	TRM
1	COAT HOOK	3071	626	TRM
1 SET	SMOKE SEALS	S88 HEAD & JAMBS	BLK	PEM

HW-30

Each single door to have

4	HINGE	3CB1HW - 4.5 x 4.5	652	IVE
1	LOCKSET	L9070T x 06N	626	SCH
1	PERMANENT CORE	88600IC x RED CORE	626	ASA
1	SURFACE CLOSER	4040XP-H	689	LCN
1	KICK PLATE	K0050 - 10 x 2 LDW x B4E	630	TRM
1	MOP PLATE	KM050 - 6 x 1 LDW x B4E	630	TRM
1	FLOOR STOP	1214	626	TRM
3	SILENCERS	1229A	GRY	TRM

HW-31

Each single door to have

4	HINGE	3CB1HW - 4.5 x 4.5	652	IVE
1	LOCKSET	L9080T x 06N	626	SCH
1	PERMANENT CORE	88600IC x RED CORE	626	ASA
1	SURFACE CLOSER	4040XP-SCUSH	689	LCN
1	KICK PLATE	K0050 - 10 x 2 LDW x B4E	630	TRM
1 SET	SMOKE SEALS	S88 HEAD & JAMBS	BLK	PEM

HW-32

Each pair door to have

8	HINGE	3CB1HW - 4.5 x 4.5	652	IVE
2	PUSH PLATE	1001-9 - 6 x 16	630	TRM
2	PULL PLATE	1014-3 - 4 x 16	630	TRM
2	SURFACE CLOSER	4040XP-SHCUSH	689	LCN
2	KICK PLATE	K0050 - 10 x 1 LDW x B4E	630	TRM
2	MEETING ASTRAGAL	29310S	628	PEM
1 SET	SOUND SEALS	S88 HEAD & JAMBS	BLK	PEM

HW-33

Each single door to have

4	HINGE	3CB1HW - 4.5 x 4.5	652	IVE
1	LOCKSET	L9070T x 06N	626	SCH
1	PERMANENT CORE	88600IC x RED CORE	626	ASA
1	SURFACE CLOSER	4040XP-EDA	689	LCN
1	KICK PLATE	K0050 - 10 x 2 LDW x B4E	630	TRM
1	FLOOR STOP	1214	626	TRM
1 SET	SMOKE SEALS	S88 HEAD & JAMBS	BLK	PEM

HW-34

Each single door to have

4	HINGE	3CB1HW - 4.5 x 4.5	652	IVE
1	EXIT DEVICE	AX-PA-98L-F-2 x 996L-06	626	VON
2	RIM CYLINDER	8852IC-H	626	ASA
2	PERMANENT CORE	88600IC x RED CORE	626	ASA
1	SURFACE CLOSER	4040XP-SCUSH	689	LCN
1	KICK PLATE	K0050 - 10 x 2 LDW x B4E	630	TRM
1 SET	SMOKE SEALS	S88 HEAD & JAMBS	BLK	PEM

HW-35

Each opening to have

1	PADLOCK	88391LB x SIDEBAR	626	ASA
1	PERMANENT CORE	88600IC x RED CORE	626	ASA
Note: Balance of material provided by Roll-Up Door Manufacturer				

HW-36

Each pair door to have

8	HINGE	3CB1HW - 4.5 x 4.5	652	IVE
1	REMOVABLE MULLION	KR9954 x MT54	689	VON
1	EXIT DEVICE	AX-PA-98L-F-2 x 996L-06 x 499F	626	VON
1	EXIT DEVICE	AX-PA-98EO-F x 499F	626	VON
1	MORTISE CYLINDER	8852IC	626	ASA
2	RIM CYLINDER	8852IC-H	626	ASA
3	PERMANENT CORE	88600IC x RED CORE	626	ASA
1	SURFACE CLOSER	4040XP-EDA	689	LCN
1	SURFACE CLOSER	4040XP-SCUSH	689	LCN
2	KICK PLATE	K0050 - 10 x 2 LDW x B4E	630	TRM
1	FLOOR STOP	1214	626	TRM
1	MULLION SEAL	5110	BLK	PEM
1 SET	SMOKE SEALS	S88 HEAD & JAMBS	BLK	PEM
Note: Install 4040XP-EDA closer and 1214 stop at 90 degree wall leaf				

HW-37

Each pair door to have

8	HINGE	3CB1HW - 4.5 x 4.5	652	IVE
1 SET	AUTO FLUSH BOLT	3820 x 3850	626	TRM
1	LOCKSET	L9070T x 06N x 7/8 STK	626	SCH
1	PERMANENT CORE	88600IC x RED CORE	626	ASA
1	COORDINATOR	3094 x 3095/3096	600	TRM
2	SURFACE CLOSER	4040XP-SCUSH	689	LCN
2	KICK PLATE	K0050 - 10 x 1 LDW x B4E	630	TRM
1	ASTRAGAL	357 x TB	600	PEM
1 SET	SMOKE SEALS	S88 HEAD, JAMBS, & ASTRAGAL	BLK	PEM

HW-38

Each pair door to have

8	HINGE	3CB1HW - 4.5 x 4.5	652	IVE
1	REMOVABLE MULLION	KR9954 x MT54	689	VON
1	EXIT DEVICE	AX-PA-98L-F-2 x 996L-06 x 499F	626	VON
1	EXIT DEVICE	AX-PA-98EO-F x 499F	626	VON
1	MORTISE CYLINDER	8852IC	626	ASA
2	RIM CYLINDER	8852IC-H	626	ASA
3	PERMANENT CORE	88600IC x RED CORE	626	ASA
2	SURFACE CLOSER	4040XP-SCUSH	689	LCN
2	KICK PLATE	K0050 - 10 x 2 LDW x B4E	630	TRM
1	MULLION SEAL	5110	BLK	PEM
1 SET	SMOKE SEALS	S88 HEAD & JAMBS	BLK	PEM

HW-39

Each pair door to have

8	HINGE	3CB1HW - 4.5 x 4.5	652	IVE
2	PUSH PLATE	1001-9 - 6 x 16	630	TRM
2	PULL PLATE	1014-3 - 4 x 16	630	TRM
2	SURFACE CLOSER	4040XP-HEDA	689	LCN
2	KICK PLATE	K0050 - 10 x 1 LDW x B4E	630	TRM
2	FLOOR STOP	1214	626	TRM
2	MEETING ASTRAGAL	29310S	628	PEM
1 SET	SOUND SEALS	S88 HEAD & JAMBS	BLK	PEM

HW-40

Each single door to have

4	HINGE	3CB1HW - 4.5 x 4.5	652	IVE
1	EXIT DEVICE	AX-PA-LD-98L-2 x 996L-06	626	VON
2	RIM CYLINDER	8852IC-H	626	ASA
2	PERMANENT CORE	88600IC x RED CORE	626	ASA
1	SURFACE CLOSER	4040XP-HEDA	689	LCN
1	KICK PLATE	K0050 - 10 x 2 LDW x B4E	630	TRM
1	FLOOR STOP	1214	626	TRM
2	MOUNTING BRACKET	328SPB	600	ZER
1	AUTO DOOR BOTTOM	420SL	628	PEM
1 SET	SOUND SEALS	S88 HEAD & JAMBS	BLK	PEM
1 SET	SOUND SEALS	315R HEAD & JAMBS	628	PEM

Note: Install door seals before closer and rim strike

Note: Adjust exit device backset to allow for jamb seal

Note: Install mounting bracket over door seals at closer and rim strike

HW-41

Each pair door to have

8	HINGE	3CB1HW - 4.5 x 4.5	652	IVE
1	REMOVABLE MULLION	KR4954 x MT54	689	VON
1	EXIT DEVICE	AX-PA-LD-98L-2 x 996L-06	626	VON
1	EXIT DEVICE	AX-PA-LD-98EO	626	VON
1	MORTISE CYLINDER	8852IC	626	ASA
2	RIM CYLINDER	8852IC-H	626	ASA
3	PERMANENT CORE	88600IC x RED CORE	626	ASA
2	SURFACE CLOSER	4040XP-SHCUSH	689	LCN
2	KICK PLATE	K0050 - 10 x 2 LDW x B4E	630	TRM
1	MULLION SEAL	5110	BLK	PEM
2	SILENCERS	1229A	GRY	TRM

HW-42

Each single door to have

4	HINGE	3CB1HW - 4.5 x 4.5	652	IVE
1	PUSH PLATE	1001-9 - 6 x 16	630	TRM
1	PULL PLATE	1014-3 - 4 x 16	630	TRM
1	SURFACE CLOSER	4040XP-HEDA	689	LCN
1	KICK PLATE	K0050 - 10 x 2 LDW x B4E	630	TRM
1	FLOOR STOP	1214	626	TRM
1 SET	SOUND SEALS	S88 HEAD & JAMBS	BLK	PEM

HW-43

Each single door to have

4	HINGE	3CB1HW - 4.5 x 4.5	652	IVE
1	LOCKSET	L9070T x 06N	626	SCH
1	PERMANENT CORE	88600IC x RED CORE	626	ASA
1	SURFACE CLOSER	4040XP-REG	689	LCN
1	KICK PLATE	K0050 - 10 x 2 LDW x B4E	630	TRM
1	FLOOR STOP	1214	626	TRM
1 SET	SMOKE SEALS	S88 HEAD & JAMBS	BLK	PEM

HW-44

Each single door to have

4	HINGE	3CB1HW - 4.5 x 4.5	652	IVE
1	LOCKSET	L9071T x 06N	626	SCH
2	PERMANENT CORE	88600IC x RED CORE	626	ASA
1	SURFACE CLOSER	4040XP-REG	689	LCN
1	KICK PLATE	K0050 - 10 x 2 LDW x B4E	630	TRM
1	OVERHEAD STOP	900S	630	GLY
1 SET	SMOKE SEALS	S88 HEAD & JAMBS	BLK	PEM

HW-45

Each single door to have

4	HINGE	3CB1HW - 4.5 x 4.5	652	IVE
1	PRIVACY	L9440 x 06N x L583-363 x L283-722	626	SCH
1	SURFACE CLOSER	4040XP-SCUSH	689	LCN
1	KICK PLATE	K0050 - 10 x 2 LDW x B4E	630	TRM
1	COAT HOOK	3071	626	TRM
3	SILENCERS	1229A	GRY	TRM

HW-46

Each single door to have

4	HINGE	3CB1HW - 4.5 x 4.5	652	IVE
1	LOCKSET	L9071T x 06N	626	SCH
2	PERMANENT CORE	88600IC x RED CORE	626	ASA
1	SURFACE CLOSER	4040XP-SCUSH	689	LCN
1	KICK PLATE	K0050 - 10 x 2 LDW x B4E	630	TRM
1 SET	SMOKE SEALS	S88 HEAD & JAMBS	BLK	PEM

HW-47

Each pair door to have

2	CONTINUOUS HINGE	700	630	IVE
1 SET	AUTO FLUSH BOLT	3820 x 3810	626	TRM
1	DUST PROOF STRIKE	3910	626	TRM
1	LOCKSET	LV9070T x 06N x 7/8 STK	626	SCH
1	PERMANENT CORE	88600IC x RED CORE	626	ASA
1	SURFACE CLOSER	4040XP-SHCUSH x ST1595	689	LCN
2	KICK PLATE	K0050 - 10 x 1 LDW x B4E	630	TRM
1	OVERHEAD STOP	900F	630	GLY
1	ASTRAGAL	357 x TB	600	PEM
1 SET	DOOR SEALS	2893V HEAD & JAMBS	628	PEM
2	DOOR SWEEP	57V	628	PEM
1	THRESHOLD	PER SILL DETAIL	628	PEM

Note: Install door seals before closer and overhead stop

HW-48

Each pair door to have

8	HINGE	3CB1HW - 4.5 x 4.5	652	IVE
1 SET	AUTO FLUSH BOLT	3820 (TOP BOLT ONLY)	626	TRM
1	LOCKSET	L9070T x 06N x 7/8 STK	626	SCH
1	PERMANENT CORE	88600IC x RED CORE	626	ASA
1	SURFACE CLOSER	4040XP-HEDA (ACTIVE)	689	LCN
2	KICK PLATE	K0050 - 10 x 1 LDW x B4E	630	TRM
2	FLOOR STOP	1214	626	TRM
1	ASTRAGAL	357	600	PEM
2	SILENCERS	1229A	GRY	TRM

HW-49

Each pair door to have

8	HINGE	3CB1HW - 4.5 x 4.5	652	IVE
1 SET	AUTO FLUSH BOLT	3820 (TOP BOLT ONLY)	626	TRM
1	LOCKSET	L9070T x 06N x 7/8 STK	626	SCH
1	PERMANENT CORE	88600IC x RED CORE	626	ASA
1	SURFACE CLOSER	4040XP-SHCUSH (ACTIVE)	689	LCN
2	KICK PLATE	K0050 - 10 x 1 LDW x B4E	630	TRM
1	OVERHEAD STOP	900S	630	GLY
1	ASTRAGAL	357	600	PEM
2	SILENCERS	1229A	GRY	TRM

HW-50

Each single door to have

4	HINGE	3CB1HW - 5.0 x 4.5	652	IVE
1	LOCKSET	L9070T x 06N	626	SCH
1	PERMANENT CORE	88600IC x RED CORE	626	ASA
1	SURFACE CLOSER	4040XP-SHCUSH	689	LCN
1	KICK PLATE	K0050 - 10 x 2 LDW x B4E	630	TRM
1	AUTO DOOR BOTTOM	420SL	628	PEM
1 SET	SOUND SEALS	S88 HEAD & JAMBS	BLK	PEM

HW-51

Each single door to have

4	HINGE	3CB1HW - 4.5 x 4.5	652	IVE
1	LOCKSET	L9080T x 06N	626	SCH
1	PERMANENT CORE	88600IC x RED CORE	626	ASA
1	SURFACE CLOSER	4040XP-REG	689	LCN
1	KICK PLATE	K0050 - 10 x 2 LDW x B4E	630	TRM
1	FLOOR STOP	1214	626	TRM
3	SILENCERS	1229A	GRY	TRM

HW-52

Each single door to have

1	CONTINUOUS HINGE	700-EPT	630	IVE
1	POWER TRANSFER	EPT-10	689	VON
1	ELECTRIC LOCKSET	AD-300-MS-50-MT-RHO-JD	626	BYO
1	PERMANENT CORE	88600IC x RED CORE	626	ASA
1	LOCK ASTRAGAL	5000-T	626	TRM
1	SURFACE CLOSER	4040XP-EDA x ST1944	689	LCN
1	KICK PLATE	K0050 - 10 x 2 LDW x B4E	630	TRM
1	OVERHEAD STOP	100S	630	GLY
1 SET	DOOR SEALS	2893V HEAD & JAMBS	628	PEM
1	DOOR SWEEP	57V	628	PEM
1	THRESHOLD	PER SILL DETAIL	628	PEM

Note: Install door seals before closer

Note: AD-300 hardware shown for door prep templating only

Note: Furnished and installed by Section 281300 Electronic Access Control

HW-53

Each single door to have

4	HINGE	3CB1HW - 4.5 x 4.5	652	IVE
1	LOCKSET	L9466T x 06N	626	SCH
2	PERMANENT CORE	88600IC x RED CORE	626	ASA
1	SURFACE CLOSER	4040XPT-STD	689	LCN
1	KICK PLATE	K0050 - 10 x 2 LDW x B4E	630	TRM
1	MOP PLATE	KM050 - 6 x 1 LDW x B4E	630	TRM
1	WALL BUMPER	1270CVPV	626	TRM
3	SILENCERS	1229A	GRY	TRM
1	THRESHOLD	PER SILL DETAIL	628	PEM

HW-54

Each single door to have

1	CONTINUOUS HINGE	700	630	IVE
1	LOCKSET	LV9485T x 06N x L583-563 x L283-722	626	SCH
1	PERMANENT CORE	88600IC x RED CORE	626	ASA
1	LOCK ASTRAGAL	5000-T	626	TRM
1	SURFACE CLOSER	4040XP-SCUSH x ST1595	689	LCN
1	KICK PLATE	K0050 - 10 x 2 LDW x B4E	630	TRM
1	COAT HOOK	3071	626	TRM
1 SET	DOOR SEALS	2893V HEAD & JAMBS	628	PEM
1	DOOR SWEEP	57V	628	PEM
1	THRESHOLD	PER SILL DETAIL	628	PEM

Note: Install door seals before closer

HW-55

Each single door to have

1	CONTINUOUS HINGE	700-EPT	630	IVE
1	POWER TRANSFER	EPT-10	689	VON
1	EXIT DEVICE	AX-PA-LD-98EO x 1439	626	VON
1	ELECTRIC TRIM	AD-300-993R-50-MT-RHO-JD	626	BYO
1	PERMANENT CORE	88600IC x RED CORE	626	ASA
1	SURFACE CLOSER	4040XP-EDA	689	LCN
1	OVERHEAD STOP	100S	630	GLY
1 SET	DOOR SEALS	BY FRAME MFR	---	---
1	DOOR SWEEP	57V	628	PEM
1	THRESHOLD	PER SILL DETAIL	628	PEM

Note: AD-300 hardware shown for door prep templating only

Note: Furnished and installed by Section 281300 Electronic Access Control

HW-56

Each pair door to have

2	CONTINUOUS HINGE	700-EPT	630	IVE
2	POWER TRANSFER	EPT-10	689	VON
1	REMOVABLE MULLION	KR4954 x MT54	689	VON
1	EXIT DEVICE	AX-PA-LD-RX-LC-98EO (INACTIVE)	626	VON
1	EXIT DEVICE	AX-PA-LD-98EO	626	VON
1	ELECTRIC TRIM	AD-300-993R	626	BYO
1	MORTISE CYLINDER	8852IC	626	ASA
2	PERMANENT CORE	88600IC x RED CORE	626	ASA
2	SURFACE CLOSER	4040XP-EDA x ST1944	689	LCN
2	KICK PLATE	K0050 - 10 x 2 LDW x B4E	630	TRM
1	FLOOR STOP	1209	626	TRM
1	OVERHEAD STOP	100S	630	GLY
1	MULLION SEAL	5110	BLK	PEM
1 SET	DOOR SEALS	2893V HEAD & JAMBS	628	PEM
2	DOOR SWEEP	57V	628	PEM
1	THRESHOLD	PER SILL DETAIL	628	PEM

Note: Install door seals before closer

Note: Install 1209 stop at 90 degree wall leaf

Note: AD-300 hardware shown for door prep templating only

Note: Furnished and installed by Section 281300 Electronic Access Control

HW-57

Each single door to have

4	HINGE	3CB1HW - 4.5 x 4.5	652	IVE
1	LOCKSET	L9071T x 06N	626	SCH
2	PERMANENT CORE	88600IC x RED CORE	626	ASA
1	SURFACE CLOSER	4040XP-SHCUSH	689	LCN
1	KICK PLATE	K0050 - 10 x 2 LDW x B4E	630	TRM
3	SILENCERS	1229A	GRY	TRM

HW-58

Each single door to have

4	HINGE	3CB1HW - 4.5 x 4.5	652	IVE
1	PUSH PLATE	1001-9 - 6 x 16	630	TRM
1	PULL PLATE	1014-3 - 4 x 16	630	TRM
1	SURFACE CLOSER	4040XP-HEDA	689	LCN
1	KICK PLATE	K0050 - 10 x 2 LDW x B4E	630	TRM
1	MOP PLATE	KM050 - 6 x 1 LDW x B4E	630	TRM
1	FLOOR STOP	1214	626	TRM
3	SILENCERS	1229A	GRY	TRM

HW-59

Each pair door to have

8	HINGE	3CB1HW - 4.5 x 4.5	652	IVE
1 SET	AUTO FLUSH BOLT	3820 (TOP BOLT ONLY)	626	TRM
1	LOCKSET	L9080T x 06N x 7/8 STK	626	SCH
1	PERMANENT CORE	88600IC x RED CORE	626	ASA
1	SURFACE CLOSER	4040XP-SHCUSH (ACTIVE)	689	LCN
2	KICK PLATE	K0050 - 10 x 1 LDW x B4E	630	TRM
1	OVERHEAD STOP	900S	630	GLY
1	ASTRAGAL	357	600	PEM
2	SILENCERS	1229A	GRY	TRM

HW-60

Each pair door to have

8	HINGE	3CB1HW - 5.0 x 4.5	652	IVE
1	REMOVABLE MULLION	KR4954 x MT54	689	VON
1	EXIT DEVICE	AX-PA-LD-98L-2 x 996L-06	626	VON
1	EXIT DEVICE	AX-PA-LD-98EO	626	VON
1	MORTISE CYLINDER	8852IC	626	ASA
2	RIM CYLINDER	8852IC-H	626	ASA
3	PERMANENT CORE	88600IC x RED CORE	626	ASA
2	SURFACE CLOSER	4040XP-SHCUSH	689	LCN
2	KICK PLATE	K0050 - 10 x 2 LDW x B4E	630	TRM
1	MULLION SEAL	5110	BLK	PEM
2	SILENCERS	1229A	GRY	TRM

HW-61

Each single door to have

4	HINGE	3CB1HW - 4.5 x 4.5	652	IVE
1	EXIT DEVICE	AX-PA-LD-98L-2 x 996L-06	626	VON
2	RIM CYLINDER	8852IC-H	626	ASA
2	PERMANENT CORE	88600IC x RED CORE	626	ASA
1	SURFACE CLOSER	4040XP-SHCUSH	689	LCN
1	KICK PLATE	K0050 - 10 x 2 LDW x B4E	630	TRM
3	SILENCERS	1229A	GRY	TRM

HW-62

Each single door to have

1	CONTINUOUS HINGE	700	630	IVE
1	LOCKSET	LV9485T x 06N x L583-563 x L283-722	626	SCH
1	PERMANENT CORE	88600IC x RED CORE	626	ASA
1	SURFACE CLOSER	4040XP-REG	689	LCN
1	KICK PLATE	K0050 - 10 x 2 LDW x B4E	630	TRM
1	MOP PLATE	KM050 - 6 x 1 LDW x B4E	630	TRM
1	WALL BUMPER	1270CVPV	626	TRM
1	COAT HOOK	3071	626	TRM
1 SET	DOOR SEALS	2893V HEAD & JAMBS	628	PEM
1	DOOR BOTTOM	222V	628	PEM
1	THRESHOLD	PER SILL DETAIL	628	PEM

HW-63

Each single door to have

1	CONTINUOUS HINGE	700	630	IVE
1	LOCKSET	LV9070T x 06N	626	SCH
1	PERMANENT CORE	88600IC x RED CORE	626	ASA
1	SURFACE CLOSER	4040XP-H	689	LCN
1	KICK PLATE	K0050 - 10 x 2 LDW x B4E	630	TRM
1	MOP PLATE	KM050 - 6 x 1 LDW x B4E	630	TRM
1	FLOOR STOP	1214	626	TRM
1 SET	DOOR SEALS	2893V HEAD & JAMBS	628	PEM
1	DOOR BOTTOM	222V	628	PEM
1	THRESHOLD	PER SILL DETAIL	628	PEM

HW-64

Each single door to have

1	CONTINUOUS HINGE	700-EPT	630	IVE
1	POWER TRANSFER	EPT-10	689	VON
1	ELECTRIC LOCKSET	AD-300-MS-50-MT-RHO-JD	626	BYO
1	PERMANENT CORE	88600IC x RED CORE	626	ASA
1	LOCK ASTRAGAL	5000-T	626	TRM
1	SURFACE CLOSER	4040XP-SHCUSH x ST1595	689	LCN
1	KICK PLATE	K0050 - 10 x 2 LDW x B4E	630	TRM
1 SET	DOOR SEALS	2893V HEAD & JAMBS	628	PEM
1	DOOR SWEEP	57V	628	PEM
1	THRESHOLD	PER SILL DETAIL	628	PEM

Note: Install door seals before closer

Note: AD-300 hardware shown for door prep templating only

Note: Furnished and installed by Section 281300 Electronic Access Control

HW-65

Each single door to have

1	CONTINUOUS HINGE	700	630	IVE
1	EXIT DEVICE	AX-PA-LD-98L-NL x 996L-NL-06	626	VON
1	RIM CYLINDER	8852IC-H	626	ASA
1	PERMANENT CORE	88600IC x RED CORE	626	ASA
1	SURFACE CLOSER	4040XP-SHCUSH x ST1595	689	LCN
1	KICK PLATE	K0050 - 10 x 2 LDW x B4E	630	TRM
1 SET	DOOR SEALS	2893V HEAD & JAMBS	628	PEM
1	DOOR SWEEP	57V	628	PEM
1	THRESHOLD	PER SILL DETAIL	628	PEM

Note: Install door seals before closer and rim strike

Note: Adjust exit device backset to allow for jamb seal

HW-66

Each single door to have

4	HINGE	3CB1HW - 4.5 x 4.5	652	IVE
1	EXIT DEVICE	AX-PA-98L-F-2 x 996L-06	626	VON
2	RIM CYLINDER	8852IC-H	626	ASA
2	PERMANENT CORE	88600IC x RED CORE	626	ASA
1	SURFACE CLOSER	4040XP-EDA	689	LCN
1	KICK PLATE	K0050 - 10 x 2 LDW x B4E	630	TRM
1	FLOOR STOP	1214	626	TRM
1 SET	SMOKE SEALS	S88 HEAD & JAMBS	BLK	PEM

HW-67

Each single door to have

1	CONTINUOUS HINGE	700-EPT	630	IVE
1	POWER TRANSFER	EPT-10	689	VON
1	EXIT DEVICE	AX-PA-LD-98EO	626	VON
1	ELECTRIC TRIM	AD-300-993R-50-MTK-RHO-JD	626	BYO
1	PERMANENT CORE	88600IC x RED CORE	626	ASA
1	SURFACE CLOSER	4040XP-EDA x ST1944	689	LCN
1	KICK PLATE	K0050 - 10 x 2 LDW x B4E	630	TRM
1	OVERHEAD STOP	100S	630	GLY
1 SET	DOOR SEALS	2893V HEAD & JAMBS	628	PEM
1	DOOR SWEEP	57V	628	PEM
1	THRESHOLD	PER SILL DETAIL	628	PEM

Note: Install door seals before closer and rim strike

Note: Adjust exit device backset to allow for jamb seal

Note: AD-300 hardware shown for door prep templating only

Note: Furnished and installed by Section 281300 Electronic Access Control

HW-68

Each single door to have

4	HINGE	3CB1HW - 4.5 x 4.5	652	IVE
1	POWER TRANSFER	EPT-10	689	VON
1	ELECTRIC LOCKSET	AD-300-MS-50-MT-RHO-JD	626	BYO
1	PERMANENT CORE	88600IC x RED CORE	626	ASA
1	SURFACE CLOSER	4040XP-REG	689	LCN
1	KICK PLATE	K0050 - 10 x 2 LDW x B4E	630	TRM
1	OVERHEAD STOP	900S	630	GLY
1 SET	SMOKE SEALS	S88 HEAD & JAMBS	BLK	PEM

Note: AD-300 hardware shown for door prep templating only

Note: Furnished and installed by Section 281300 Electronic Access Control

HW-69

Each pair door to have

2	CONTINUOUS HINGE	700-EPT	630	IVE
2	POWER TRANSFER	EPT-10	689	VON
1	REMOVABLE MULLION	KR4954 x MT54	689	VON
1	EXIT DEVICE	AX-PA-LD-RX-LC-98EO (INACTIVE)	626	VON
1	EXIT DEVICE	AX-PA-LD-98EO	626	VON
1	ELECTRIC TRIM	AD-300-993R-50-MT-RHO-JD	626	BYO
1	MORTISE CYLINDER	8852IC	626	ASA
2	PERMANENT CORE	88600IC x RED CORE	626	ASA
2	SURFACE CLOSER	4040XP-EDA	689	LCN
1	FLOOR STOP	1209	626	TRM
1	OVERHEAD STOP	100S	630	GLY
1	MULLION SEAL	5110	BLK	PEM
1 SET	DOOR SEALS	BY FRAME MFR	---	---
2	DOOR SWEEP	57V	628	PEM
1	THRESHOLD	PER SILL DETAIL	628	PEM

Note: Install 1209 stop at 90 degree wall leaf

Note: AD-300 hardware shown for door prep templating only

Note: Furnished and installed by Section 281300 Electronic Access Control

HW-70

Each single door to have

4	HINGE	3CB1HW - 4.5 x 4.5	652	IVE
1	POWER TRANSFER	EPT-10	689	VON
1	ELECTRIC LOCKSET	AD-300-MS-50-MT-RHO-JD	626	BYO
1	PERMANENT CORE	88600IC x RED CORE	626	ASA
1	SURFACE CLOSER	4040XP-H	689	LCN
1	KICK PLATE	K0050 - 10 x 2 LDW x B4E	630	TRM
1	FLOOR STOP	1214	626	TRM
3	SILENCERS	1229A	GRY	TRM

Note: AD-300 hardware shown for door prep templating only

Note: Furnished and installed by Section 281300 Electronic Access Control

HW-71

Each single door to have

4	HINGE	3CB1HW - 5.0 x 4.5	652	IVE
1	EXIT DEVICE	AX-PA-98L-F-2 x 996L-06	626	VON
2	RIM CYLINDER	8852IC-H	626	ASA
2	PERMANENT CORE	88600IC x RED CORE	626	ASA
1	SURFACE CLOSER	4040XP-SCUSH	689	LCN
1	KICK PLATE	K0050 - 10 x 2 LDW x B4E	630	TRM
1 SET	SMOKE SEALS	S88 HEAD & JAMBS	BLK	PEM

HW-72

Each single door to have

4	HINGE	3CB1HW - 4.5 x 4.5	652	IVE
1	LOCKSET	L9466T x 06N	626	SCH
2	PERMANENT CORE	88600IC x RED CORE	626	ASA
1	SURFACE CLOSER	4040XP-HEDA	689	LCN
1	KICK PLATE	K0050 - 10 x 2 LDW x B4E	630	TRM
1	FLOOR STOP	1214	626	TRM
1 SET	SOUND SEALS	S88 HEAD & JAMBS	BLK	PEM

HW-73

Each single door to have

4	HINGE	3CB1HW - 4.5 x 4.5	652	IVE
1	POWER TRANSFER	EPT-10	689	VON
1	ELECTRIC LOCKSET	AD-300-MS-40-MT-RHO-JD	626	BYO
1	PERMANENT CORE	88600IC x RED CORE	626	ASA
1	SURFACE CLOSER	4040XP-SCUSH	689	LCN
1	KICK PLATE	K0050 - 10 x 2 LDW x B4E	630	TRM
1	COAT HOOK	3071	626	TRM
3	SILENCERS	1229A	GRY	TRM

Note: AD-300 hardware shown for door prep templating only

Note: Furnished and installed by Section 281300 Electronic Access Control

HW-74

Each single door to have

4	HINGE	3CB1HW - 4.5 x 4.5	652	IVE
1	LOCKSET	L9466T x 06N	626	SCH
2	PERMANENT CORE	88600IC x RED CORE	626	ASA
1	SURFACE CLOSER	4040XP-EDA	689	LCN
1	KICK PLATE	K0050 - 10 x 2 LDW x B4E	630	TRM
1	FLOOR STOP	1214	626	TRM
1 SET	SMOKE SEALS	S88 HEAD & JAMBS	BLK	PEM

HW-75

Each single door to have

1	CONTINUOUS HINGE	700	630	IVE
1	LOCKSET	LV9070T x 06N	626	SCH
1	PERMANENT CORE	88600IC x RED CORE	626	ASA
1	LOCK ASTRAGAL	5000-T	626	TRM
1	SURFACE CLOSER	4040XP-EDA x ST1944	689	LCN
1	KICK PLATE	K0050 - 10 x 2 LDW x B4E	630	TRM
1	OVERHEAD STOP	100S	630	GLY
1 SET	DOOR SEALS	2893V HEAD & JAMBS	628	PEM
1	DOOR SWEEP	57V	628	PEM
1	THRESHOLD	PER SILL DETAIL	628	PEM

Note: Install door seals before closer

HW-76

Each single door to have

1	CONTINUOUS HINGE	700-EPT	630	IVE
1	POWER TRANSFER	EPT-10	689	VON
1	ELECTRIC LOCKSET	AD-300-MS-50-MTK-RHO-JD	626	BYO
1	PERMANENT CORE	88600IC x RED CORE	626	ASA
1	SURFACE CLOSER	4040XP-REG	689	LCN
1	KICK PLATE	K0050 - 10 x 2 LDW x B4E	630	TRM
1	FLOOR STOP	1214	626	TRM
1 SET	DOOR SEALS	2893V HEAD & JAMBS	628	PEM
1	DOOR BOTTOM	222V	628	PEM
1	THRESHOLD	PER SILL DETAIL	628	PEM

Note: AD-300 hardware shown for door prep templating only

Note: Furnished and installed by Section 281300 Electronic Access Control

HW-77

Each single door to have

4	HINGE	3CB1HW - 4.5 x 4.5	652	IVE
1	POWER TRANSFER	EPT-10	689	VON
1	ELECTRIC LOCKSET	AD-300-MS-70-MT-RHO-JD	626	BYO
1	PERMANENT CORE	88600IC x RED CORE	626	ASA
1	SURFACE CLOSER	4040XP-SCUSH	689	LCN
1	KICK PLATE	K0050 - 10 x 2 LDW x B4E	630	TRM
1 SET	SMOKE SEALS	S88 HEAD & JAMBS	BLK	PEM
Note: AD-300 hardware shown for door prep templating only				
Note: Furnished and installed by Section 281300 Electronic Access Control				

HW-78

Each single door to have

4	HINGE	3CB1HW - 4.5 x 4.5	652	IVE
1	POWER TRANSFER	EPT-10	689	VON
1	ELECTRIC LOCKSET	AD-300-MS-50-MT-RHO-JD	626	BYO
2	PERMANENT CORE	88600IC x RED CORE	626	ASA
1	SURFACE CLOSER	4040XP-EDA	689	LCN
1	KICK PLATE	K0050 - 10 x 2 LDW x B4E	630	TRM
1	WALL BUMPER	1270CV/PV	626	TRM
1 SET	SMOKE SEALS	S88 HEAD & JAMBS	BLK	PEM
Note: AD-300 hardware shown for door prep templating only				
Note: Furnished and installed by Section 281300 Electronic Access Control				

HW-79

Each single door to have

1	CONTINUOUS HINGE	715-EPT	630	IVE
1	POWER TRANSFER	EPT-10	689	VON
1	ELECTRIC LOCKSET	AD-300-MS-50-MT-RHO-JD	626	BYO
1	PERMANENT CORE	88600IC x RED CORE	626	ASA
1	LOCK ASTRAGAL	5000-T	626	TRM
1	SURFACE CLOSER	4040XP-EDA x ST1944	689	LCN
1	ARMOR PLATE	KA050-2 - 36 x 2 LDW x B4E	630	TRM
1	OVERHEAD STOP	100HP	630	GLY
1	DOOR VIEWER	976	626	TRM
1 SET	DOOR SEALS	2893V HEAD & JAMBS	628	PEM
1	DOOR SWEEP	57V	628	PEM
1	THRESHOLD	PER SILL DETAIL	628	PEM
Note: Install door seals before closer				
Note: AD-300 hardware shown for door prep templating only				
Note: Furnished and installed by Section 281300 Electronic Access Control				

HW-80

Each pair door to have

1	CONTINUOUS HINGE	715-EPT	630	IVE
1	CONTINUOUS HINGE	715	630	IVE
1	POWER TRANSFER	EPT-10	689	VON
1 SET	AUTO FLUSH BOLT	3820 x 3810	626	TRM
1	DUST PROOF STRIKE	3910	626	TRM
1	ELECTRIC LOCKSET	AD-300-MS-50-MT-RHO-JD x 7/8 STK	626	BYO
1	PERMANENT CORE	88600IC x RED CORE	626	ASA
1	SURFACE CLOSER	4040XP-EDA x ST1944 (ACTIVE)	689	LCN
2	ARMOR PLATE	KA050-2 - 36 x 1 LDW x B4E	630	TRM
2	OVERHEAD STOP	100HP	630	GLY
1	DOOR VIEWER	976 (ACTIVE)	626	TRM
1	ASTRAGAL	357 x TB	600	PEM
1 SET	DOOR SEALS	2893V HEAD & JAMBS	628	PEM
2	DOOR SWEEP	57V	628	PEM
1	THRESHOLD	PER SILL DETAIL	628	PEM

Note: Install door seals before closer

Note: AD-300 hardware shown for door prep templating only

Note: Furnished and installed by Section 281300 Electronic Access Control

HW-81

All material provided by Double-Acting Traffic Door Manufacturer

HW-82

Each single door to have

1	CONTINUOUS HINGE	700-EPT	630	IVE
1	POWER TRANSFER	EPT-10	689	VON
1	EXIT DEVICE	AX-PA-LD-98EO x 1439	626	VON
1	ELECTRIC TRIM	AD-300-993R-50-MT-RHO-JD	626	BYO
1	PERMANENT CORE	88600IC x RED CORE	626	ASA
1	SURFACE CLOSER	4040XP-HEDA	689	LCN
1	FLOOR STOP	1209	626	TRM
1 SET	DOOR SEALS	BY FRAME MFR	---	---
1	DOOR SWEEP	57V	628	PEM
1	THRESHOLD	PER SILL DETAIL	628	PEM

Note: AD-300 hardware shown for door prep templating only

Note: Furnished and installed by Section 281300 Electronic Access Control

HW-83

Each single door to have

1	CONTINUOUS HINGE	700-EPT	630	IVE
1	POWER TRANSFER	EPT-10	689	VON
1	ELECTRIC LOCKSET	AD-300-MS-50-MT-RHO-JD	626	BYO
1	PERMANENT CORE	88600IC x RED CORE	626	ASA
1	LOCK ASTRAGAL	5000-T	626	TRM
1	SURFACE CLOSER	4040XP-SCUSH x ST1595	689	LCN
1	KICK PLATE	K0050 - 10 x 2 LDW x B4E	630	TRM
1 SET	DOOR SEALS	2893V HEAD & JAMBS	628	PEM
1	DOOR SWEEP	57V	628	PEM
1	THRESHOLD	PER SILL DETAIL	628	PEM

Note: Install door seals before closer

Note: AD-300 hardware shown for door prep templating only

Note: Furnished and installed by Section 281300 Electronic Access Control

HW-84

Each single door to have

1	CONTINUOUS HINGE	700	630	IVE
1	LOCKSET	LV9070T x 06N	626	SCH
1	PERMANENT CORE	88600IC x RED CORE	626	ASA
1	LOCK ASTRAGAL	5000-T	626	TRM
1	SURFACE CLOSER	4040XP-SHCUSH x ST1595	689	LCN
1	KICK PLATE	K0050 - 10 x 2 LDW x B4E	630	TRM
1 SET	DOOR SEALS	2893V HEAD & JAMBS	628	PEM
1	DOOR SWEEP	57V	628	PEM
1	THRESHOLD	PER SILL DETAIL	628	PEM

Note: Install door seals before closer

HW-85

Each single door to have

4	HINGE	3CB1HW - 4.5 x 4.5	652	IVE
1	LOCKSET	L9080T x 06N	626	SCH
1	PERMANENT CORE	88600IC x RED CORE	626	ASA
1	SURFACE CLOSER	4040XP-EDA	689	LCN
1	KICK PLATE	K0050 - 10 x 2 LDW x B4E	630	TRM
1	FLOOR STOP	1214	626	TRM
1 SET	SMOKE SEALS	S88 HEAD & JAMBS	BLK	PEM

HW-86

Each single door to have

1	CONTINUOUS HINGE	700-EPT	630	IVE
1	POWER TRANSFER	EPT-10	689	VON
1	ELECTRIC LOCKSET	AD-300-MS-50-MT-RHO-JD	626	BYO
1	PERMANENT CORE	88600IC x RED CORE	626	ASA
1	SURFACE CLOSER	4040XP-REG	689	LCN
1	KICK PLATE	K0050 - 10 x 2 LDW x B4E	630	TRM
1	FLOOR STOP	1214	626	TRM
1 SET	DOOR SEALS	2893V HEAD & JAMBS	628	PEM
1	DOOR BOTTOM	222V	628	PEM
1	THRESHOLD	PER SILL DETAIL	628	PEM

Note: AD-300 hardware shown for door prep templating only

Note: Furnished and installed by Section 281300 Electronic Access Control

HW-87

Each single door to have

4	HINGE	3CB1HW - 4.5 x 4.5	652	IVE
1	LOCKSET	L9080T x 06N	626	SCH
1	PERMANENT CORE	88600IC x RED CORE	626	ASA
1	SURFACE CLOSER	4040XP-REG	689	LCN
1	KICK PLATE	K0050 - 10 x 2 LDW x B4E	630	TRM
1	FLOOR STOP	1214	626	TRM
1 SET	SMOKE SEALS	S88 HEAD & JAMBS	BLK	PEM

HW-88

Each pair door to have

2	CONTINUOUS HINGE	700-EPT	630	IVE
2	POWER TRANSFER	EPT-10	689	VON
1	REMOVABLE MULLION	KR4954 x MT54	689	VON
1	EXIT DEVICE	AX-PA-LD-RX-LC-98EO (INACTIVE)	626	VON
1	EXIT DEVICE	AX-PA-LD-98EO	626	VON
1	ELECTRIC TRIM	AD-300-993R	626	BYO
1	MORTISE CYLINDER	8852IC	626	ASA
2	PERMANENT CORE	88600IC x RED CORE	626	ASA
2	SURFACE CLOSER	4040XP-EDA	689	LCN
2	FLOOR STOP	1209	626	TRM
1	MULLION SEAL	5110	BLK	PEM
1 SET	DOOR SEALS	BY FRAME MFR	---	---
2	DOOR SWEEP	57V	628	PEM
1	THRESHOLD	PER SILL DETAIL	628	PEM

Note: AD-300 hardware shown for door prep templating only

Note: Furnished and installed by Section 281300 Electronic Access Control

HW-89

Each single door to have

1	CONTINUOUS HINGE	700-EPT	630	IVE
1	POWER TRANSFER	EPT-10	689	VON
1	ELECTRIC LOCKSET	AD-300-MS-40-MT-RHO-JD	626	BYO
1	PERMANENT CORE	88600IC x RED CORE	626	ASA
1	LOCK ASTRAGAL	5000-T	626	TRM
1	SURFACE CLOSER	4040XP-SCUSH x ST1595	689	LCN
1	KICK PLATE	K0050 - 10 x 2 LDW x B4E	630	TRM
1	COAT HOOK	3071	626	TRM
1 SET	DOOR SEALS	2893V HEAD & JAMBS	628	PEM
1	DOOR SWEEP	57V	628	PEM
1	THRESHOLD	PER SILL DETAIL	628	PEM

Note: Install door seals before closer

Note: AD-300 hardware shown for door prep templating only

Note: Furnished and installed by Section 281300 Electronic Access Control

HW-90

Each single door to have

4	HINGE	3CB1HW - 4.5 x 4.5	652	IVE
1	LOCKSET	L9070T x 06N	626	SCH
1	PERMANENT CORE	88600IC x RED CORE	626	ASA
1	SURFACE CLOSER	4040XP-EDA	689	LCN
1	KICK PLATE	K0050 - 10 x 2 LDW x B4E	630	TRM
1	FLOOR STOP	1214	626	TRM
3	SILENCERS	1229A	GRY	TRM

HW-91

Each single door to have

1	CONTINUOUS HINGE	700-EPT	630	IVE
1	POWER TRANSFER	EPT-10	689	VON
1	EXIT DEVICE	AX-PA-LD-98EO	626	VON
1	ELECTRIC TRIM	AD-300-993R-70-MT-RHO-JD	626	BYO
1	PERMANENT CORE	88600IC x RED CORE	626	ASA
1	SURFACE CLOSER	4040XP-SHCUSH x ST1595	689	LCN
1	KICK PLATE	K0050 - 10 x 2 LDW x B4E	630	TRM
1 SET	DOOR SEALS	2893V HEAD & JAMBS	628	PEM
1	DOOR SWEEP	57V	628	PEM
1	THRESHOLD	PER SILL DETAIL	628	PEM

Note: Install door seals before closer and rim strike

Note: Adjust exit device backset to allow for jamb seal

Note: AD-300 hardware shown for door prep templating only

Note: Furnished and installed by Section 281300 Electronic Access Control

HW-92

Each single door to have

1	CONTINUOUS HINGE	700	630	IVE
1	LOCKSET	LV9070T x 06N	626	SCH
1	PERMANENT CORE	88600IC x RED CORE	626	ASA
1	LOCK ASTRAGAL	5000-T	626	TRM
1	SURFACE CLOSER	4040XP-HEDA x ST1944	689	LCN
1	KICK PLATE	K0050 - 10 x 2 LDW x B4E	630	TRM
1	FLOOR STOP	1209	626	TRM
1 SET	DOOR SEALS	2893V HEAD & JAMBS	628	PEM
1	DOOR SWEEP	57V	628	PEM
1	THRESHOLD	PER SILL DETAIL	628	PEM

Note: Install door seals before closer

HW-93

Each pair door to have

1	CONTINUOUS HINGE	700-EPT	630	IVE
1	CONTINUOUS HINGE	700	630	IVE
1	POWER TRANSFER	EPT-10	689	VON
1 SET	AUTO FLUSH BOLT	3820 x 3810	626	TRM
1	DUST PROOF STRIKE	3910	626	TRM
1	ELECTRIC LOCKSET	AD-300-MS-70-MT-RHO-JD x 7/8 STK	626	BYO
1	PERMANENT CORE	88600IC x RED CORE	626	ASA
1	SURFACE CLOSER	4040XP-SHCUSH x ST1595	689	LCN
2	KICK PLATE	K0050 - 10 x 1 LDW x B4E	630	TRM
1	OVERHEAD STOP	900F	630	GLY
1	ASTRAGAL	357 x TB	600	PEM
1 SET	DOOR SEALS	2893V HEAD & JAMBS	628	PEM
2	DOOR SWEEP	57V	628	PEM
1	THRESHOLD	PER SILL DETAIL	628	PEM

Note: Install door seals before closer and overhead stop

Note: AD-300 hardware shown for door prep templating only

Note: Furnished and installed by Section 281300 Electronic Access Control

1	EXIT DEVICE	AX-PA-LD-9875L-NL x 996L-NL-06	626	VON
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HW-94

Each pair door to have

1	CONTINUOUS HINGE	700-EPT	630	IVE
1	CONTINUOUS HINGE	700	630	IVE
1	POWER TRANSFER	EPT-10	689	VON
1 SET	AUTO FLUSH BOLT	3820 x 3810	626	TRM
1	DUST PROOF STRIKE	3910	626	TRM
1	EXIT DEVICE	AX-PA-LD-9875EO	626	VON
1	ELECTRIC TRIM	AD-300-993M-70-MT-RHO-JD	626	BYO
1	PERMANENT CORE	88600IC x RED CORE	626	ASA
1	SURFACE CLOSER	4040XP-SHCUSH x ST1595	689	LCN
2	KICK PLATE	K0050 - 10 x 1 LDW x B4E	630	TRM
1	OVERHEAD STOP	900F	630	GLY
1	ASTRAGAL	357 x TB	600	PEM
1 SET	DOOR SEALS	2893V HEAD & JAMBS	628	PEM
2	DOOR SWEEP	57V	628	PEM
1	THRESHOLD	PER SILL DETAIL	628	PEM

Note: Install door seals before closer and overhead stop

Note: AD-300 hardware shown for door prep templating only

Note: Furnished and installed by Section 281300 Electronic Access Control

HW-95

Each single door to have

4	HINGE	3CB1HW - 4.5 x 4.5	652	IVE
1	POWER TRANSFER	EPT-10	689	VON
1	ELECTRIC LOCKSET	AD-300-MS-50-MT-RHO-JD	626	BYO
1	PERMANENT CORE	88600IC x RED CORE	626	ASA
1	SURFACE CLOSER	4040XP-SHCUSH	689	LCN
1	KICK PLATE	K0050 - 10 x 2 LDW x B4E	630	TRM
3	SILENCERS	1229A	GRY	TRM

Note: AD-300 hardware shown for door prep templating only

Note: Furnished and installed by Section 281300 Electronic Access Control

HW-96

Each single door to have

1	CONTINUOUS HINGE	700-EPT	630	IVE
1	POWER TRANSFER	EPT-10	689	VON
1	ELECTRIC LOCKSET	AD-300-MS-50-MT-RHO-JD	626	BYO
1	PERMANENT CORE	88600IC x RED CORE	626	ASA
1	SURFACE CLOSER	4040XP-REG x 4040XP-18TJ x ST1630	689	LCN
1	KICK PLATE	K0050 - 10 x 2 LDW x B4E	630	TRM
1	MOP PLATE	KM050 - 6 x 1 LDW x B4E	630	TRM
1	OVERHEAD STOP	100HP	630	GLY
1 SET	DOOR SEALS	2893V HEAD & JAMBS	628	PEM
1	DOOR BOTTOM	222V	628	PEM
1	THRESHOLD	PER SILL DETAIL	628	PEM

Note: AD-300 hardware shown for door prep templating only

Note: Furnished and installed by Section 281300 Electronic Access Control

HW-97

Each single door to have

1 SET	CENTER PIVOT	7255-SET	689	IVE
2	PUSH PLATE	1001-3 - 4 x 16	630	TRM
1	CONCEALED CLOSER	6031-STD	689	LCN
2	KICK PLATE	K0050 - 10 x 1 LDW x B4E	630	TRM
2	WALL BUMPER	1270CVPV	626	TRM

HW-98

Each pair door to have

8	HINGE	3CB1HW - 4.5 x 4.5	652	IVE
1	REMOVABLE MULLION	KR4954 x MT54	689	VON
1	EXIT DEVICE	AX-PA-LD-98L-2 x 996L-06	626	VON
1	EXIT DEVICE	AX-PA-LD-98EO	626	VON
1	MORTISE CYLINDER	8852IC	626	ASA
2	RIM CYLINDER	8852IC-H	626	ASA
3	PERMANENT CORE	88600IC x RED CORE	626	ASA
2	SURFACE CLOSER	4040XP-HEDA	689	LCN
2	KICK PLATE	K0050 - 10 x 2 LDW x B4E	630	TRM
2	FLOOR STOP	1214	626	TRM
1	MULLION SEAL	5110	BLK	PEM
2	MOUNTING BRACKET	328SPB	600	ZER
2	AUTO DOOR BOTTOM	420SL	628	PEM
1 SET	SOUND SEALS	S88 HEAD & JAMBS	BLK	PEM
1 SET	SOUND SEALS	315R HEAD & JAMBS	628	PEM

Note: Install door seals before closer and rim strike

Note: Adjust exit device backset to allow for jamb seal

Note: Install mounting bracket over door seals at closer

HW-99

Each pair door to have

8	HINGE	3CB1HW - 4.5 x 4.5	652	IVE
1	REMOVABLE MULLION	KR4954 x MT54	689	VON
1	EXIT DEVICE	AX-PA-LD-98L-2 x 996L-06	626	VON
1	EXIT DEVICE	AX-PA-LD-98EO	626	VON
1	MORTISE CYLINDER	8852IC	626	ASA
2	RIM CYLINDER	8852IC-H	626	ASA
3	PERMANENT CORE	88600IC x RED CORE	626	ASA
2	SURFACE CLOSER	4040XP-SHCUSH	689	LCN
2	KICK PLATE	K0050 - 10 x 2 LDW x B4E	630	TRM
1	MULLION SEAL	5110	BLK	PEM
2	MOUNTING BRACKET	328SPB	600	ZER
2	AUTO DOOR BOTTOM	420SL	628	PEM
1 SET	SOUND SEALS	S88 HEAD & JAMBS	BLK	PEM
1 SET	SOUND SEALS	315R HEAD & JAMBS	628	PEM

Note: Install door seals before closer and rim strike

Note: Adjust exit device backset to allow for jamb seal

Note: Install mounting bracket over door seals at closer

HW-100

Each single door to have

1	CONTINUOUS HINGE	700	630	IVE
1	EXIT DEVICE	AX-PA-LD-98EO	626	VON
1	SURFACE CLOSER	4040XP-EDA x ST1944	689	LCN
1	KICK PLATE	K0050 - 10 x 2 LDW x B4E	630	TRM
1	OVERHEAD STOP	100S	630	GLY
1 SET	DOOR SEALS	2893V HEAD & JAMBS	628	PEM
1	DOOR SWEEP	57V	628	PEM
1	THRESHOLD	PER SILL DETAIL	628	PEM

Note: Install door seals before closer and rim strike

Note: Adjust exit device backset to allow for jamb seal

HW-SG1

Each single gate to have

1	PADLOCK	88391LB x SIDEBAR	626	ASA
1	PERMANENT CORE	88600IC x RED CORE	626	ASA

Note: Balance of material provided by Gate Manufacturer

HW-SG2

Each pair gate to have

1	FIRE DEPT PADLOCK	3772	626	KNX
1	PADLOCK	88391LB x SIDEBAR	626	ASA
1	PERMANENT CORE	88600IC x RED CORE	626	ASA

Note: Balance of material provided by Gate Manufacturer

HW-SG3

Each pair gate to have

1	PADLOCK	88391LB x SIDEBAR	626	ASA
1	PERMANENT CORE	88600IC x RED CORE	626	ASA

Note: Balance of material provided by Gate Manufacturer

HW-SG4

Each pair gate to have

2	EXIT DEVICE	AX-PA-LD-98EO x WH	626	VON
2	ELECTRIC TRIM	AD-400-993R-70-MT-RHO-JD	626	BYO
2	PERMANENT CORE	88600IC x RED CORE	626	ASA
2	GATE BOX	K-BXED-V992L-2	600	KEE
2 SET	GATE HINGE/CLOSER	MAMMOTH-180	BLK	LOC

Note: Balance of material provided by Gate Manufacturer

Note: AD-300 hardware shown for gate prep templating only

Note: Furnished and installed by Section 281300 Electronic Access Control

HW-SG5

Each pair gate to have

2	EXIT DEVICE	AX-PA-LD-98EO x WH	626	VON
2	ELECTRIC TRIM	AD-400-993R-70-MT-RHO-JD	626	BYO
2	PERMANENT CORE	88600IC x RED CORE	626	ASA
2	GATE BOX	K-BXED-V992L-2	600	KEE
2 SET	GATE HINGE/CLOSER	MAMMOTH-180 x CLB	ALU	LOC

Note: Balance of material provided by Gate Manufacturer

Note: AD-300 hardware shown for gate prep templating only

Note: Furnished and installed by Section 281300 Electronic Access Control

HW-SG6

Each pair gate to have

--	GATE HINGE	PER GATE DETAIL	---	---
1	PADLOCK	88391LB x SIDEBAR	626	ASA
1	PERMANENT CORE	88600IC x RED CORE	626	ASA

Note: Balance of material provided by Gate Manufacturer

HW-SG7

Each rolling to have

1	PADLOCK	88391LB x SIDEBAR	626	ASA
1	PERMANENT CORE	88600IC x RED CORE	626	ASA

Note: Balance of material provided by Gate Manufacturer

HW-SG8

Each single gate to have

1	EXIT DEVICE	AX-PA-CD-98L x 996L-06 x WH	626	VON
1	MORTISE CYLINDER	8852IC	626	ASA
1	RIM CYLINDER	8852IC-H	626	ASA
2	PERMANENT CORE	88600IC x RED CORE	626	ASA
1	GATE BOX	K-BXED-V992L-2	600	KEE
1 SET	GATE HINGE/CLOSER	MAMMOTH-180	BLK	LOC

Note: Balance of material provided by Gate Manufacturer

HW-SG9

Each single gate to have

--	GATE HINGE	PER GATE DETAIL	---	---
1	PADLOCK	88391LB x SIDEBAR	626	ASA
1	PERMANENT CORE	88600IC x RED CORE	626	ASA

Note: Balance of material provided by Gate Manufacturer

HW-SG10

Each single gate to have

1	EXIT DEVICE	AX-PA-CD-98L x 996L-06 x WH	626	VON
1	MORTISE CYLINDER	8852IC	626	ASA
1	RIM CYLINDER	8852IC-H	626	ASA
2	PERMANENT CORE	88600IC x RED CORE	626	ASA
1	GATE BOX	K-BXED-V992L-2	600	KEE
1 SET	GATE HINGE/CLOSER	MAMMOTH-180 x CLB	ALU	LOC

Note: Balance of material provided by Gate Manufacturer

HW-SG11

Each pair gate to have

2	EXIT DEVICE	AX-PA-LD-98EO x WH	626	VON
2 SET	GATE HINGE/CLOSER	MAMMOTH-180	BLK	LOC
Note: Balance of material provided by Gate Manufacturer				

HW-SG12

Each single gate to have

1	EXIT DEVICE	AX-PA-LD-98EO x WH	626	VON
1 SET	GATE HINGE/CLOSER	MAMMOTH-180	BLK	LOC
Note: Balance of material provided by Gate Manufacturer				

HW-SG13

Each pair gate to have

2	EXIT DEVICE	AX-PA-CD-98L x 996L-06 x WH	626	VON
2	MORTISE CYLINDER	8852IC	626	ASA
2	RIM CYLINDER	8852IC-H	626	ASA
4	PERMANENT CORE	88600IC x RED CORE	626	ASA
2	GATE BOX	K-BXED-V992L-2	600	KEE
2 SET	GATE HINGE/CLOSER	MAMMOTH-180	BLK	LOC
Note: Balance of material provided by Gate Manufacturer				

HW-SG14

Each single gate to have

1	EXIT DEVICE	AX-PA-LD-98EO x WH	626	VON
1	ELECTRIC TRIM	AD-400-993R-70-MT-RHO-JD	626	BYO
1	PERMANENT CORE	88600IC x RED CORE	626	ASA
1	GATE BOX	K-BXED-V992L-2	600	KEE
1 SET	GATE HINGE/CLOSER	MAMMOTH-180	BLK	LOC
Note: Balance of material provided by Gate Manufacturer				
Note: AD-300 hardware shown for gate prep templating only				
Note: Furnished and installed by Section 281300 Electronic Access Control				

HW-SG15

Each pair gate to have

2	EXIT DEVICE	AX-PA-CD-98L x 996L-06 x WH	626	VON
2	MORTISE CYLINDER	8852IC	626	ASA
2	RIM CYLINDER	8852IC-H	626	ASA
4	PERMANENT CORE	88600IC x RED CORE	626	ASA
2	GATE BOX	K-BXED-V992L-2	600	KEE
2 SET	GATE HINGE/CLOSER	MAMMOTH-180 x CLB	ALU	LOC
Note: Balance of material provided by Gate Manufacturer				

HW-SG16

Each single gate to have

1	EXIT DEVICE	AX-PA-LD-98EO x WH	626	VON
1	ELECTRIC TRIM	AD-400-993R-70-MT-RHO-JD	626	BYO
1	PERMANENT CORE	88600IC x RED CORE	626	ASA
1	GATE BOX	K-BXED-V992L-2	600	KEE
1 SET	GATE HINGE/CLOSER	MAMMOTH-180 x CLB	ALU	LOC

Note: Balance of material provided by Gate Manufacturer

Note: AD-300 hardware shown for gate prep templating only

Note: Furnished and installed by Section 281300 Electronic Access Control

HW-SG17

Each pair gate to have

2	ELECTRIC LOCKSET	AD-400-MS-70-MT-RHO-JD	626	BYO
2	PERMANENT CORE	88600IC x RED CORE	626	ASA
2	GATE BOX	K-BXMOR8155	600	KEE
2 SET	GATE HINGE/CLOSER	MAMMOTH-180 x CLB	ALU	LOC

Note: Balance of material provided by Gate Manufacturer

Note: AD-300 hardware shown for gate prep templating only

Note: Furnished and installed by Section 281300 Electronic Access Control

HW-SG18

Each single gate to have

1	LOCKSET	LV9080T x 06N	626	SCH
1	PERMANENT CORE	88600IC x RED CORE	626	ASA
1	LOCK ASTRAGAL	5000-T	626	TRM
1	GATE BOX	K-BXSAR45	600	KEE
1 SET	GATE HINGE/CLOSER	MAMMOTH-180	BLK	LOC

Note: Balance of material provided by Gate Manufacturer

HW-MISC

Miscellaneous Hardware

1	KEY CABINET	1206-A-760 CAP. FLOOR UNIT	GRY	LUN
5	LOCKSET	L9070T x 06N	626	SCH
5	SURFACE CLOSER	4040XP-REG	689	LCN
2	EXIT DEVICE	AX-PA-CD-98NL-OP x 110NL	626	VON
10	PADLOCK	88391LB x SIDEBAR	626	ASA
10	PERMANENT CORE	88600IC x RED CORE	626	ASA
1 SET	TOOLS AND INSTRUCTIONS FOR HARDWARE ON JOB			
1 SET	CATALOG CUTS AND HARDWARE SCHEDULE FOR JOB			

END OF SECTION

SECTION 08 80 00

GLAZING

1. PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Glass and glazing for hollow metal work windows storefronts curtain walls and doors.
- B. Spandrel glazing.

1.2 REFERENCES

- A. ANSI Z97.1 - Safety Performance Specifications and Methods of Test for Safety Glazing Used in Buildings.
- B. ASTM C920 - Elastomeric Joint Sealants.
- C. ASTM C1036 - Flat Glass.
- D. ASTM C1048 - Heat-Treated Flat Glass.
- E. ASTM C1172 - Specification for Laminated Architectural Flat Glass.
- F. ASTM C1651 - Measurement of Roll Wave Optical Distortion in Heat-Treated Flat Glass.
- G. ASTM E774 - Sealed Insulating Glass Units.
- H. CBC - California Building Code, (CCR) California Code of Regulations, Title 24, Part 2.
- I. CPSC - Consumer Product Safety Council.
- J. GANA - Glazing Manual.
- K. UL - Underwriters' Laboratories, Inc., Building Materials Directory.

1.3 QUALITY ASSURANCE

- A. Conform to The Glass Association of North America (GANA) Glazing Manual and Sealant Manual for glazing installation methods.

1.4 REGULATORY REQUIREMENTS

- A. Conform to all glass labeling requirements of the CBC - California Building Code, (CCR) California Code of Regulations, Title 24, Part 2, Section 2403.

1.5 SUBMITTALS

- A. Submit product data under provisions of Section 01 33 00.
- B. Provide structural, physical and environmental characteristics, size limitations, special handling or installation requirements.
- C. Provide data on glazing sealant. Identify colors available.
- D. Submit samples under provisions of Section 01 33 00.
- E. Submit two samples, 12 x 12 inches in size, illustrating each glass coloration.
- F. Submit 12 inch long bead of glazing sealant in color selected.

- G. Submit sealed glass unit manufacturer's certificate under provisions of Section 01 33 00 indicating units meet or exceed specified requirements.

1.6 DELIVERY, STORAGE, AND PROTECTION

- A. Deliver, store and protect products under provisions of Section 01 61 00.

1.7 WARRANTY

- A. Provide ten year manufacturer's warranty under provisions of Section 01 77 00.
- B. Warranty: Include coverage of sealed insulating glass units from seal failure, interpane dusting or misting, and replacement of same.
- C. Warranty: Include coverage for reflective coating on mirrors and replacement of same.
- D. Warranty: Include coverage for delamination of laminated glass and replacement of same.

2. PART 2 PRODUCTS

2.1 ACCEPTABLE GLASS MANUFACTURERS

A. Clear and Tinted Float Glass:

1. AGC Industries, Inc., www.agc.com.
2. Guardian Industries Corp., www.guardianglass.com.
3. Pilkington Glass HA, www.pilkington.com.
4. Vitro Architectural Glass, www.vitroglazings.com.
5. Oldcastle Glass, www.obe.com.
6. Zeledyne Versalux Architectural Glass, www.hartung-glass.com.
7. Viracon, Inc., www.viracon.com.

B. Fire-Resistive Glazing:

1. AGC Interedge Technologies, UL No. R19261, www.firesafe-glass.com.
2. Nippon Electric Glass, Co., UL No. R13849, www.fireglass.com.
3. Pilkington Glass NA, UL No. R16644, www.pilkington.com.
4. Saint-Gobain, UL No. R14515, www.vetrotech.com.
5. Technical Glass Products, UL No. R13377, www.fireglass.com.
6. SAFTI, UL No. R14212, www.safti.com

C. Fire-Resistive Safety Glazing:

1. AGC Interedge Technologies, UL No. R19261, www.firesafe-glass.com.
2. Nippon Electric Glass, Co., UL No. R13849, [ww.fireglass.com](http://www.fireglass.com).
3. Pilkington Glass NA, UL No. R16644, www.pilkington.com.
4. Saint-Gobain, UL No. R14515, www.vetrotech.com.

5. Technical Glass Products, UL No. R13377, www.fireglass.com.
6. SAFTI, UL No. R14212, www.safti.com.

D. Tempered Glass:

1. AGC Industries, Inc., www.agc.com.
2. Guardian Industries Corp., www.guardianglass.com.
3. Oldcastle Glass Co., www.obe.com.
4. Interpane, www.interpane.com.
5. Pilkington Glass NA, www.pilkington.com.
6. Vitro Architectural Glass, www.vitroglazings.com.
7. Zeledyne Versalux Architectural Glass, www.hartung-glass.com.
8. Viracon, Inc., www.viracon.com.

E. Laminated Glass:

1. AGC Industries, Inc., www.agc.com.
2. Guardian Industries Corp., www.guardianglass.com.
3. Interpane, www.interpane.com.
4. Oldcastle Glass Co., www.obe.com.
5. Pilkington Glass HA, www.pilkington.com.
6. Vitro Architectural Glass, www.vitroglazings.com.
7. Zeledyne Versalux Architectural Glass, www.hartung-glass.com.
8. Viracon, Inc., www.viracon.com.

F. Sealed Insulating Glass:

1. AGC Industries, Inc., www.agc.com.
2. Guardian Industries Corp., www.guardianglass.com.
3. Interpane, www.interpane.com.
4. Oldcastle Glass Co., www.obe.com.
5. Pilkington Glass NA, www.pilkington.com.
6. Vitro Architectural Glass, www.vitroglazings.com.
7. Zeledyne Versalux Architectural Glass, www.hartung-glass.com.
8. Viracon, Inc., www.viracon.com.

G. Substitutions: Under provisions of Section 01 25 13.

2.2 GLASS MATERIALS, GENERAL

- A. Primary Glass Standard: Comply with ASTM C1036 requirements, including reference to type, class, quality, and, if applicable, form, finish, and pattern.
- B. Tempered Glass Standard: Comply with ASTM C1048 requirements, including those indicated by reference to kind, condition, type, quality, class, and, if applicable, form, finish, and pattern.
- C. Laminated Glass Standard: Comply with ASTM C1172 requirements including reference to type, class, quality, and if applicable, form, finish and pattern.
- D. Sizes: Fabricate glass to sizes required for glazing openings, with edge clearances and tolerances complying with recommendations of glass manufacturer and GANA.
- E. Provide thicknesses indicated or, if not indicated, as recommended by glass manufacturer for application indicated.
- F. Roller wave distortion shall not exceed 0.003 inch as measured peak to valley at the center of the glass, and 0.008 inch at the leading and trailing edge of the lite of glass as measured by ASTM C1651.

2.3 PRIMARY GLASS PRODUCTS

- A. Clear Float Glass: ASTM C1036, Type I (transparent glass, flat), Class 1 (clear), Quality q3 (glazing select). With light transmittance of 0.88–0.91 percent, shading coefficient of 0.94, U-value of 1.02 and solar heat gain coefficient of 0.81 for 1/4 inch thick glass.
- B. Tinted Float Glass: ASTM C1036, Type I (transparent glass, flat), Class 2 (tinted heat absorbing and light reducing), Quality q3 (glazing select) as follows:
 - 1. Blue: Manufacturer's standard tint, with light transmittance of 55-57 percent, shading coefficient of 0.61-0.70, U-value of 1.02, and solar heat gain coefficient of 0.61 for 1/4 inch thick glass.
 - 2. Blue-Green or Green: Manufacturer's standard tint, with visible light transmittance of 74-76 percent, shading coefficient of 0.69-0.72, U-value of 1.02, and solar heat gain coefficient of 0.62 for 1/4 inch thick glass.
- C. Mirror Glass: ASTM C1036, Type I Transparent Glass, Flat; Class 1, Clear; q1 mirror select; 1/4 inch thick with pressure-sensitive adhesive coated scrim-impregnated film tape safety backing.

2.4 FIRE RESISTIVE GLAZING

- A. Fire Resistive Glazing: Clear flat ceramic glazing sheet of 3/16 or 1/4 inch nominal thickness weighing 2.5 to 3 psf, permanently labeled with appropriate testing and inspection marks, standard polish with visible light transmission of 76.9 to 89 percent; listed by UL.
- B. Fire-Resistive Safety Glazing: 1/4 inch thick tempered or 3/8 inch thick laminated glazing unit. Unit to comply with ANSI Z97.1, CPSC 16 CFR 1201, Category II, and be listed by UL. Laminated unit to have the following characteristics:
 - 1. First Ply: Single pane of clear, flat, fire-resistive ceramic glazing, 3/16 inch thick, standard polish.
 - 2. Interlayer: Clear calcium silicate interlayer.
 - 3. Second Ply: Single pane of clear, flat, fire-resistive ceramic glazing, 3/16 inch thick, standard polish.

2.5 TEMPERED GLASS PRODUCTS

- A. Manufacturing Process: Horizontal (roller hearth) process with roll wave distortion parallel with bottom edge of glass as installed.

- B. Clear Tempered Float Glass: ASTM C1048, Kind FT (fully tempered), Condition A (uncoated surfaces), Type 1 (transparent glass, flat) Class 1 (clear), Quality q3 (glazing select); conforming to ANSI Z97.1 and CPSC 16 CFR 1201, Category II.
- C. Clear Tempered Float Glass - Low E: ASTM C1048, Kind FT (fully tempered), Condition C (coated) with low E coating on No. 2 surface, Type 1 (transparent glass, flat) Class 1 (clear), Quality q3 (glazing select); conforming to ANSI Z97.1, and CPSC 16 CFR 1201, Category II.
- D. Tinted Tempered Float Glass: ASTM C1048, Kind FT (fully tempered), Condition A (uncoated surfaces), Type 1 (transparent glass, flat), Class 2 (tinted heat absorbing and light reducing), Quality q3 (glazing select), tint color matching non-heat treated float glass; conforming to ANSI Z97.1, and CPSC 16 CFR 1201, Category II.

2.6 LAMINATED GLASS PRODUCTS

- A. Laminated Safety Glass: Two plies of float glass of equal thickness, ASTM C1172, kind LHS (heat-strengthened), laminated with 0.030 inch thick plastic interlayer; conforming to ANSI Z97.1, and CPSC 16 CFR 1201, Category II. Unit to have the following characteristics:
 - 1. Glass: Class 1 - clear for inner ply only. Class 2, blue-green or green tint outer ply only.
 - 2. Glass Thickness (each pane): 1/8 inch as indicated.
 - 3. Color of Plastic Interlayer: Clear
 - 4. Coating: Low E coating on No. 2 surface of inner ply of exterior glass. Low E coating to be similar to Vitro Solarban 90.
- B. Plastic Interlayer:
 - 1. Saflex (Solutia); Monsanto Co., www.saflex.com.
 - 2. Butacite; E.I. DuPont DeNemours & Co., Inc., www.dupont.com.
 - 3. Eastman Chemical Company, Vanceva, www.vanceva.com.
 - 4. Kuraray America, Inc., www.trosifol.com.

2.7 SEALED INSULATING GLASS UNITS

- A. Comply with ASTM E774, Class A.
- B. Thickness of Exterior Pane: 1/4 inch.
- C. Thickness of Interior Pane: 1/4 inch.
- D. Air Space Thickness: 1/2 inch.
- E. Exterior Pane: Laminated safety glass.
- F. Interior Pane: Clear float glass. Clear tempered float glass.
- G. Coating: Low E coating on No. 2 surface. Low E coating to be similar to Vitro Solarban 90.
- H. Spacer Material: Stainless steel warm edge spacer.
- I. Dessicant: Molecular sieve or silica gel or blend of both.

2.8 SILICONE COATED SPANDREL GLASS

- A. ASTM C1048, Type I, Condition C, Quality - Q3.
- B. Type: Heat-strengthened.
- C. Condition: C, opacifier coated.
- D. Opacity: To match adjacent non-spandrel glazing.
- E. Minimum Thickness: 1/4 inch.
- F. Coating Color: As selected by Architect.

2.9 GLAZING SEALANTS AND PREFORMED GLAZING TABS

- A. General: Comply with ASTM C920, and sealant and glass manufacturers recommendations for suitability and compatibility.
- B. One-Part Butyl Glazing Sealant:
 - 1. Chem-Calk 300; Bostik Construction Products Div., www.bostik-findley-us.com.
 - 2. BC 158; Pecora Corp., www.pecora.com.
- C. One-Part Acid-Curing Silicone Glazing Sealant: Type S; Grade NS; Class 25:
 - 1. Dowsil 999; Dow Consumer Solutions, www.consumer.dow.com.
 - 2. SCS 1200; General Electric Corp., www.gesealants.com.
 - 3. 863; Pecora Corp., www.pecora.com.
 - 4. Omniglaze; Sonneborn Building Products Div.; ChemRex Products, Inc., www.chemrex.com.
 - 5. Proglaze; Tremco, www.tremcosealants.com.
- D. Preformed Butyl-Polyisobutylene Glazing Tape:
 - 1. 3M Glazing Tape, 3M Corporation, www.3m.com.
 - 2. Norseal V990 Tape: Saint-Gobain North America, www.foams.saint-gobain.com.
 - 3. Tremco Polyshim II Tape; Tremco, Inc., www.tremcosealants.com.
 - 4. Sika Glazing Tape, Sika Corporation, www.usa.sika.com.

2.10 GLAZING ACCESSORIES

- A. Setting Blocks: Neoprene; EPDM or silicone blocks, 80-90 Shore A durometer hardness.
- B. Spacer Shims: Neoprene; EPDM or silicone blocks, Shore A durometer hardness; self adhesive one face.
- C. Glazing Gasket: Resilient polyvinylchloride extruded shape to suit glazing channel retaining slot with prefabricated molded corners. Black color.
- D. Glazing Clips: Manufacturer's standard type.

3. PART 3 EXECUTION

3.1 INSPECTION

- A. Verify surfaces of glazing channels or recesses are clean, free of obstructions, and ready for work of this Section.
- B. Beginning of installation means acceptance of substrate.

3.2 PREPARATION

- A. Clean contact surfaces with solvent and wipe dry.
- B. Seal porous glazing channels or recesses.
- C. Prime surfaces scheduled to receive sealant.

3.3 EXTERIOR DRY METHOD (PREFORMED GLAZING)

- A. Cut glazing tape to length; install on glass pane. Seal corners by butting tape and dabbing with butyl sealant.
- B. Place setting blocks at 1/4 inch points with edge block no more than 6 inches from corners.
- C. Rest glass on setting blocks and push against fixed stop with sufficient pressure to attain full contact at perimeter of pane.
- D. Install removable stops without displacement of glazing gasket. Exert pressure for full continuous contact.
- E. Trim protruding tape edge.
- F. Use for all aluminum windows and aluminum framed storefronts.

3.4 EXTERIOR COMBINATION METHOD (TAPE AND SEALANT)

- A. Cut glazing tape to length and set against permanent stops, 3/16 inch below sightline. Seal corners by butting tape and dabbing with butyl sealant.
- B. Apply heel bed of butyl sealant along intersection of removable stop with frame ensuring full seal between glass and frame.
- C. Place setting blocks at 1/4 points with edge block no more than 6 inches from corners.
- D. Rest glass on setting blocks and push against tape and heel bead of sealant with sufficient pressure to attain full contact at perimeter of pane.
- E. Install removable stops with spacer strips inserted between glass, and applied stops at 24 inch intervals, 1/4 inch below sightline.
- F. Fill gap between pane and removable stop with silicone sealant to depth equal to bite of frame on pane, but not more than 3/8 inch below sightline.
- G. Apply cap bead of silicone sealant along exterior void, to uniform line, flush with sightline. Tool or wipe sealant surface with solvent for smooth appearance.
- H. Use for all exterior steel frames.

3.5 INTERIOR - DRY METHOD (TAPE AND TAPE)

- A. Cut glazing tape to length and set against permanent stops, projecting 1/16 inch above sight line.
- B. Place setting blocks at 1/4 points with edge block no more than 6 inches from corners.

- C. Rest glazing on setting blocks and push against tape for full contact at perimeter of pane or unit.
- D. Place glazing tape on free perimeter of glazing in same manner described above.
- E. Install removable stop without displacement of tape. Exert pressure on tape for full continuous contact.
- F. Knife trim protruding tape.
- G. Use for all interior steel frames.

3.6 CLEANING

- A. After installation, mark pane with an "X" by using plastic tape or removable paste.
- B. Remove glazing materials from finish surfaces.
- C. Remove labels after Work is completed.

END OF SECTION

SECTION 08 88 53 – BULLET RESISTANT SECURITY GLAZING**PART 1 GENERAL****1.1 REFERENCE**

- A. Underwriters Laboratory UL 752-Standard for Bullet Resisting Equipment, ASTM C 1172 - Standard Specification for Laminated Architectural Flat Glazing, NIJ Standard 0108.01 - (National Institute of Justice) Standard for Ballistic Resistant Protective Materials (September, 1985).

1.2 SUBMITTALS

- A. The following shall be submitted by the manufacturer in accordance with Sections 13070 and any Special Contract Requirements: Submit for approval prior to fabrication: samples, product data (including preparation, storage and installation methods), cuts & anchor spacing, reinforcement & location, product specifications, shop drawings, test reports (current UL Listing Verification & UL 752 Test Results as provided by Underwriters Laboratories), and printed data in sufficient detail to indicate compliance with the contract documents.
- B. Manufacturer's instructions for installation and cleaning of TSS Bullet Resistant Polycarbonate. All required submittals shall be approved prior to installation.

1.3 DESIGN PERFORMANCE

- A. Through the design, manufacturing techniques and material application the TSS Bullet Resistant Polycarbonate Security Glazing shall be constructed of Laminated Acrylic/Polycarbonate sheets with a UL Standard 752 Level 3 rating.
- B. Light Transmission in excess of 90%.
- C. UL Level 3 to be 1.25" thickness.

1.4 QUALITY ASSURANCE

- A. Manufacturer shall be a Company that specializes in manufacturing products of the specified type with a minimum of five years' experience. Installer shall be a Company that specializes in product type specified. Manufacturer shall provide a sample with color/finish to the Architect for approval prior to start of work.

1.5 DELIVERY, STORAGE & HANDLING

- A. Deliver the materials to the project with the manufacturer's UL Listed Labels intact and legible. Handle the materials with care to prevent damage. Store materials inside and under cover, stack flat and off floor. Project conditions (temperature, humidity, and ventilation) shall be

within the maximum limit recommendations set by manufacturer. Do not install products that are under conditions outside these limits.

1.6 WARRANTY

- A. All materials shall be warranted against defects for a period of 1 year for the date of receipt at the project site. Certificates of manufacturer's standard limited warranty shall be provided at project completion.

PART 2 PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

- A. Products shall be manufactured by: Total Security Solutions, Inc., 170 National Park Drive, Fowlerville, MI 48836, 800-513-1468. Attn: Sales Department, info@tssbulletproof.com . Web: www.tssbulletproof.com . No substitutions shall be accepted.

2.2 PRODUCT: BULLET RESISTANT POLYCARBONATE SECURITY GLAZING.

- A. Product to be TSS POLYCARBONATE LP 1250

PART 3 EXECUTION

3.1 PREPARATION

- A. Prior to installing the bullet resistant material, the contractor shall verify that all supports have been installed as required by the contract documents and architectural drawings, and approved shop/CAD drawings, if required. Installer shall notify architect of any unsatisfactory preparation that is responsibility of another installer.

- B. Clean and prepare all surfaces per manufacturers recommendations for achieving the best results for the substrate under the project conditions.

3.3 POST APPLICATION

- A. Inspection and Cleaning: Verify installation is complete and complies with manufacturer's requirements. Clean product and accessories, removing excess sealant, labels and protective covers.
- B. Product Warranty: Applicable warranty shall be issued to owner upon final release of completed project.

END OF SECTION

SECTION 09 21 16

GYPSUM BOARD ASSEMBLIES

1. PART 1 GENERAL

1.1 WORK INCLUDED

- A. Gypsum board.
- B. Glass mat gypsum sheathing.
- C. Shaft wall coreboard.
- D. Gypsum soffit board.
- E. Abuse/Impact resistant gypsum board.
- F. Acoustically enhanced gypsum board.
- G. Taped and sanded joint treatment.
- H. Surface primer.
- I. Texture finish.
- J. Resilient furring channels.
- K. Metal channel ceiling framing.

1.2 REFERENCES

- A. ASTM A641 - Zinc-Coated (Galvanized) Carbon Steel Wire.
- B. ASTM C11 - Standard Terminology Relating to Gypsum and Related Building Materials and Systems.
- C. ASTM C79 - Standard Specification for Treated Core and Nontreated Core Gypsum Sheathing Board.
- D. ASTM C475 - Joint Treatment Materials for Gypsum Wallboard Construction.
- E. ASTM C514 - Nails for the Application of Gypsum Wallboard.
- F. ASTM C557 - Adhesives for Fastening Gypsum Wallboard to Wood Framing.
- G. ASTM C645 - Non-Load (Axial) Bearing Steel Studs, Runners (Track), and Rigid Furring Channels for Screw Application of Gypsum Board.
- H. ASTM C754 - Installation of Steel Framing Members to Receive Screw Attached Gypsum Wallboard, Backing Board, or Water Resistant Backing Board.
- I. ASTM C840 - Application and Finishing of Gypsum Board.
- J. ASTM C919 - Use of Sealants in Acoustical Applications.
- K. ASTM C1002 - Steel Drill Screws for the Application of Gypsum Board.
- L. ASTM C1177 - Standard Specification for Glass Mat Gypsum Substrate for Use as Sheathing.
- M. ASTM C1396 - Standard Specification for Gypsum Board.

- N. ASTM C1629 - Standard Specification for the Abuse-Resistant Nondecorated Interior Gypsum Panel Products and Fiber-Reinforced Cement Panels.
- O. ASTM D226 - Asphalt-Saturated Felt Used in Roofing and Waterproofing.
- P. ASTM D1037 - Test Methods for Evaluating Properties of Wood-Based Fiber and Particle Panel Materials.
- Q. ASTM D3273 - Standard Test Method for Resistance to Growth of Mold on the Surface of Interior Coatings in an Environmental Chamber.
- R. ASTM D3274 - Standard Test Method for Evaluating Degree of Surface Disfiguration of Paint Films in Fungal or Algal Growth, or Soil and Dirt Accumulation.
- S. ASTM D4977 - Standard Test Method for Granular Adhesion to Mineral Surfaced Roofing by abrasion (modified).
- T. ASTM D5420 - Standard Test Method for Impact Resistance of Flat, Rigid Plastic Specimen by Means of a Striker Impacted by a Falling Weight (Gardner Impact).
- U. ASTM E90 - Method for Laboratory Measurement of Airborne Sound Transmission Loss of Building Partitions.
- V. ASTM E695 - Standard Method of Measuring Relative Resistance of Wall, Floor, and Roof Construction to Impact Loading.
- W. CBC - California Building Code, (CCR) California Code of Regulations, Title 24, Part 2.
- X. GA 201 - Using Gypsum Board for Walls and Ceilings.
- Y. GA 214 - Levels of Gypsum Board Finish.
- Z. GA 216 - Application and Finishing of Gypsum Board.
- AA. GA 253 - Application of Gypsum Sheathing.
- BB. GA 600 - Fire Resistance Design Manual.
- CC. ISO 14040 - Environmental Management - Life cycle assessment - Principals and Framework.
- DD. UL - Underwriters Laboratories.

1.3 QUALITY ASSURANCE

- A. Applicator: Company specializing in gypsum board systems work with five years documented experience.

1.4 REGULATORY REQUIREMENTS

- A. Conform to CBC, California Building Code, (CCR) California Code of Regulations, Title 24, Part 2, Chapter 7, and UL and GA requirements for fire rated assemblies as indicated on the drawings
- B. Conform to UL No. 2079 for cyclical design at head of fire rated walls.

1.5 ACOUSTICAL PERFORMANCE

- A. Acoustical Attenuation for Identified Interior Partitions: 55 STC in accordance with ASTM E90.

1.6 ENVIRONMENTAL REQUIREMENTS

- A. Maintain uniform temperature of minimum 60 degrees F and humidity of 30 to 50 percent prior to, during, and after installation of the Work of this Section.

1.7 DEFINITIONS

- A. Refer to ASTM C11 for definitions of terms related to gypsum board assemblies.

1.8 FIELD SAMPLES

- A. Provide field samples under provisions of Section 01 33 00.
- B. On wall and ceiling surface duplicate specified texture finish on at least 100 sq.ft. of surface area.
- C. Provide complete finish including surface primer.
- D. Simulate finished lighting conditions for review of field sample.
- E. After surface texture is accepted, the accepted surface will remain as part of the Work and will be used to evaluate subsequent applications of finish texture.

2. PART 2 PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS - GYPSUM BOARD SYSTEM

- A. American Gypsum Corp., www.americangypsum.com.
- B. Certainteed, www.certainteed.com.
- C. Georgia Pacific Corp., www.gp.com.
- D. National Gypsum Co., www.nationalgypsum.com.
- E. PABCO Gypsum, www.pabcogypsum.com.
- F. United States Gypsum Co., www.usg.com.
- G. Substitutions: Under provisions of Section 01 25 13.

2.2 FRAMING MATERIALS

- A. Metal Furring: ASTM C645, hat-shaped, 7/8 inch deep, 0.0329 inch thick.
- B. Resilient Furring Channel: Manufacturer's standard product designed to reduce sound transmission, complying with ASTM C645 for material, finish and widths of face and fastening flange; 1/2 inch deep x 0.0179 inch thick asymmetric-shaped channel with face connected to single flange by slotted leg (web).
- C. Furring Channel: ASTM C754, 1-1/2 inch x 0.475 lb./ft. channel.
- D. Fasteners: ASTM C1002.
- E. Hanger Wire: ASTM A641, Class 1 coating (galvanized) soft temper, 9 gauge.
- F. Tie Wire: ASTM A641, Class 1 coating (galvanized) soft temper, 16 and 18 gauge.
- G. Adhesive: ASTM C557.

2.3 GYPSUM BOARD MATERIALS

- A. Standard Gypsum Board: ASTM C1396; 5/8 inch thick unless otherwise indicated, maximum permissible length; ends square cut, tapered and beveled edges. Similar to Sheetrock Brand EcoSmart Panels manufactured by United States Gypsum Company.

- B. Fire Rated Gypsum Board: ASTM C1396; fire resistive type, UL rated; 5/8 inch thick unless otherwise indicated, maximum permissible length; ends square cut, tapered and beveled edges. Similar to Sheetrock Brand EcoSmart Panels manufactured by United States Gypsum Company
- C. Mold and Mildew Resistant Gypsum Board: ASTM C1396; 5/8 inches thick unless otherwise indicated, maximum length; ends square cut, tapered and beveled edges. Mold and mildew resistant core and paper facing, meeting ASTM D3273, with a score of 10 as rated according to ASTM D3274. Similar to Sheetrock Brand EcoSmart Mold Tough Panels manufactured by United States Gypsum Company.
- D. Fire Rated Mold and Mildew Resistant Gypsum Board: ASTM C1396; fire resistive type, UL rated 5/8 inches thick unless otherwise indicated, maximum length; ends square cut, tapered and beveled edges. Mold and mildew resistant core and paper facing, meeting ASTM D3273, with a score of 10 as rated according to ASTM D3274. Similar to Sheetrock Brand EcoSmart Mold Tough Firecode X Panels manufactured by United States Gypsum Company.
- E. Moisture Resistant Gypsum Board: ASTM C1396 with a score of 10 as rated according to ASTM D3274; 5/8 inch thick unless otherwise indicated, water resistant core; water resistant paper on front, back, and long edges; maximum permissible length; ends square cut, tapered and beveled edges.
- F. Fire Rated Moisture Resistant Gypsum Board: ASTM C1396; fire resistive type, UL rated; 5/8 inch thick unless otherwise indicated; water resistant core; water resistant paper on front, back and long edges; maximum permissible length; ends square cut, tapered and beveled edges.
- G. Acoustically Enhanced Gypsum Board: ASTM C1396, 5/8 inch thick multilayer product constructed of two layers of gypsum board sandwiching a viscoelastic sound-absorbing polymer core; maximum permissible length; ends square cut, tapered and beveled edges, similar to Sound Break as manufactured by National Gypsum Company.
- H. Fire Rated Acoustically Enhanced Gypsum Board: ASTM C1396: fire resistive type, UL rated; 5/8 inch thick multilayer product constructed of two layers of gypsum board sandwiching a viscoelastic sound-absorbing polymer core; maximum permissible length; ends square cut, tapered and beveled edges, similar to Sound Break as manufactured by National Gypsum Company.
- I. Shaftwall Coredboard: ASTM C1396; fire resistive type, UL rated; 1 inch thick; water resistant core; mold, mildew, and water resistant paper on front, back and long edges; maximum permissible length; ends square cut, beveled edges.
- J. Exterior Gypsum Soffit Board: ASTM C1396; fire resistive type, UL rated; 5/8 inch thick unless otherwise noted, maximum permissible lengths; enhanced sag resistant core; water resistant paper on front, back and long edges; beveled tongue and groove edges.
- K. Glass-Mat Gypsum Sheathing Board: ASTM C1177; 1/2 inch thick, similar to Dens-Glass Gold manufactured by Georgia Pacific Corp.
- L. Fire Rated Glass-Mat Gypsum Sheathing Board: ASTM C1177; 5/8 inch thick, similar to Dens-Glass Gold Fireguard, Type X manufactured by Georgia Pacific Corp.
- M. Glass Mat Gypsum Parapet Sheathing: ASTM C1177; 1/2 inch thick, with glass mat facing one side, durable low perm coating on the other, similar to DensDeck Duraguard manufactured by Georgia Pacific Corp.
- N. Fire Rated Glass Mat Gypsum Parapet Sheathing: ASTM C1177; 5 / 8 inch thick, with glass mat facing one side, durable low perm coating on the other, similar to DensDeck Fireguard Type X manufactured by Georgia Pacific Corp.
- O. Abuse/Impact Resistant Gypsum Board: ASTM C1629 ; 5/8 inch thick, maximum permissible lengths; ends square cut, tapered and beveled edges; with additives and fiberglass mat facings to enhance indentation resistance, abrasion, and impact resistance. Similar to Sheetrock Brand VHI Panels manufactured by United States Gypsum Company meeting the following characteristics:
 - 1. Surface Abrasion: ASTM C1629 / D 4977, Level 2.

2. Indentation Resistance: ASTM C1629 / D5420, Level 1.
 3. Soft-Body Impact: ASTM C1629 / E695, Level 3.
 4. Hard-Body Impact: ASTM C1629, Level 3.
 5. Mold / Mildew Resistance: ASTM D3273, with a score of 10.
- P. Fire Rated Abuse/Impact Resistant Gypsum Board: ASTM C1629; fire resistive type, UL rated; 5/8 inch thick, maximum permissible lengths; ends square cut, tapered and beveled edges; with additives and fiberglass mat facings to enhance indentation resistance, abrasion, and impact resistance. Similar to Sheetrock Brand VHI Firecode X Panels manufactured by United States Gypsum Company meeting the following characteristics:
1. Surface Abrasion: ASTM C1629 / D 4977, Level 2.
 2. Indentation Resistance: ASTM C1629 / D5420, Level 1.
 3. Soft-Body Impact: ASTM C1629 / E695, Level 3.
 4. Hard-Body Impact: ASTM C1629, Level 3.
 5. Mold / Mildew Resistance: ASTM D3273, with a score of 10.
- Q. Flexible Gypsum Board: ASTM C1396; 1/4 inch thick, maximum permissible lengths; ends square cut, slightly tapered edges.
- R. Fire Rated Flexible Gypsum Board: ASTM C1396; fire resistive type, UL rated, 1/4 inch thick, maximum permissible lengths; ends square cut, slightly tapered edges.
- S. Mold and Mildew Resistant Flexible Gypsum Board: ASTM C1396; 1/4 inch thick, maximum permissible lengths; ends square cut, slightly tapered edges. Mold and mildew-resistant gypsum core and paper facing meeting ASTM D3273, with a score of 10 as rated according to ASTM D3274.

2.4 ACCESSORIES

- A. Acoustical Sealant: Non-hardening, non-skinning, for use in conjunction with gypsum board: As specified in Section 07 92 00.
- B. Fire Rated Sealant and Fiber Stuffing: As specified in Section 07 84 00.
- C. Corner Beads: Metal, hot dip galvanized.
- D. Edge Trim: GA 201 and GA 216; Type LC bead, unless otherwise indicated.
- E. Control Joints: Roll-formed zinc, Type USG No. 093.
- F. Aluminum Trim and Reveal Moldings: Extruded accessories of profiles and dimensions indicated. Alloy 6063-T5, baked-enamel finish. Similar to products manufactured by Fry Reglet Co., www.fryreglet.com.
- G. Curved-Edge Cornerbead: Vinyl type with notched or flexible flanges.
- H. Spot Grout: ASTM C475, setting-type joint compound.
- I. Joint Materials Interior: ASTM C475; reinforcing tape, joint compound, adhesive, water, and fasteners. Use tapes and compound recommended by gypsum board manufacturer for the use intended. Use ready mixed, drying type compounds. Use taping compound for embedding tape and first coat over fasteners and flanges of corner beads and trim. Use topping compound for fill and finish coats.

- J. Joint Materials, Exterior:
 - 1. Gypsum Soffit Board: Setting-type taping and setting-type, sandable topping compound.
 - 2. Glass-Mat Gypsum Sheathing: 2 inch wide 10 x 10 self-adhering fiberglass joint tape recommended by manufacturer.
- K. Primer: Flat latex basecoat paint equivalent to First Coat manufactured by United States Gypsum Company.
- L. Spray Texture Finish: Equivalent to USG Spray Texture Finish, fine orange peel texture, manufactured by United States Gypsum Company.
- M. Membrane: ASTM D226; No. 15 asphalt saturated roofing felt.

3. PART 3 EXECUTION

3.1 INSPECTION

- A. Verify that site conditions are ready to receive Work.
- B. Beginning of installation means acceptance of substrate.

3.2 WALL FURRING INSTALLATION

- A. Erect wall furring for direct attachment to masonry walls.
- B. Erect metal furring vertically at 16 inches o.c. Secure in place on alternate channel flanges at maximum 24 inches o.c.

3.3 ACOUSTICAL ACCESSORIES INSTALLATION

- A. Space resilient furring channels horizontally at maximum 16 inches o.c., not more than 2 inches from floor and ceiling lines.
- B. Locate nested joints over framing members.
- C. Install acoustical sealant within partitions in accordance with manufacturer's instructions and ASTM C919.
- D. Seal perimeter, joints, openings and penetrations on each face of partition.

3.4 CEILING FRAMING INSTALLATION

- A. Install in accordance with ASTM C754 and CBC, California Building Code, (CCR) California Code of Regulations, Title 24, Part 2, Chapter 25.
- B. Coordinate locations of hangers with other Work.
- C. Install ceiling framing independent of walls and columns.
- D. Space 9 gauge hanger wires 3'-0" o.c. along 1-1/2 inch furring channels and within 6 inches of end of furring channel.
- E. Install 1-1/2 inch furring channels at 4'-0" o.c. and within 6 inches of parallel walls. Provide 1 inch clearance between end of channels and abutting walls.
- F. Position furring channels for proper ceiling height, level, and secure with hanger wire saddle-tied along channel.
- G. At channel splices, interlock flanges, overlap ends 12 inches and secure each end with double-strand of 16 gauge tie wire.

- H. Erect metal furring at right angles to 1-1/2 inch furring channels. Space metal furring 16 inches o.c.
- I. Install metal furring within 6 inches of parallel walls. Provide 1 inch clearance between end of furring and abutting wall.
- J. Secure metal furring to furring channel with clips or saddle tie with double strand of 18 gauge tie wire.
- K. At splices of metal furring nest furring at least 8 inches and securely wire-tie each end with double strand of 16 gauge tie-wire.
- L. Reinforce openings in ceiling suspension system which interrupt main furring channels or metal furring with lateral channel bracing. Extend bracing minimum 24 inches past each end of openings.

3.5 GYPSUM BOARD INSTALLATION

- A. Install gypsum board in accordance with ASTM C840 and manufacturer's instructions.
- B. Erect single layer standard gypsum board in most economical direction, with ends and edges occurring over firm bearing except those ends and edges which are perpendicular to framing.
- C. Erect single layer fire rated gypsum board vertically, with edges and ends occurring over firm bearing except those ends and edges which are perpendicular to framing members. Comply with required UL, CBC, or GA fire rated assembly.
- D. Erect double layer gypsum board with standard gypsum board for first layer placed in most economical direction with second layer placed parallel to face layer with adhesive and supplementary fasteners. Off-set joints of second layer from joints of first layer by at least 12 inches.
- E. Erect double layer fire rated gypsum board in accordance with required UL, CBC, or GA fire rated assembly.
- F. Use screws when fastening gypsum board to metal furring.
- G. Use screws when fastening gypsum board to wood furring or framing except where nails are required for UL or UBC fire rated assembly.
- H. Install fire stop sealant and fiber stuffing at wall penetrations and terminations in accordance with required UL, CBC, or GA fire rated assembly in accordance with Section 07 84 00.
- I. Install acoustical sealant at wall penetrations and terminations as specified in this section and in accordance with Section 07 92 00.
- J. Isolate perimeter of gypsum board applied to non-load bearing partitions at structural abutments. Provide ½ inch wide space and trim with metal edge. Seal joint between metal edge and structural surface with acoustical sealant.
- K. Where partitions intersect structural members projecting below underside of floor / roof slabs and decks, cut gypsum panels to fit profile formed by structural member. Allow ½ inch wide space and install acoustical sealant.
- L. Treat cut edges and holes in moisture resistant gypsum board with sealant.
- M. Install gypsum board with mold and mildew-resistant core and paper facing at exterior locations on the interior face of all exterior walls.
- N. Place control joints not to exceed 30 feet maximum in either direction for partitions and ceilings. Provide adequate seal or safin insulation behind control joints to maintain sound or fire ratings.
- O. Place corner beads at external corners. Use longest practical length. Place edge trim where gypsum board abuts dissimilar materials.

- P. Spot grout metal door frames. Apply spot grout at each jamb anchor clip just before inserting board into frame.

3.6 CURVED PARTITIONS

- A. Install panels horizontally and unbroken across curved surface.
- B. Wet gypsum panels on surface that will become compressed.
- C. On convex side of partition, begin installation at one end of curved surface and fasten panels to studs as they are wrapped around curve.
- D. On concave side of partition, start fastening panels at center of curve and work outward to panel ends.
- E. Allow wetted panels to dry before applying joint treatment.

3.7 EXTERIOR SOFFIT INSTALLATION

- A. Apply gypsum soffit board panels perpendicular to supports with end joints staggered and located over supports.
- B. Install panels with 1/4 inch open space where panels abut other construction or penetrations.
- C. Fasten with corrosion-resistant screws.

3.8 GLASS MAT GYPSUM SHEATHING INSTALLATION

- A. Install glass mat gypsum sheathing in accordance with manufacturer's instructions and in accordance with GA-253.
- B. Install glass mat gypsum sheathing with gold side out.
- C. Install glass mat gypsum parapet sheathing with blue low-perm side out.
- D. Install glass mat gypsum sheathing with long dimension parallel to framing members.
- E. Fasten with corrosion-resistant screws.
- F. Install fire rated glass mat gypsum sheathing in accordance with listed assembly indicated from UL, CBC or GA.

3.9 SHAFT WALL ASSEMBLY INSTALLATION

- A. Shaft wall assemblies shall be installed to comply with requirements of fire-resistance-rated assemblies indicated from UL, CBC or GA.
- B. Do not bridge building expansion joints with shaft-wall assemblies. Frame both sides of joint with furring and other supports.
- C. At penetrations in shaft wall, maintain fire-resistive rating by installing supplemental fire protection behind boxes, elevator call buttons, elevator floor indicators and similar items.
- D. Isolate gypsum finish panels from building structure to prevent cracking while maintaining continuity of fire-rated construction.
- E. Seal gypsum board shaft walls with fire rated sealant at perimeter of assembly where it abuts other work and at joints and penetrations.
- F. Where shaft wall assemblies cannot be positioned within 2 inches of the shaft wall face of structural beams, floor edges and similar projections into shaft, install 5/8 inch thick gypsum board cants covering tops of projections.

- G. Install multiple layers of gypsum board materials as specified for double layer installation.

3.10 JOINT TREATMENT

- A. Tape, fill, and sand joints, edges, and corners in accordance with GA-214.
- B. Feather successive coats a minimum of 2 inches onto adjoining surfaces for each coat.
- C. Where fire resistance rating is required, detail of joint treatment shall meet fire rating requirement.
- D. Level 1 Treatment:
 - 1. All joints and angles shall have tape embedded in joint compound.
 - 2. Surface shall be free of excess joint compound.
 - 3. Tool marks and ridges are acceptable.
 - 4. Use for plenum areas above ceiling, in areas that are generally concealed and other areas not normally open to view.
- E. Level 2 Treatment:
 - 1. All joints and angles shall have tape embedded in joint compound and one separate coat of joint compound shall be applied over all fastener heads and accessories.
 - 2. Surface shall be free of excess joint compound.
 - 3. Tool marks and ridges are acceptable.
 - 4. Use where surface is substrate to ceramic tile, acoustic tile, or tackable wallboard system.
- F. Level 3 Treatment:
 - 1. Not used.
- G. Level 4 Treatment:
 - 1. All joints and angles shall have tape embedded in joint compound with three separate coats of topping compound applied over all joints, angles, fasteners, and accessories.
 - 2. All compound shall be smooth and free of tool marks and ridges.
 - 3. Sand lightly between coats, taking care not to roughen face paper.
 - 4. Use for all surfaces that are scheduled to receive a textured and painted finish, except areas of food service and preparation, or a surface applied wallcovering.
- H. Level 5 Treatment:
 - 1. All joints and angles shall have tape embedded in joint compound with three separate coats of topping compound applied over all joints, fasteners, and accessories.
 - 2. Apply two thin skim coats of topping compound over entire surface.
 - 3. All compound shall be smooth and free of tool marks and ridges.
 - 4. Sand lightly between coats.
 - 5. Use for all surfaces that are scheduled to receive a painted finish in food service and preparation areas and all horizontal surfaces of restrooms and shower areas.

- I. Glass-Mat Gypsum Sheathing Board: Apply self-adhering fiberglass joint tape over joints and embed in bead of acrylic latex sealant applied into board joint.
- J. Gypsum Board Soffit Board: Apply joint tape over joints and embed in setting type joint compound. Skim joint surface with setting type joint compound for smooth finish.

3.11 FINISHING

- A. Roller apply surface primer to all gypsum board surfaces scheduled to receive a painted and textured finish prior to application of paint or texture finish.
- B. Spray apply textured finish to all surfaces scheduled to receive a paint finish except surfaces of food service and preparation areas.
- C. Remove any overspray of texture finish from door frames, windows, and other adjoining construction.

3.12 TOLERANCES

- A. Maximum Variation from True Flatness: 1/8 inch in 10 feet in any direction.

3.13 RECYCLING CONSTRUCTION WASTE

- A. Recycle gypsum board waste under the provisions of Section 01 74 19.

3.14 PROTECTION

- A. Protect adjacent surfaces from joint compound. Promptly remove from floors and other surfaces. Repair stained and marred surfaces damaged during gypsum board application.
- B. Protect work of this section from weather, condensation, direct sunlight, and other detrimental causes during the construction period.
- C. Remove and replace gypsum panels that become wet, moisture damaged and mold damaged.

END OF SECTION

SECTION 09 22 16

METAL STUD FRAMING

1. PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Formed metal stud framing.
- B. Shaft wall framing.
- C. Furring channels.
- D. Framing accessories.

1.2 REFERENCES

- A. ASTM A653 - Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.
- B. ASTM A924 - General Requirements for Steel Sheet, Metallic-Coated by the Hot-Dip Process.
- C. ASTM C645 -Standard Specification for Nonstructural Steel Framing Members.
- D. ASTM C754 - Installation of Steel Framing Members to Receive Screw-Attached Gypsum Wallboard, Backing Board, or Water-Resistant Backing Board.
- E. ASTM C1002 - Steel Drill Screws for the Application of Gypsum Board or Metal Plaster Bases.
- F. CBC - California Building Code (CCR) California Code of Regulations, Title 24, Part 2.
- G. NFPA 80 - Fire Doors and Windows.
- H. GA600 - Fire Resistance Design Manual.
- I. SFIA - Steel Framing Industry Association.
- J. SSMA - Steel Stud Manufacturer's Association.
- K. SSPC - The Society for Protective Coatings.
- L. UL - Underwriters Laboratories.

1.3 QUALITY ASSURANCE

- A. Perform work in accordance with ASTM C754 and the recommendations of the SSMA and SFIA.
- B. Maintain one copy of each document on site.

1.4 REGULATORY REQUIREMENTS

- A. Conform to CBC - California Building Code, (CCR) California Code of Regulations, Title 24, Part 2, Chapter 7, and UL and GA requirements for fire rated assemblies.
- B. Conform to UL No. 2079 for cyclical design at head of fire rated walls.

1.5 SEQUENCING AND SCHEDULING

- A. Coordinate Work under the provisions of Section 01 31 00.

- B. Coordinate installation of head of wall track with spray applied fireproofing in Section 07 81 00.

2. PART 2 PRODUCTS

2.1 MANUFACTURERS

- A. California Expanded Metal Products Co. (ICC - ESR - 3016), www.cemcosteel.com.
- B. Consolidated Fabricators Corp. (IAPMO - UER-0313), www.confabbpd.com.
- C. ClarkDietrich Building Systems (Intertek CCRR - 0206), www.clarkdietrich.com.
- D. Frametek Steel Products (ICC - ESR - 4205), www.frameteksteel.com.
- E. Steel Stud Manufacturing Co. (ICC - ESR - 3064P), www.scafco.com.
- F. United Metal Products, Inc. (LATF - 16949), www.unitedmetalproducts.com.
- G. Substitutions: Under provisions of Section 01 25 13.

2.2 STUD FRAMING MATERIALS

- A. Framing System Components: ASTM C645. Depth as scheduled.
- B. Studs: ASTM A653, Grade 33 for steel 0.0428 inch thick and below, Grade 50 for steel 0.0538 inch thick and above, galvanized to G60 coating class in compliance with ASTM A924, non-load bearing rolled steel, channel shaped, punched for utility access, depth as scheduled on the drawings.
 - 1. Thickness: 0.0329 inch unless otherwise indicated. 0.0428 inch and 0.0538 inch where indicated.
- C. Runners: Of same material and finish as studs, unpunched. Minimum thickness one size greater than wall stud.
- D. Ceiling Runners: Of same material, finish and thickness as studs. Minimum thickness one size greater than wall stud.
- E. Deflection Track: Top runner track designed to allow for deflection of structure to interior partition fabricated of same material, finish and thickness as studs and of the following configuration:
 - 1. Top runner track with slotted flanges, 2-1/2 inch deep with vertical slots 1 inch on center.
 - 2. Products: Subject to compliance with requirements, provide one of the following:
 - (a) Max Trak as manufactured by ClarkDietrich Building Systems (Intertek CCRR-0205), www.clarkdietrich.com.
 - (b) SLT standard slotted track as manufactured by Steel Stud Manufacturing C. (IAPMO ER-0283), www.scafco.com.
- F. Firestop Track: Top runner track designed to allow for deflection of structure to interior partition fabricated of same material, finish and thickness as studs and capable of maintaining a fire rated joint system as determined by UL 2079 using intumescent tape applied to face of track. Of the following configuration:
 - 1. Top runner track with slotted flanges, 2-1/2 inches deep with vertical slots 1 inch on center.
 - 2. Intumescent tape to be applied to face of track in length and thickness required to maintain designated fire rating of wall.

3. Products: Subject to compliance with requirements, provide one of the following:
- (a) Blaze Frame DSL, as manufactured by BlazeFrame Industries, www.blazeframe.com.
 - (b) FAS Track as manufactured by CEMCO, www.cemcosteel.com
 - (c) Blaze Frame DSL, as manufactured by ClarkDietrich Building Systems, www.clarkdietrich.com.
- G. Shaft Wall Framing: Manufacturer's standard J track, C-T studs, 0.0329 inch thick, inch depth as scheduled.
- H. Hat Shaped, Rigid Furring Channels: ASTM C645, 7/8 inch deep, 0.0329 inch thick.
- I. Resilient Furring Channels: ASTM C645, 1/2 inch deep, 0.0179 inch thick, asymmetric-shaped channel designed to reduce noise transmission with face attached by slotted flange.
- J. Z-Shaped Furring: Non slotted web, face flange of 1-1/4 inch, wall attachment flange of 3/4 inch, minimum thickness of 0.0329 inch thick.
- K. Furring and Bracing Members: Of same material and finish as studs, thickness to suit purpose.
- L. Radiused Track and Runners: ASTM A653, galvanized to G60 coating class, 0.0329 inch thick steel Flex - C Trac as manufactured by Flex-Ability Concepts, www.flexc.com, or standard unpunched track and runner of same material, finish, and thickness as studs.

2.3 ACCESSORIES

- A. Fasteners: ASTM C1002, self-drilling, self-tapping screws.
- B. Metal Backing: 0.0538 inch thick galvanized steel.
- C. Anchorage Devices: Powder actuated.
- D. Primer: SSPC 20.
- E. Beam Clips: 0.0179 inch thick x 2-3/8 inch long galvanized steel clip as manufactured by Claw International, www.clawinternational.com.
- F. Flute Cover: FAS Strap as manufactured by CEMCO, www.cemco.com, or FC Flute Closure as manufactured by ClarkDietrich, www.clarkdietrich.com. Width to match flute opening in metal deck. Intumescent tape applied for fire rated head of wall conditions.
- G. Spray Applied Fireproofing: As specified in Section 07 81 00.
- H. Fiber Stuffing: Mineral fiber as specified in Section 07 84 00.

3. PART 3 EXECUTION

3.1 EXAMINATION

- A. Verify that conditions are ready to receive Work.
- B. Verify field measurements are as shown on Drawings.
- C. Verify that rough-in utilities are in proper location.
- D. Beginning of installation means installer accepts existing conditions.

3.2 ERECTION

- A. Install components in accordance with ASTM C754 requirements; manufacturer's instructions; details indicated on drawings; and as specified herein.

- B. Coordinate installation of sealant specified in Sections 07 92 00 and 09 21 16.
- C. Coordinate installation of spray applied fireproofing specified in Section 07 81 00.
- D. Coordinate installation of fiber stuffing as specified in Section 07 84 00.
- E. Align and secure top and bottom runners at 24 inches o.c.
- F. Fit runners under and above openings; secure intermediate studs at spacing of wall studs.
- G. Install studs vertically at 16 inches o.c. horizontal spacing.
- H. Connect studs to tracks using fastener method.
- I. Stud splicing not permissible.
- J. Construct corners using minimum three studs.
- K. Double studs of 0.0329 inch thickness at wall openings, door and window jambs, and each side of other openings that are 4'-0" or less in width.
- L. Double studs of 0.0428 inch thickness at wall openings, door and window jambs, and at each side of other openings that are more than 4'-0" in width.
- M. Frame door and window openings with details indicated; with GA-600 and NFPA 80.
- N. Install framing below sills of openings to match framing above head of opening.
- O. Coordinate erection of studs with requirements of door and window frame supports and attachments.
- P. Brace stud framing system and make rigid.
- Q. Construct toilet and plumbing chase walls of 0.0428 inch thick studs braced horizontally at midpoint and quarter point of wall but not less than 48 inches o.c. vertically with 2-1/2 inch wide cross studs.
- R. Erect minimum 0.0329 inch thick studs behind all cementitious backing board and ceramic tile installations.
- S. Erect minimum 0.0538 inch thick studs behind all casework and wall mounted cabinets.
- T. Align stud web openings and point stud flanges in the same directions.
- U. Secure stud ends to bottom tracks on both faces.
- V. Coordinate installation of bucks, anchors, and backing with electrical and mechanical work to be placed in or behind stud framing.
- W. Backing: Secure steel backing to studs. Install backing for support of toilet partitions, wall cabinets, toilet accessories, hardware, and all other wall mounted items.
- X. Extend partition framing full height to structural support or substrates above suspended ceilings, except where partitions are indicated to terminate at ceiling. Install deflection track, anchor to structure.
- Y. For sound and fire resistance rated partitions extend framing to underside of floor/roof or other continuous solid surface to obtain rating. Install fire-rated deflection track, anchor to structure.
- Z. Continue partition framing over door and window openings and frame around ducts penetrating partitions above ceiling.
- AA. Maintain clearance under structural building members to avoid deflection transfer to studs. Provide deflection track top runner to attain lateral support and avoid axial loading.

- BB. Coordinate placement of insulation in multiple stud spaces made inaccessible after stud framing erection.
- CC. Maintain clearance under structural building members at fire-resistance rated assemblies. Provide firestop track top runner.
- DD. Install beam clips on beam flanges spaced at 2'-0" on center.

3.3 RADIUS PARTITION ERECTION

- A. Cut top and bottom runners through leg and web at 2 inch intervals for arc length or use manufacturer's standard flexible runner track.
- B. Allow for uncut straight lengths of not less than 12 inches at ends of arcs.
- C. Bend runners to uniform curve of radius indicated and locate straight lengths so they are tangent to arcs.
- D. Support outside (cut) leg of runners by clinching a 1 inch high x 0.0329 inch thick steel sheet strip to inside of cut legs using metal lock fasteners.
- E. Attach runners to structural elements at floor and ceiling with fasteners located 2 inches from ends and spaced 24 inches on center.

3.4 SHAFT WALL ERECTION

- A. Shaftwall assemblies shall be installed to comply with requirements of fire-resistance-rated assemblies indicated from UL, CBC or GA.
- B. Do not bridge building expansion joints with shaftwall assemblies. Frame both sides of joint with furring and other supports.
- C. Install supplementary framing in shaftwall assemblies around openings and as required for blocking, bracing and support of fixtures, equipment and services which cannot be supported directly by shaftwall assembly framing.
- D. At penetrations in shaft-wall, maintain fire-resistive rating by installing supplemental framing around penetration and fire protection behind boxes, elevator call buttons, elevator floor indicators and similar items.

3.5 ERECTION TOLERANCES

- A. Maximum variation from true position: 1/2 inch.
- B. Maximum variation of any member from plane: 1/8 inch in 10 feet.
- C. Maximum variation from plumb: 1/8 inch in 10 feet.

3.6 RECYCLING CONSTRUCTION WASTE

- A. Recycle excess materials waste under the provisions of Section 01 74 19.

END OF SECTION

SECTION 09 24 00

CEMENT PLASTERING

1. PART 1 GENERAL

1.1 WORK INCLUDED

- A. Metal lathing and suspended ceiling framing.
- B. Portland cement plaster system.
- C. Acrylic based finish coat.
- D. Plaster texture schedule.
- E. Plaster application schedule.

1.2 REFERENCES

- A. ASTM A641 - Zinc-Coated (Galvanized) Carbon Steel Wire.
- B. ASTM C150 - Portland Cement.
- C. ASTM C206 - Finishing Hydrated Lime.
- D. ASTM C847 - Standard Specifications for Metal Lath.
- E. ASTM C897 - Aggregate for Job-Mixed Portland Cement-Based Plasters.
- F. ASTM C926 - Application of Portland Cement-Based Plaster.
- G. ASTM C932 - Surface-Applied Bonding Agents for Exterior Plaster.
- H. ASTM C933 - Welded Wire Lath.
- I. ASTM C954 - Steel Drill Screws for the Application of Gypsum Board or Metal Plaster Bases to Steel Studs from 0.033 inches to 0.112 inches in thickness.
- J. ASTM C1002 - Steel Drill Screws for the Application of Gypsum Board or Metal Plaster Bases.
- K. ASTM C1063 - Installation of Lathing and Furring for Portland Cement Based Plaster.
- L. NAAMM Standard ML/SFA 920 - Guide Specifications for Metal Lathing and Furring.
- M. Lathing and Plaster Systems Manual - Third Edition.
- N. Military Specification MIL-B-19235 - Bonding Agents.
- O. PCA (Portland Cement Association) - Portland Cement Plaster (Stucco) Manual.
- P. CBC - California Building Code, (CCR) California Code of Regulations, Title 24, Part 2.
- Q. IAPMO - International Association of Plumbing and Mechanical Officials, Uniform Evaluation Service (UES) Reports.
- R. ICC - International Code Council.
- S. TSIB - Technical Services Information Bureau.

1.3 QUALITY ASSURANCE

- A. Applicator: Company specializing in cement plaster work with five years documented experience.
- B. At the completion of lathing and prior to the application of scratch coat of plaster, contact the Technical Services Information Bureau, www.tsib.org, and arrange for inspection of lathing and accessories installation. Provide Architect a written report of the results of the inspection.
- C. Installation of underlayment and penetration flashing shall be in accordance with manufacturer's installation guidelines and recommendations. Provide site reports from manufacturer's field service representative, indicating observation of underlayment and flashing installation.

1.4 REGULATORY REQUIREMENTS

- A. Conform to CBC, California Building Code, (CCR) California Code of Regulations, Title 24, Part 2, Chapter 7, for fire rated assemblies as indicated on drawings.
- B. Conform to CBC, California Building Code, (CCR) California Code of Regulations, Title 24, Part 2, Chapter 25 for materials and their installation.
- C. Obtain approval of enforcement agency for installation of self furring metal lath.

1.5 SUBMITTALS

- A. Submit product data under provisions of Section 01 33 00.
- B. Provide product data on plaster materials, characteristics and limitations of products specified.
- C. Submit samples of integral color and texture for plaster finish.
- D. Provide underlayment manufacturer's written installation instructions.

1.6 FIELD SAMPLES

- A. Provide sample panel under provisions of Section 01 33 00.
- B. Construct field sample panel, minimum 96 inches long by 96 inches wide, illustrating lath installation, base coat installation, surface texture, and color of finish coat.
- C. Locate where directed.
- D. Accepted sample may remain as part of the Work.

1.7 PRE-INSTALLATION CONFERENCE

- A. Convene a conference two weeks prior to commencing work of this Section under the provisions of Section 01 31 00.
- B. Require the attendance of parties directly affecting the Work of this Section.
- C. Review requirements for installation of all materials specified in this Section for sequencing, proper installation, integration and protection.

1.8 ENVIRONMENTAL REQUIREMENTS

- A. Do not apply plaster when substrate or ambient air temperature is less than 40 degrees F or more than 90 degrees F.
- B. Maintain minimum ambient temperature of 40 degrees F during and after installation of plaster.

- C. Protect portland cement plaster from uneven and excessive evaporation during dry weather and from strong blasts of dry air.

1.9 WARRANTY

- A. Provide ten year warranty for underlayment and flashings under provisions of Section 01 77 00.
- B. Warranty: Include coverage for published water infiltration properties of underlayment and flashings installed for exterior walls and openings.

2. PART 2 PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Lathing Materials:

1. Amico-West, www.amico-lath.com.
2. ClarkDietrich Building Systems, www.clarkdietrich.com.
3. CEMCO, www.cemcosteel.com.
4. Structa Wire Corp., www.structawire.com.

B. Accessories:

1. ClarkDietrich Building Systems, www.clarkdietrich.com.
2. Flannery, Inc., www.flannerytrim.com.
3. Fry Reglet Corp., www.fryreglet.com.
4. Metalex Corp., www.metlx.com.
5. CEMCO, www.cemcosteel.com.
6. Amico-West, www.amico-lath.com.
7. Stockton Wire Products, www.stocktonproducts.com.
8. Structa Wire Corp., www.structawire.com.

C. Acrylic-Based Finish Coat:

1. BASF, Master Builders, Master Protect HB 400 Acrylic Finish, www.master-builders-solutions.basf.us.com.
2. Dryvit Systems DPR: Modified Textured Acrylic Finish, www.dryvit.com.
3. Omega Stucco, Akrosil, www.omega-products.com.
4. Senergy, Inc., Senerlastic Plus Acrylic Finish, www.senergy.cc.
5. Sto Industries, StoLit, www.stocorp.com.

D. Underlayment:

1. Underlayment: Tyvek as manufactured by E.I. DuPont de Nemours, www.tyvek.com
 - (a) First layer: Commercial Wrap D.

(b) Second layer: Commercial Wrap.

2. Other acceptable underlayment: Dryline Building Wrap CP and Rain Drain as manufactured by National Shelter Products, Inc., www.drylinewrap.com.

E. Substitutions: Under provisions of Section 01 25 13.

2.2 PLASTER BASE COAT MATERIALS

- A. Cement: ASTM C150, Normal - Type I, Portland.
- B. Lime: ASTM C206, Type S.
- C. Aggregate: In accordance with ASTM C897 and PCA Plaster (Stucco) Manual.
- D. Water: Clean, fresh, potable and free of mineral or organic matter which can affect plaster.
- E. Bonding Agent: ASTM C932; type recommended for bonding plaster to concrete and concrete masonry surfaces. Larsen Products Corp. - Weld-Crete, www.larsenproducts.com.
- F. Plaster Mix Reinforcement: Glass fibers, 1/2 inch nominal length, alkali resistant.
- G. Substitutions: Under provisions of Section 01 25 13.

2.3 PLASTER FINISH COAT MATERIALS

- A. Acrylic Finish Coat: Factory-mixed formulation of acrylic emulsion, colorfast mineral pigments and fine aggregates for use over portland cement plaster base coats. Integral pre-mixed color from manufacturer's entire range color selection.

2.4 METAL LATHING

- A. Metal Lath for Vertical Surfaces: ASTM C847, 3.4 lb/sq.yd. expanded metal, galvanized, self furring type with "V" shaped continuous groove or self-furring welded wire lath, ASTM C933 1.95 lb/sq. yd. galvanized according to ASTM A641 equal to Mega Lath as manufactured by Structa Wire Corp., IAPMO UES Report No. 2017.
- B. Metal Lath for Horizontal Surfaces: ASTM C847, 3.4 lb./sq.yd. expanded metal, galvanized, with factory applied kraft paper backing or self-furring welded wire lath, ASTM C933 1.95 lb/sq. yd. galvanized according to ASTM A641, with factory applied kraft paper equal to Mega Lath as manufactured by Structa Wire Corp., IAPMO UES Report No. 2017.

2.5 ACCESSORIES

- A. Corner Mesh: Formed steel, minimum 0.0179 inch thick; expanded flanges shaped to permit complete embedding in plaster; minimum 2 inches wide; galvanized finish. Equivalent to ClarkDietrich, CEMCO, or Cornerite.
- B. Corner Reinforcement: Equivalent to Western Metal, 0.0179 inch Stucco-Lok or 18 gage Stockton Corneraid for straight corners. Stockton Bullnose Regular for rounded corners, galvanized finish.
- C. Strip Mesh: Metal lath, 3.4 lb/sq. yd. expanded metal, galvanized, 6 inches wide x 18 inches long.
- D. Vent Screed: Equivalent to Stockton SVR, minimum 0.0179 inch thick; depth governed by plaster thickness, minimum 4 inch width, double "V" profile with perforated expanse between "V"s of longest possible lengths; galvanized finish.
- E. Casing Bead: Formed steel; minimum 0.0179 inch thick; thickness governed by plaster thickness; maximum possible lengths; with square edges; galvanized finish.

- F. Curved Casing Bead: Square-edged style fabricated from aluminum, preformed into curve or radius indicated.
- G. Weep Screed: Equivalent to Stockton W-S#7, minimum 0.0179 inch thick; depth governed by plaster thickness, minimum 3-1/2 inch high flange, "V" shaped, of longest possible lengths; galvanized finish.
- H. Drip Screed: Equivalent to Stockton SDC or BSS No. 10 drip mould as indicated on drawings, minimum 0.0179 inch thick; depth governed by plaster thickness, minimum 3-1/2 inch high flange, of longest possible lengths; galvanized finish.
- I. Window/Door Drip Screed: Equivalent to Stockton WTP, minimum 0.0179 inch thick; depth governed by plaster thickness, minimum 3-1/2 inch high flange, of longest possible lengths; galvanized finish.
- J. Control and Expansion Joints: Equivalent to Western XJ 15-3, depth to conform to plaster thickness, maximum practical lengths, galvanized finish.
- K. Single Point Screed: Equivalent to Stockton PBS, minimum 0.0179 inch thick; depth governed by plaster thickness, maximum practical lengths; galvanized finish.
- L. Interior Corner Joints: Equivalent to Western No. 30, depth to conform to plaster thickness, maximum practical lengths, galvanized finish.
- M. Anchorages: Nails, staples, or other approved metal supports, of type and size to suit application, galvanized to rigidly secure lath and associated metal accessories in place.
- N. Screws: ASTM C954 or ASTM C1002, self drilling.
- O. Penetration Flashing: Tyvek flashing system. Straight flash for jambs and heads, FlexWrap for sills. Equivalent as manufactured by The Polymer Group, Inc. or National Shelter Products, Inc.
- P. Polyethylene Sheet: Clear, 6 mil thick.
- Q. Wire: ASTM A641, Class 1 coating (galvanized), soft temper.
- R. Powder Activated Fastener: 0.157 inch diameter X-U premium nail with washer as manufactured by Hilti, Inc., www.us.hilti.com, ICC/ES Report No. ESR-2269.
- S. Tape: Acrylic adhesive backed oriented polypropylene, 3 inch in width.

2.6 SUSPENDED METAL CEILING FRAMING

- A. Runner Channels: 1-1/2 inch high cold rolled steel, 0.475 lb./ft., galvanized.
- B. Furring Channels: 3/4 inch high cold rolled steel, 0.30 lb./ft., galvanized.
- C. Hanger Wires: ASTM A641, No. 8 gauge galvanized, soft temper wire.
- D. Tie Wire: ASTM A641, No. 18 gauge galvanized, soft temper wire.

2.7 CEMENT PLASTER MIXES

- A. Mix and proportion cement plaster in accordance with ASTM C926 and PCA Plaster (Stucco) Manual.
- B. Scratch Coat and Brown Coat: One part cement, minimum 3-1/2 and maximum 5 parts aggregate, and 0-3/4 parts hydrated lime. Alkali resistant glass fibers at a rate of 1 lb. per sack of cement. When expanded lath is used fibers shall only be used in brown coat. When welded wire lath is used, fibers shall be used in both scratch and brown coat.
- C. Acrylic-Based Finish Coat: Factory packaged; comply with finish coat manufacturer's directions.
- D. Mix only as much plaster as can be used in 1 hour.

- E. Mix materials dry, to uniform color and consistency, before adding water.
- F. Protect mixtures from frost, contamination, and evaporation.
- G. Do not retemper mixes after initial set has occurred.

3. PART 3 EXECUTION

3.1 INSPECTION

- A. Verify that surfaces and site conditions are ready to receive Work. Notify Architect in writing of all unsatisfactory surfaces and conditions.
- B. Masonry: Verify joints are cut flush and surface is ready to receive Work of this Section. Verify no bituminous or water repellent coatings exist on masonry surface.
- C. Concrete: Verify surfaces are flat, honeycomb is filled flush, and surface is ready to receive work of this Section. Verify no bituminous, water repellent, or form release agents exist on concrete surface that are detrimental to plaster.
- D. Grounds and Blocking: Verify items within walls for other Sections of Work have been installed.
- E. Mechanical and Electrical: Verify services within walls have been tested and approved.
- F. Beginning of installation means acceptance of existing conditions.

3.2 PREPARATION

- A. Protect surfaces near the Work of this Section from damage, disfiguration, and overspray. Mask off all ventilation screeds occurring in plastered areas.
- B. Clean masonry surfaces of foreign matter. Clean surfaces using acid solutions, solvents, or detergents. Wash surfaces with clean water.
- C. Apply bonding agent in accordance with manufacturer's instructions.

3.3 INSTALLATION - LATHING MATERIALS

- A. Install metal lathing in accordance with ML/SFA 920, ASTM C1063 and as specified herein.
- B. On vertical surfaces apply 2 layers of underlayment over substrate; weatherlap horizontal edges 6 inches, vertical edges 6 inches. Fasten in place at 12 inches on center vertically over stud. Tape seal all joints and penetrations on base layer. Installation to conform to Single "Separate" Layer Method in accordance with TSIB Bulletin 60.220.
- C. Install penetration flashing around all openings and penetrations in exterior walls in compliance with underlayment manufacturer's recommendations and in conformance with recommendations contained in Plaster and Lathing Systems Manual and ML/SFA 920. Turn sill flashing up 6 inches at jambs. Extend flashing back onto sill, jamb, and head of all openings.
- D. Apply metal lath taut, with long dimension perpendicular to supports.
- E. Lap ends of expanded metal lath a minimum of 1 inch. Secure end laps with tie wire where they occur between supports.
- F. Lap sides of expanded metal lath a minimum of 1-1/2 inches.
- G. Lap sides of welded wire lath a minimum of 1 mesh opening spacing at sides and ends. End laps shall occur over supports.

- H. Furr out metal lath from vertical supports or backing not less than 1/4 inch. Furring of metal lath on vertical supports having a bearing surface width of 1-5/8 inches or less is not required.
- I. Attach metal lath to wood supports using 1-1/2 inch No. 11 galvanized nails with 7/16 inch diameter heads at maximum 6 inches on center. In addition, at horizontal wood supports, secure lath to each support with 1/2 inch wide, 1-1/2 inch long No. 9 W & M gage ring shank, hook staple placed around a 10d common nail laid flat under the surface of the lath at 27 inches o.c. and not more than 3 inches from the edge of each sheet.
- J. Attach metal lath to vertical metal supports with tie wires or No. 8 self drilling screws with 3/8 inch diameter wafer head capable of penetrating metal supports by not less than 1/4 inch or 3 full threads. Maximum spacing 6 inches on center.
- K. Attach metal lath to horizontal metal supports with tie wires or No. 8 self drilling screws with 3/8 inch diameter wafer head fitted with 1 inch O.D. x 1/4 inch I.D. x 16 gage galvanized cut washers capable of penetrating metal supports by not less than 1/4 inch or 3 full threads.
- L. Attach metal lath to masonry using powder actuated fastener with washers with minimum 1 inch penetration into substrate. Space at maximum 16 inches on center horizontally and 6 inches on center vertically. Securely wire tie side laps.
- M. Continuously reinforce internal angles with corner mesh, except where corner joint No. 30 is shown. Fasten at perimeter edges only.
- N. Place beaded external angle with mesh at corners. Fasten at outer edges only.
- O. Place strip mesh diagonally at corners of lathed openings. Secure rigidly in place.
- P. Place 6 inch wide strips of metal lath centered over junctions of dissimilar backing materials. Secure rigidly in place.
- Q. Place window/door drip screed at head of all windows and door openings in exterior walls.
- R. Place weep screed at base of all vertical plaster applications at foundation line not less than 4 inches above earth or 2 inches above paved surfaces. Underlayment and lath shall cover and terminate on the attachment flange of the screed.
- S. Place drip screed at base of all vertical plaster applications which do not terminate at framed wall openings or at foundation line.
- T. Place vent screed in soffit areas indicated.
- U. Place casing beads at all terminations of plaster finish not otherwise indicated to have screeds installed and at all intersections with dissimilar materials. Butt and align ends. Secure rigidly in place.
- V. Install accessories to lines and levels.

3.4 INSTALLATION - SUSPENDED METAL CEILING FRAMING

- A. Install in accordance with ASTM C1063.
- B. Coordinate location of hangers with other Work.
- C. Install ceiling framing independent of walls and columns.
- D. Reinforce openings in ceiling suspension system which interrupt main carrying channels or furring channels with lateral channel bracing. Extend bracing minimum of 24 inches past end of openings.

3.5 CONTROL AND EXPANSION JOINTS

- A. Locate interior control and expansion joints as indicated on the drawings, but not to exceed 20'-0" o.c. horizontally or vertically.
- B. Locate exterior control and expansion joints as indicated on drawings but not to exceed 12'-0" o.c. horizontally or vertically.
- C. Establish control and expansion joints with specified joint device.
- D. Attach control and expansion joints to metal lath with wire ties.
- E. Install expansion joint over 3 inch wide strip of polypropylene tape to assist with air seal continuity.
- F. Cut metal lath behind expansion joints.
- G. Coordinate joint placement with other related Work.

3.6 PLASTERING

- A. Apply plaster in accordance with ASTM C926 and PCA Portland Cement Plaster (Stucco) Manual.
- B. Three Coat Application: At metal lathed surfaces, apply scratch coat to a nominal thickness of 3/8 inch, brown coat to a nominal thickness of 3/8 inch, and finish coat to a nominal thickness of 1/8 inch.
- C. Two Coat Application: At masonry surfaces, apply 1/2 inch thick leveling coat and then 1/8 inch finish coat.
- D. Moisture Curing: Moist cure plaster surfaces using a fine fog spray to assure continuous hydration of cementitious materials. Where hot, dry and windy conditions exist, plaster surfaces shall be moistened and covered with a single sheet of polyethylene plastic to prevent water loss thru evaporation.
- E. Moist cure scratch and brown coats. Do not apply brown coat sooner than 48 hours following scratch coat.
- F. After curing, dampen base coat prior to applying finish coat. Do not apply finish coat sooner than 7 days following brown coat.
- G. Apply acrylic-based finish coat as factory packaged; do not add other ingredients; comply with manufacturer's written instructions.

3.7 FINISH COAT TEXTURE

- A. Sand smooth texture as defined by Parex USA.

3.8 TOLERANCES

- A. Maximum Variation from True Flatness: 1/8 inch in 10 feet.

3.9 CLEANING

- A. Remove protective maskings.
- B. Remove any overspray from surrounding materials.
- C. Clean adjacent affected surfaces.

3.10 PLASTER TEXTURE SCHEDULE

- A. Exterior Vertical Surfaces: Sand smooth.
- B. Exterior Horizontal Surfaces: Sand smooth.

3.11 PLASTER APPLICATION SCHEDULE

- A. Exterior Vertical Surface of Masonry Building and Yard Walls: Two coat plaster over bonding agent.
- B. Exterior Vertical Surface of Framed Walls: Three coat plaster over metal lath and underlayment.
- C. Exterior Horizontal Framed Surfaces: Three coat plaster over metal lath.
- D. Exterior Horizontal Masonry Surfaces: Two coat plaster over bonding agent.

END OF SECTION

SECTION 09 30 14

PORCELAIN TILE FLOOR FINISHING

1. PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Porcelain tile floor finish using the full bed application method.
- B. Porcelain tile base.
- C. Threshold at door opening.

1.2 REFERENCES

- A. ANSI/TCA A108.5 - Ceramic Tile Installed with Dry-Set Portland Cement Mortar or Latex Portland Cement Mortar.
- B. ANSI/TCA A108.11 - Interior Installation of Cementitious Backer Units.
- C. ANSI/TCA A118.1 - Dry-Set Portland Cement Mortar.
- D. ANSI/TCA A118.4 - Latex-Portland Cement Mortar.
- E. ANSI/TCA A118.7 - Polymer Modified Ceramic Tile Grouts.
- F. ANSI/TCA A118.9 - Test Methods and Specification for Cementitious Backer Units.
- G. ANSI/TCA A137.1 - Specifications for Ceramic Tile.
- H. ASTM A1064 - Carbon-Steel Wire and Welded Wire Reinforcement, Plain and Deformed, for Concrete.
- I. ASTM D4551 - Poly (Vinyl Chloride) (PVC) Plastic Flexible Concealed Water-Containment Membrane.
- J. MIA - Marble Institute of America.
- K. TCA (Tile Council of America) - Handbook for Ceramic Tile Installation.

1.3 SUBMITTALS

- A. Submit shop drawings under provisions of Section 01 33 00.
- B. Submit shop drawings indicating tile layout and patterns, color arrangement, perimeter conditions, and junctions with dissimilar materials.
- C. Submit samples under provisions of Section 01 33 00.
- D. Submit 4 samples of each tile, to indicate pattern and color variations.
- E. Submit manufacturer's installation instructions under provisions of Section 01 33 00.
- F. Submit manufacturer's certificate under provisions of Section 01 33 00 that products meet or exceed ANSI/TCA A137.1.
- G. Submit maintenance data under provisions of Section 01 77 00.
- H. Include recommended cleaning and stain removal methods, and cleaning materials.

1.4 QUALITY ASSURANCE

- A. Conform to ANSI/TCA A137.1 for tile material.
- B. Conform to ANSI/TCA A137.1 DCOF AcuTest for coefficient of friction.
- C. Conform to ANSI/TCA Standards and TCA Handbook for tile installation.

1.5 QUALIFICATIONS

- A. Manufacturer: Company specializing in the manufacture of products specified in this Section with minimum five years documented experience.
- B. Installer: Company specializing in applying the work of this Section with minimum five years documented experience.

1.6 ENVIRONMENTAL REQUIREMENTS

- A. Maintain 50 degrees F during installation of mortar materials.

1.7 EXTRA MATERIALS

- A. Provide extra quantity of full size tile and trim shape units to Owner under provisions of Section 01 77 00.
- B. Provide quantity equal to 5 percent of units installed of each shape and color.

2. PART 2 PRODUCTS

2.1 MANUFACTURERS - TILE

- A. Caesar, www.caesar.it
- B. Crossville Ceramics, www.crossvilleinc.com.
- C. Dal-Tile Corp., www.daltile.com.
- D. Emser Tile, www.emser.fiandre.com.
- E. Graniti Fiandre, www.granitifiandre.com.
- F. Imola Ceramica, www.imolaceramica.com.
- G. Interceramic, www.interceramic.com.
- H. Iris Ceramics, www.irisfmg.com.
- I. Portobello America, Inc., www.portobelloamerica.com.
- J. Pantheon Tile, www.pantheon tile.com.
- K. Shaw Commercial, www.shawinc.com.
- L. Substitutions: Under provisions of Section 01 25 13.

2.2 TILE MATERIAL

- A. Porcelain Floor Tile: ANSI/TCA A137.1, conforming to the following:

Manufacturer and Pattern	Equivalent to Argent by Crossville, Inc.
Moisture Absorption	0 to 0.5 percent
Size	12 x 12 x 3/8 inch
Edge	Square
Surface Finish	Matte
Color	As selected from minimum of 20 standard colors of varying tones and colors, must include red, green, blue, grey, tan, and brown options.
Coefficient of Friction According to ANSI A137.1 DCOF AcuTest	Not less than 0.42 average value wet and dry.

- B. Base: Match floor tile for moisture absorption, surface finish, and color; tile size; 12 inch long x 6 inch high; bull-nosed top edge, coved internal and external corner.

2.3 MANUFACTURERS - MORTAR AND GROUT

- A. C-Cure, www.c-cure.com.
- B. Custom Building Products, www.custombuildingproducts.com.
- C. H.B. Fuller Company, www.hbfuller.com.
- D. Hydromet, www.bostikfindley-usa.com.
- E. Laticrete International, Inc., www.laticrete.com.
- F. W.R. Bonsal Company, www.bonsal.com.
- G. MAPEI, www.mapei.com.
- H. Substitutions: Under provisions of Section 01 25 13.

2.4 MORTAR MATERIALS

- A. Portland Cement Mortar Materials: ANSI/TCA A118.1.

2.5 GROUT MATERIALS

- A. Portland Cement Grout Materials : ANSI/TCA A118.7.

2.6 ACCESSORIES

- A. Waterproof Membrane: ASTM D4551, Grade 40, polyvinyl chloride sheet.
- 1. Compotite Corporation, www.compotite.com.
 - 2. Dal-Tile Corp., www.daltile.com.
 - 3. Pasco Manufacturing Inc., www.pascospecialty.com.
 - 4. Noble Company, www.noblecompany.com.
 - 5. Substitutions: Under provisions of Section 01 25 13.

- B. Reinforcing Mesh: ASTM A1064, 2 x 2 inch size, of WO.5/WO.5 wire size; welded fabric, galvanized.
- C. Thresholds: Marble complying with Group A of the Marble Institute of America (MIA), color selected by Architect; profile as indicated or selected from manufacturer's standard shapes.
- D. Sealant: Type specified in Section 07 92 00.

2.7 MORTAR MIX AND GROUT MIX

- A. Mix and proportion pre-mix setting bed bond coat and grout materials in accordance with manufacturer's instructions, and referenced standards.

2.8 SEALER

- A. Tile and Grout Sealer: Aqua Mix Penetrating Sealer manufactured by Aqua Mix, Inc., www.aquamix.com.

3. PART 3 EXECUTION

3.1 EXAMINATION

- A. Verify that surfaces are ready to receive work.
- B. Beginning of installation means installer accepts condition of existing surfaces.

3.2 PREPARATION

- A. Protect surrounding work from damage or disfiguration.
- B. Vacuum clean existing surfaces and damp clean.
- C. Seal substrate surface cracks with filler. Level existing substrate surfaces to acceptable flatness tolerances.
- D. Blend tiles before installation to produce an even range of color and finish.

3.3 INSTALLATION - FULL MORTAR BED METHOD

- A. Install mortar bed, tile, and grout in accordance with ANSI/TCA 108.5 and applicable tile installation standards of the TCA Handbook.
- B. Install waterproof membrane material. Extend vertically up wall a minimum of 6 inches. Extend into floor drain. Use recommended solvent cement to weld joints when pan dimensions exceed maximum width of material.
- C. Set marble thresholds at interior door openings.
- D. Apply mortar bed over surfaces to a thickness as indicated and to slopes as shown.
- E. Install reinforcing mesh in middle of mortar bed.
- F. Install thin load bearing direct bond membrane in bond coat. Extend vertically up wall a minimum of 6 inches. Extend into floor drains. Use recommended solvent cement to weld joints when membrane dimensions exceed maximum width of material.
- G. Apply bond coat.
- H. Lay tile to pattern indicated on Drawings, or if not indicated, request from Architect. Do not interrupt tile pattern through openings.
- I. Cut and fit tile tight to penetrations through tile. Form corners and bases neatly. Align floor, base, and wall joints.

- J. Place tile joints uniform in width, subject to variance in tolerance allowed in tile size. Make joints watertight without voids, cracks, excess mortar, or excess grout.
- K. Sound tile after setting. Replace hollow sounding units.
- L. Provide control joints, vertical and horizontal, at not-to-exceed 20'-0" oc. Keep control joints free of mortar or grout. Install joints in accordance with TCA Handbook. Apply sealant to joints.
- M. Allow tile to set for a minimum of 48 hours prior to grouting.
- N. Grout tile joints.
- O. Apply sealant to junction of tile and dissimilar materials and junction of dissimilar planes.

3.4 CLEANING

- A. Clean work under provisions of Section 01 77 00.
- B. Clean tile surfaces.

3.5 SEALING

- A. Install sealer on all surfaces in accordance with manufacturer's recommendations.

3.6 PROTECTION

- A. Protect finished installation under provisions of Section 01 61 00.
- B. Do not permit traffic over finished floor surface for a minimum of 48 hours. After 48 hours and until 72 hours, cover area with 3/8 inch plywood panels if traffic is required.

END OF SECTION

SECTION 09 30 15

PORCELAIN TILE WALL FINISHING

1. PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Porcelain tile wall and wainscot finish using the thinset application method.
- B. Porcelain tile base.
- C. Cementitious backing board.

1.2 REFERENCES

- A. ANSI/TCA A108.5 - Ceramic Tile Installed with Dry-Set Portland Cement Mortar or Latex Portland Cement Mortar.
- B. ANSI/TCA A108.11 - Interior Installation of Cementitious Backer Units.
- C. ANSI/TCA A118.1 - Dry-Set Portland Cement Mortar.
- D. ANSI/TCA A118.4 - Latex-Portland Cement Mortar.
- E. ANSI/TCA A118.7 - Polymer Modified Ceramic Tile Grouts.
- F. ANSI/TCA A118.9 - Test Methods and Specifications for Cementitious Backer Units.
- G. ANSI/TCA A137.1 - Specifications for Ceramic Tile.
- H. ASTM C847 - Standard Specifications for Metal Lath.
- I. ASTM D226 - Asphalt-Saturated Felt Used in Roofing and Waterproofing.
- J. TCA (Tile Council of America) - Handbook for Ceramic Tile Installation.

1.3 SUBMITTALS

- A. Submit shop drawings under provisions of Section 01 33 00.
- B. Submit shop drawings indicating tile layout, patterns, color arrangement, perimeter conditions, junctions with dissimilar materials.
- C. Submit samples under provisions of Section 01 33 00.
- D. Submit 4 samples of each tile, representative of pattern and color variations.
- E. Submit manufacturer's installation instructions under provisions of Section 01 33 00.
- F. Submit maintenance data under provisions of Section 01 77 00.
- G. Include recommended cleaning and stain removal methods, and cleaning materials.

1.4 QUALITY ASSURANCE

- A. Conform to ANSI/TCA A137.1 for tile material.
- B. Conform to ANSI/TCA Standards and TCA Handbook for tile installation.

1.5 QUALIFICATIONS

- A. Manufacturer: Company specializing in the manufacture of products specified in this Section with minimum five years documented experience.
- B. Installer: Company specializing in applying the work of this Section with minimum five years documented experience.

1.6 ENVIRONMENTAL REQUIREMENTS

- A. Maintain 50 degrees F during installation of mortar materials.

1.7 EXTRA MATERIALS

- A. Provide extra quantity of full size tile and trim shape units to Owner under provisions of Section 01 77 00.
- B. Provide quantity equal to 5 percent of units installed of each shape and color.

2. PART 2 PRODUCTS

2.1 MANUFACTURERS - TILE

- A. Caesar, www.caesar.it.
- B. Crossville Ceramics, www.crossvilleinc.com.
- C. Dal-Tile Corp., www.daltile.com.
- D. Emser Tile, www.emser.com.
- E. Graniti Fiandre, www.granitifiandre.com.
- F. Imola Ceramica, www.imolaceramica.com.
- G. Interceramic, www.interceramic.com.
- H. Iris Ceramics, www.irisfmg.com.
- I. Portobello America, Inc., www.portobelloamerica.com.
- J. Pantheon Tile, www.pantheon tile.com.
- K. Shaw Commercial, www.shawinc.com.
- L. Substitutions: Under provisions of Section 01 25 13.

2.2 TILE MATERIAL

- A. Porcelain Wall Tile: ANSI/TCA A137.1, conforming to the following:

Moisture Absorption	0 to 0.5 percent
Manufacturer and Pattern	Equivalent to Argent by Crossville, Inc.
Size	12 x 12 x 3/8 inch
Edge	Square
Surface Finish	Matte
Color	As selected As selected from minimum of 20 standard colors of varying tones and colors, must include red, green, blue, grey, tan, and brown options.

- B. Base: Match wall tile for moisture absorption, surface finish, and color; tile size; 12 inch long x 6 inch high; coved bottom.
- C. Wainscot Cap: Match wall tile for moisture absorption, surface finish, and color, tile size 12 inch long x 6 inch high, bullnosed top edge.

2.3 MANUFACTURERS - MORTAR AND GROUT

- A. C-Cure, www.c-cure.com.
- B. Custom Building Products, www.custombuildingproducts.com.
- C. H.B. Fuller Company, www.hbfuller.com.
- D. Hydromet, www.bostikfindley.com.
- E. Laticrete International, Inc., www.laticrete.com.
- F. MAPEI, www.mapei.com.
- G. W.R. Bonsal Company, www.bonsal.com.
- H. Substitutions: Under provisions of Section 01 25 13.

2.4 MORTAR MATERIALS

- A. Latex-Portland Cement Mortar: ANSI/TCA A118.4 and the following:
 - 1. Acrylic resin latex additive.
 - 2. Dry mortar mix supplied by latex manufacturer.

2.5 GROUT MATERIALS

- A. Latex-Portland Cement Grout: ANSI/TCA A118.7 of color selected and the following:
 - 1. Acrylic resin latex additive.
 - 2. Microban antimicrobial additive, www.microban.com.
 - 3. Dry mortar mix supplied by latex manufacturer.

2.6 ACCESSORIES

- A. Membrane: ASTM D226; No. 15 asphalt saturated roofing felt.
- B. Reinforcing Mesh: ASTM C847; 3.4 lb./sq.yd. expanded metal, galvanized, self-furring type.
- C. Backing Board: ANSI/TCA A118.9; High density, cementitious, glass fiber reinforced, 1/2 inch thick; 2 inch wide coated glass fiber tape for joints and corners; manufacture licensed by TCA.
- D. Sealant: Type specified in Section 07 92 00.

2.7 MORTAR MIX AND GROUT MIX

- A. Mix and proportion pre-mix setting bed and grout materials in accordance with manufacturer's instructions and referenced standards.

2.8 SEALER

- A. Tile and Grout Sealer: Aqua Mix Penetrating Sealer manufactured by Aqua Mix, Inc., www.aquamix.com.

3. PART 3 EXECUTION

3.1 EXAMINATION

- A. Verify that surfaces are ready to receive work.
- B. Beginning of installation means installer accepts condition of existing surfaces.

3.2 PREPARATION

- A. Protect surrounding work from damage or disfiguration.
- B. Vacuum clean existing surfaces and damp clean.
- C. Seal substrate surface cracks with filler. Level existing substrate surfaces to acceptable flatness tolerances.
- D. Blend tiles before installation to produce an even range of color and finish.

3.3 INSTALLATION - THINSET METHOD

- A. Install mortar, tile, and grout in accordance with ANSI/TCA 108.5 and applicable tile installation standards of the TCA Handbook.
- B. Install membrane over substrate; weatherlap horizontal edges 4 inches, vertical edges 6 inches.
- C. Install backing board in accordance with manufacturer's instructions and ANSI/TCA A108.11. Tape joints and corners; cover with skim coat of dry-set mortar to a feather edge.
- D. Lay tile to pattern indicated. If not indicated, request from Architect. Do not interrupt tile pattern around openings.
- E. Cut and fit tile tight to penetrations through tile. Form corners and bases neatly. Align wall, base, and floor joints.
- F. Place tile joints uniform in width, subject to variance in tolerance allowed in tile size. Make joints watertight, without voids, cracks, excess mortar or excess grout.
- G. Form internal angles square and external angles bullnosed.
- H. Sound tile after setting. Replace hollow sounding units.
- I. Keep control joints free of mortar or grout. Apply sealant to joints.
- J. Allow tile to set for a minimum of 48 hours prior to grouting.
- K. Grout tile joints.
- L. Apply sealant to junction of tile and dissimilar materials and junction of dissimilar planes.

3.4 CLEANING

- A. Clean work under provisions of Section 01 77 00.
- B. Clean tile surfaces.

3.5 SEALING

- A. Install sealer on all surfaces in accordance with manufacturer's instructions.

END OF SECTION

SECTION 09 51 13

ACOUSTICAL PANEL CEILINGS

1. PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Suspended metal grid ceiling system.
- B. Acoustical panels.
- C. Non-fire rated assembly.
- D. Perimeter trim.

1.2 REFERENCES

- A. ASTM A513 - Electric-Resistance-Welded Carbon and Alloy Steel Mechanical Tubing.
- B. ASTM A641 - Zinc-Coated (Galvanized) Carbon Steel Wire.
- C. ASTM C635 - Metal Suspension Systems for Acoustical Tile and Lay-in Panel Ceilings.
- D. ASTM C636 - Installation of Metal Ceiling Suspension Systems for Acoustical Tile and Lay-in Panels.
- E. ASTM D3273 - Standard Test Method for Resistance to Growth of Mold on the Surface of Interior Coatings in an Environmental Chamber.
- F. ASTM E84 - Test Methods for Surface Burning Characteristics of Building Materials.
- G. ASTM E580 - Application of Ceiling Suspension Systems for Acoustic Tile and Lay-in Panels in Areas Requiring Seismic Restraint.
- H. ASTM E1264 - Classification of Acoustical Ceiling Products.
- I. DSA - Division of the State Architect.
- J. CBC - California Building Code, (CCR) California Code of Regulations, Title 24, Part 2.
- K. ICC - ES - International Code Council Evaluation Service, Inc.
- L. UL - Underwriters' Laboratories Building Material Directory.

1.3 QUALITY ASSURANCE

- A. Manufacturer: Company specializing in manufacture of ceiling suspension system and ceiling panels with five years minimum experience.
- B. Installer: Company with five years minimum documented experience, approved by manufacturer.

1.4 REGULATORY REQUIREMENTS

- A. Conform to CBC, California Building Code (CCR) California Code of Regulations, Title 24, Part 2, Chapter 16A for suspension system requirements and DSA IR 25-2.13.

- B. Conform to applicable UL and CBC combustibility requirements for materials.
- 1.5 SUBMITTALS

- A. Submit product data under provisions of Section 01 33 00.
- B. Provide product data on metal grid system components and acoustic units.
- C. Submit samples under provisions of Section 01 33 00.
- D. Submit two samples 6 x 6 inch in size, illustrating material and finish of acoustic units.
- E. Submit two samples each, 12 inches long, of suspension system main runner, cross runner, and edge trim.

1.6 ENVIRONMENTAL REQUIREMENTS

- A. Maintain uniform temperature of minimum 60 degrees F, and humidity of 50 percent prior to, during, and after installation.

1.7 SEQUENCING/SCHEDULING

- A. Do not install acoustical ceilings until building is enclosed, sufficient heat is provided, dust generating activities have terminated, and overhead work is completed, tested, and approved.
- B. Schedule installation of acoustic units after interior wet work is dry.

1.8 EXTRA STOCK

- A. Provide extra quantity of acoustic units to Owner under provisions of Section 01 77 00.
- B. Provide quantity equal to 2 percent of units installed.

2. PART 2 PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS - SUSPENSION SYSTEM

- A. Armstrong Ceiling Systems, www.armstrongceilings.com. ICC-ES No. ESR-1308.
- B. Certainteed, www.certainteed.com ICC-ES No. ESR-3336.
- C. Chicago Metallic Corporation, www.chicagometallic.com. ICC-ES No. ESR-2631.
- D. USG Interior Systems, (DONN), www.usg.com. ICC-ES No. ESR-1222.
- E. Substitutions: Under provisions of Section 01 25 13.

2.2 SUSPENSION SYSTEM MATERIALS

- A. Grid: ASTM C635, heavy duty, non-fire rated, exposed T; components die cut and interlocking. Catalog numbers of acceptable manufacturer are indicated on drawings.
- B. Accessories: Stabilizer bars, clips, splices, and edge moldings required for suspended grid system.
- C. Grid Materials: Commercial quality cold rolled steel with galvanized coating.
- D. Grid Finish: Off-White color, baked enamel.
- E. Support Channels and Hangers: Galvanized steel; size and type to suit application, to rigidly secure acoustic ceiling system including integral mechanical and electrical components, as detailed on drawings.

- F. Compression Strut: As detailed on drawings. ASTM A513, telescoping tube design, galvanized 3/4 inch diameter 14 gage rigid steel tubing with crimped end attached to roof framing and secured to 1/2 inch diameter 14 gage rigid steel tubing with crimped end to main runners.
- G. Hanger Wire: ASTM A641, Class 1 coating (galvanized), soft temper, No. 12 gage.

2.3 ACCEPTABLE MANUFACTURERS - ACOUSTIC UNITS

- A. Armstrong Ceiling Systems, www.armstrongceilings.com.
- B. Certainteed, www.certainteed.com.
- C. USG Interiors, Inc., www.usg.com.
- D. Substitutions: Under provisions of Section 01 25 13.

2.4 ACOUSTIC UNIT MATERIALS

- A. Acoustic Panels: ASTM E1264, conforming to the following:

1. Type 1 Equivalent to Cortega, manufactured by Armstrong.

- (a) Pattern Designation : 3520
- (b) Size : 24 x 48 inches
- (c) Thickness : 5/8 inches
- (d) Composition : Mineral
- (e) Light Reflectance : 84 percent
- (f) NRC Range : .50 to .60
- (g) CAC Range : 30 to 35
- (h) Edge : Square
- (i) Surface Color : White
- (j) Flame Spread : ASTM E-84 (0-25) Class A, UL 25 or under
- (k) Smoke Density : Not to exceed 450 when tested in accordance with CBC Standard No. 12-8-1
- (l) Mold/Mildew Inhibitor: Biocide treatment that inhibits mold and mildew when tested according to ASTM D3273.

2. Type 2 Equivalent to Dune manufactured by Armstrong.

- (a) Pattern Designation : 4990
- (b) Size : 24 x 24 inches
- (c) Thickness : 3/4 inches
- (d) Composition : Mineral
- (e) Light Reflectance : 83 percent
- (f) NRC Range : .65 to .75
- (g) CAC Range : 30 to 40
- (h) Edge : Beveled tegular
- (i) Surface Color : White
- (j) Flame Spread : ASTM E84 (0-25) Class A, UL 25 or under
- (k) Smoke Density : Not to exceed 450 when tested in accordance with CBC Standard No. 12-8-1
- (l) Mold/Mildew Inhibitor: Biocide treatment that inhibits mold and mildew when tested according to ASTM D3273.

3. Type 3 Equivalent to Optima Health Zone manufactured by Armstrong.

- (a) Size : 24 x 48 inches
- (b) Thickness : 1 inches
- (c) Composition : Fiberglass
- (d) Light Reflectance : 86 percent
- (e) NRC Range : .90 to .95
- (f) Edge : Square
- (g) Surface Color : White
- (h) Flame Spread : ASTM E-84 (0-25) Class A, UL 25 or under
- (i) Smoke Density : Not to exceed 450 when tested in accordance with CBC Standard No. 12-8-1
- (j) Mold/Mildew Inhibitor: Biocide treatment that inhibits mold and mildew when tested according to ASTM D3273.

3. PART 3. PARTS

3.1 INSPECTION

- A. Verify that existing conditions are ready to receive work.
- B. Verify that layout of hangers will not interfere with other work.
- C. Beginning of installation means acceptance of existing conditions.

3.2 INSTALLATION - GRID SYSTEM

- A. Install system in accordance with ASTM C636 and ASTM E580 as supplemented in this Section and with notes on the drawing entitled Metal Suspension Systems for Lay In Panel Ceilings.
- B. Install after major above ceiling work is complete. Coordinate the location of hangers with other work.
- C. Hang system independent of columns, ducts, pipes and conduit. Where carrying members are spliced, avoid visible displacement of face plane of adjacent members.
- D. Where ducts or other equipment prevent the regular spacing of hangers, reinforce the nearest affected hangers and related carrying channels to span the extra distance.
- E. Compression struts to be installed at each main runner not exceeding 12'- 0" o.c. in both directions and not more than 8 inches from end of main runner. Insert main 3/4 inch tube over 1/2 inch tube with a minimum 6 inch lap. Secure crimped end of main 3/4 inch tube to structural framing with metal screws and 1/2 inch tube to main runner with metal screws. Secure tube sections together with 2 set screws. Install prefabricated compression post according to manufacturer's recommendations.
- F. Locate system on room axis according to reflected plan.
- G. Do not eccentrically load system, or produce rotation of runners.
- H. Install edge molding at intersection of ceiling and vertical surfaces, using longest practical lengths. Miter corners. Provide edge moldings at junctions with other interruptions.

3.3 INSTALLATION - ACOUSTIC UNITS

- A. Field rabbet cut edge of perimeter tiles to match factory rabbeted edge. Paint cut surface if necessary to match surface of tile.
- B. Fit acoustic units in place, free from damaged edges or other defects detrimental to appearance and function.

- C. Lay directional patterned units one way in room. Fit border neatly against abutting surfaces.
- D. Install acoustic units level, in uniform plane, and free from twist, warp and dents.

3.4 TOLERANCES

- A. Maintain tolerances in accordance with Section 01 43 00.
- B. Variation from flat and level surface: 1/8 inch in 10 feet.
- C. Variation from plumb of grid members caused by eccentric loads: Two degrees maximum.

END OF SECTION

SECTION 09 54 90

LINEAR PLANK METAL CEILING SYSTEM

PART 1 GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section Includes:
 - 1. Non-perforated metal ceiling panels
 - 2. Acoustical backing
 - 3. Suspension systems
 - 4. Accessories; provide other necessary items including devices for attachment overhead construction, secondary members, splines, splices, connecting clips, wall connectors, wall angles, and other devices required for a complete installation.
 - 5. Supplemental support framing: Provide fully engineered secondary framing as required to meet code, conforming to layout shown in drawings, to support direct-hung metal ceilings suspension system.
- B. Related Sections / Work:
 - 1. Sections 05 40 00 – Cold-Formed Metal Framing
 - 2. Sections 09 20 00 – Plaster and Gypsum Board
 - 3. Sections 09 50 00 – Acoustical Ceilings
 - 4. Sections 09 90 00 – Paintings and Coatings
 - 5. Division 23 – Heating, Ventilating and Air Conditioning
 - 6. Division 26 – Electrical
- C. This Section covers the general requirements only for Acoustical Metal Ceilings as shown on the drawings. The supplying and installation of additional accessory features and other items not specifically mentioned herein, but which are necessary to make a complete installation, shall also be included or clarified accordingly.
- D. Qualification Data:
 - 1. Test Reports: Certified reports from independent agency substantiating structural compliance to windloads and other governing requirements.
 - 2. Certificates:
 - a. Data substantiating manufacturer and installer qualifications.
 - b. Certified data attesting fire rated materials comply with specifications.
 - 3. Manufacturer's Instructions: Detailed installation instructions and maintenance data.

1.3 REFERENCES

- A. American Society for Testing and Materials (ASTM)
 - 1. E 84 – “Standard Test Method for Surface Burning Characteristics of Building Materials”
 - 2. E 488 – “Standard Test Methods for Strength of Anchors in Concrete and Masonry Elements”
 - 3. B 209 – “Standard Specification for Aluminum and Aluminum Alloy Sheet and Plate”
 - 4. C 423 – “Sound Absorption and Sound Absorption Coefficients by Reverberation Room Method”
 - 5. E 580 – “Standard Practice for Application of Ceiling Suspension Systems for Acoustical Tile and Lay-in Panels in Areas Requiring Moderate Seismic Restraint”
 - 6. C 635 – “Standard Specification for Metal Suspension Systems for Acoustical Tile and Lay-in Panel Ceilings”
 - 7. C 636 – “Recommended Practice for Installation of Metal Ceiling Suspensions Systems for Acoustical and Lay-in Panels”
 - 8. A 641 – “Standard Specification for Zinc-Coated (Galvanized) Carbon Steel Wire”
 - 9. A 653 – “Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy Coated (Galvannealed) by the Hot-Dip process”
 - 10. E 1264 – “Classification for Acoustical Ceiling Products”
 - 11. E 1477 – “Standard Test Method for Luminous Reflectance Factor of Acoustical Materials by use of Integrating-Sphere Reflectometers”
 - 12. D 1044 – “Practice for Abrasion Resistance”
 - 13. D 1002 – “Practice for Adhesion Resistance”

1.4 SUBMITTALS

- A. Product Data: Manufacturer’s published literature, including specifications.
- B. Product Certification: Manufacturer’s certifications that products comply with specified requirements and governing codes including product data, laboratory test reports and research reports showing compliance with specified standards.
- C. Shop Drawings: Submit shop drawings for reflected ceiling plans (RCP’s), drawn to scale, and indicating penetrations and ceiling mounted items. Show the following details:
 - 1. Reflected Ceiling Plan(s): Indicating metal ceiling layout, ceiling mounted items and penetrations.
 - 2. Suspension System, Carrier and Component Layout.
 - 3. Details of system assembly and connections to building components.
- D. Samples for Verification: Full-size units (or as specified below) of each type of ceiling assembly indicated; in sets for each color, texture, and pattern specified, showing the full range of variations expected in these characteristics. Submit samples for each type specified.
 - 1. 11" square metal panel units.
 - 2. 11" long samples of each exposed molding or trim.
 - 3. 11" long samples of each suspension component.

1.5 QUALITY ASSURANCE

A. Manufacturer/Installer Qualifications:

1. Provide metal ceiling system components produced by a single manufacturer with a minimum 10 years' experience in actual production of specified products and with resources to provide consistent quality in appearance and physical properties, including production in an environmentally controlled indoor factory facility and having previously certified Miami-Dade County NOA certifications.
2. Provide suspension system components produced by a single manufacturer to provide compatible components for a complete metal ceiling system installation.
3. Perform installations using a firm with installers having no less than 3 years of successful experience on projects of similar size and requirements.

B. Regulatory Requirements:

1. Fire Rating Performance Characteristics: Install system to provide a flame spread of 0 - 25, complying with certified testing to ASTM E 84.
2. Structural Criteria: Install and certify system to comply with structural and wind load requirements of governing codes.
3. Installation Standard for Suspension System: Comply with ASTM C 636.
4. Miami-Dade County, Florida Notice of Acceptance No. 17-0807.11

C. Mock-Up: Prior to beginning installation erect a mock-up section, where directed, using all system components.

D. Pre-installation Conference: Conduct a conference, prior to start of installation, to review system requirements, shop drawings, and all coordination needs.

1.6 DELIVERY, STORAGE AND HANDLING

- A. Deliver system components in manufacturer's original unopened packages, clearly labeled.
- B. Store components in fully enclosed dry space. Carefully place on skids, to prevent damage from moisture and other construction activities.
- C. Handle components to prevent damage to surfaces and edges, and to prevent distortion and other physical damage.

1.7 PROJECT CONDITIONS

- A. Begin system installations only after spaces are enclosed and weather-tight, and after all wet work and overhead work have been completed.
- B. Prior to starting installations, allow materials to reach ambient room temperature and humidity intended to be maintained for occupancy.

1.8 WARRANTY

- A. Provide specified manufacturer's warranty against defects in workmanship, discoloration, or other defect considered undesirable by the Architect or Employer.
- B. This warranty shall remain in effect for a minimum period of one (1) year from date of initial acceptance.

1.9 MAINTENANCE & EXTRA MATERIALS

- A. Maintenance Instructions: Provide manufacturer's standard maintenance and cleaning instructions for finishes provided.
- B. Extra Materials: Furnish extra materials described below that match products installed, are packaged with protective covering for storage, and are identified with labels describing contents. Only typical system components are included with attic stock.
 - 1. Acoustical Metal Ceiling Pan Units: Full-size units equal to two percent (2%) of amount installed.
 - 2. Ceiling Suspension System Components: Quantity of each grid and exposed component equal to two percent (2%) of amount installed.

PART 2 PRODUCTS

2.1 MANUFACTURER

- A. Provide 300C linear plank metal ceiling system manufactured by Hunter Douglas Ceilings & Walls exclusively from CertainTeed, Inc., 5015 Oakbrook Parkway, Suite 100, Norcross, GA 30093. Tel: (800) 366-4327; www.CTSpecialtyCeilings.com
- B. Substitutions: Under provisions of Section 01 25 13

2.2 SYSTEM MATERIALS

- A. Linear metal plank ceiling system for interior and exterior installations:
 - 1. Exterior: Miami-Dade County, Florida Notice of Acceptance No. 17-0807.11
- B. Panel Profile Type: 300C, roll formed .028" thick aluminum; 11.811" (300 mm) wide, fabricated to provide a beveled edge joint between panels when installed.
 - 1. Length: Standard 12'
- C. Suspension System (Concealed):
 - 1. Carrier: Formed, inverted V-shaped, 0.95 mm (0.040") thick roll-formed aluminum, by 62 mm (2.45") high carrier sections. Carrier cross sections receiving ceiling panels pre-punched with prongs for snap attachment and support of panel side edges.
 - a. Provide manufacturer's standard metal carrier suspension system components, including splices, connector wire clips, hanger rods and adjustment springs, PVC closing pieces and trim for panel end attachment to wall.
 - 2. Seismic/Wind Uplift Compression Struts: Verify and insert proper sizes required to comply with governing codes, as designed by registered structural engineer.
- D. Perforations:
 - 1. Interior: Non-perforated
 - 2. Exterior: Non-perforated
 - a. Pattern: Non-perforated
- E. Panel Finish:
 - 1. Paint; color to be selected by architect
 - a. Decorated Wood-Look Powder Coat

2.3 ACCESSORY MATERIALS

- A. Edge trim: Manufacturer's standard edge trim moldings.
- B. Acoustic Material – interior only: Non-woven black fabric with 1" thick glass fiber, 1-1/2 pcf density, polywrapped.
 - 1. NRC Rating: .75
- C. Air Distribution Devices: Provide distribution devices that are independently suspended, relocatable, adjustable from below finished ceiling, and capable of being concealed behind (invisible to view) and fully integrated with ceiling system so as to allow no interruption of ceiling components.
- D. Lighting Fixtures: Provide fixtures capable of being fully integrated with ceiling system and requiring no interruption of ceiling components, that are independently suspended, and as selected to conform to lighting criteria specified in Division 16.

PART 3- EXECUTION

3.1 EXAMINATION

- A. Examine substrates and structural framing to which acoustical metal panels attach or abut, with installer present, for compliance with requirements specified in this and other Sections that affect installation and anchorage, and other conditions affecting performance of metal panel ceilings.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Coordination: Furnish layouts for cast-in-place anchors, clips, and other ceiling anchors whose installation is specified in other Sections.
- B. Measure each ceiling area and establish layout of acoustical metal pan units to balance border widths at opposite edges of each ceiling. Avoid using less-than-half-width units at borders, and comply with layout shown on reflected ceiling plans.
- C. Survey substrate for wall attachment to assure squareness and proper elevation for wall panel installation.

3.3 INSTALLATION

- A. General: Install acoustical metal pan ceilings, per manufacturers shop drawings provided, per manufacturer's written instructions and to comply with publications referenced below.
 - 1. Cisca "Ceiling Systems Handbook"
 - 2. Standard for Ceiling Suspension System Installations - ASTM C 636
 - 3. Standard for Ceiling Suspension Systems Requiring Seismic Restraint - ASTM E 580
 - 4. IBC (International Building Code) Standard for Seismic Zone for local area
- B. Suspend ceiling hangers from building's approved structural substrates and as follows:
 - 1. Install hangers plumb and free from contact with insulation or other objects within ceiling plenum that are not part of supporting structure or of ceiling suspension system.
 - 2. Splay hangers only where required to miss obstructions; offset resulting horizontal forces by bracing, counter-splaying, or other equally effective means.

3. Where width of ducts and other construction within ceiling plenum produce hanger spacings that interfere with location of hangers at spacing required to support standard suspension system members, install supplemental suspension members and hangers in form of trapezes or equivalent devices. Utilize supplemental suspension members and hangers to support ceiling loads within performance limits established by referenced standards and publications.
 4. Where used secure wire hangers to ceiling suspension members and to supports above with a minimum of three tight turns. Connect hangers directly either to structures or to inserts, eye screws, or other devices that are secure; that are appropriate for substrate; and that will not deteriorate or otherwise fail due to age, corrosion, or elevated temperatures.
 5. Space hangers not more than 48" on-center, along each member supported directly from hangers, unless otherwise indicated; and provide hangers not more than 12" from ends of each member. Supply supporting calculations from licensed Structural Engineer verifying hanger spacing meets all requirements, when spacing exceeds those recommended.
 6. Level grid to 1/8" in 10' from specified elevation(s), square and true.
 7. Adjust suspension system runners so they are square (within .5 degree from 90 degrees) and securely interlocked with one another. Remove and replace dented, bent, or kinked members.
- C. Secure bracing wires to ceiling suspension members and to supports acceptable to Architect/Engineer and/or inspector. Suspend bracing from building's structural members and/or structural deck, as required for hangers, without attaching to permanent metal forms, steel deck, or steel deck tabs (unless directed otherwise).
- D. Install edge moldings and trim of type indicated at perimeter of acoustical ceiling area and where necessary to conceal edges of acoustical metal pan. Method of edge trim attachment and design of edge trims to be approved by Architect.
1. Screw attach moldings to substrate at intervals not more than 18" on-center and not more than 6" from ends, leveling with ceiling suspension system to a tolerance of 1/8" in 10'. Miter corners accurately and connect securely.
 2. Do not use exposed fasteners, including pop rivets, on moldings and trim without prior written approval, or unless detailed otherwise.
- E. Scribe and cut acoustical metal panel units for accurate fit at penetrations by other work through ceilings. Stiffen edges of cut units as required to eliminate evidence of buckling or variations in flatness exceeding referenced standards for stretcher-leveled metal sheet.
- F. Install acoustical metal panel units in coordination with suspension system. Fit adjoining units to form flush, tight joints. Scribe and cut units for accurate fit at borders and around construction penetrating ceiling.

3.4 ADJUST AND CLEAN

- A. Adjust components to provide uniform tolerances.
- B. Replace all ceiling panels that are scratched, dented or otherwise damaged.
- C. Clean exposed surfaces with non-solvent, non-abrasive commercial type cleaner.

End of Section

SECTION 09 64 56

RESILIENT STAGE FLOORING

PART 1 -GENERAL

1.1 SUMMARY

- A. Section includes: Furnishing and installing a new stage floor as specified and as indicated on Drawings for the auditorium stage.
- B. Installation work includes, but is not limited to the following:
 - 1. Verification of dimensions and conditions at the job site.
 - 2. Installation of new sheet vapor retardant on substrate surface, neoprene pads, shimmed sleepers, plywood sub-flooring, finish flooring, door sills, wall base, and apron edge nosings in accordance with these Specifications, related Drawings, established trade criteria, and all applicable code requirements.
- C. Related work:
 - 1. The above scope of work is intended as a reference guide only and is not intended to define the limits of the work necessary for a complete installation. All labor, materials, and equipment necessary for the proper operation of all systems must be provided.
- D. Bids must include:
 - 1. All equipment specified or indicated in the 'Products' section and in the related drawing documents, including all the necessary hardware, fittings, and components necessary for a complete and functional stage floor.
 - 2. Schedule and time estimate for preparation, fabrication, equipment delivery, and installation.

1.2 SUBMITTALS

- A. Make submittals in accordance with Section 013300.
 - 1. Submit product data for moisture barrier, resilient blocks, insulation, floor materials, and floor coating.
 - 2. Submit a 1'-0" x 1'-0" sample of flooring including proposed assembly of subflooring, resilient neoprene pads, edge blocking on one side, and floor finish color on surface.
 - 3. Submit drawings of proposed assembly and installation, including layout, attachment, edge and threshold treatments.
 - 4. Submit details of proposed application of finishes.

1.3 QUALITY ASSURANCE

- A. The entire stage floor shall be installed by a single Contractor including moisture barrier, flooring, anchorage system, acoustical batting, sub-flooring, resilient mounts, trim, sleepers, expansion provisions, and finish.
- B. All flooring must be obtained from a single manufacturer or source to ensure the match of color, texture, pattern, and quality.

- C. The contractor shall be specialized in the installation of resilient flooring with not less than 5 years of experience in the installation of stage flooring.

1.4 WARRANTY

- A. Contractor shall provide Owner with copies of a 3-year warranty for finished wood flooring and associated work. This warranty shall agree to repair or replace flooring that shrinks, warps, cracks, or otherwise deteriorates excessively, or that buckles, delaminates, or breaks its anchorage or bond with substrate or otherwise fails to perform as required or as represented by the manufacturer due to failures of materials and workmanship. Warranty shall be signed by the Contractor who shall assume the responsibility for obtaining warranties on materials from manufacturers.

PART 2 - PRODUCTS

2.1 FINISH PANEL FLOORING

- A. Plyron, exterior grade, 3/4 inch thick, tempered both sides.

2.2 SUB-FLOORING

- A. One layer of A-C Douglas Fir plywood, exterior glue, 3/4 inch thick.

2.3 SLEEPERS

- A. Douglas Fir 2x4s. Kiln-dried to 15% maximum moisture content. Discard bowed or twisted pieces.

2.4 CUSHION BLOCKS

- A. 3/4" thick neoprene resilient pads, approximately 2" x 2" square, hardness of 45-50 durometer.

2.5 ACCESSORIES

- A. Sheet Vapor Retardant: 6 mil thick black polyethylene, with 2 inch wide self adhesive, reinforced tape for lap joint sealing.
- B. Wall Base: Vinyl, 4-inch high with a 3 inch toe, ventilating type, with attachment accessories, pre-fabricated corner intersections, black color.
- C. Insulation: Provide semi-rigid glass fiber insulation panels, 1-1/2 inch thick, unfaced.

2.6 FINISHING

- A. Paint & Sealer: Water-based, acrylic theatrical primer.
 - 1. Basis-of-Design Product: Subject to compliance with requirements, provide Tough-Prime by Rosco Laboratories or approved comparable product. Black: Satin.
 - 2. Color: No. 06055 Black.

PART 3 -EXECUTION

3.1 DELIVERY, STORAGE, HANDLING, AND PREPARATION

- A. Protect wood flooring from excessive moisture in shipment, storage, and handling. Deliver in unopened packaging fully identified to show type, brand, grade, and quality.
- B. Place wood flooring materials in space to be floored at least 7 days in advance of start of installation. Open packages of wood flooring that are sealed to permit natural adjustment of moisture content.

- C. Maintain minimum room temperature 65 degrees F, maximum 78 degrees F, for a period of 2 days prior to delivery of materials, during, and after installation.
- D. Verify that recessed subfloor surface is smooth and flat to a tolerance of 1/16 inch per 10 feet.
- E. Verify that concrete substrate moisture content is 8 percent maximum.
- F. Do not install wood flooring until wet construction work is completed and building is completely weatherproofed.
- G. Broom clean substrate.

3.2 INSTALLATION

A. General:

- 1. Comply with flooring manufacturer's recommendations and approved submittals. Maintain 1-1/4" inch clear separation at all perimeters and penetrations.
- 2. Install moisture barrier wherever flooring will be installed on concrete.
- 3. Provide positive captive shims or approved leveling compound under sleepers as necessary to bring top of sleepers to required level to within 1/8 inch in 10 feet. Maximum plus or minus 1/8 inch over the entire floor.
- 4. Provide neoprene pads for optimum floor resiliency. Space nominally 16 inches on center in upstage to downstage direction and 16 inches on center in onstage to offstage direction. Ensure that pads rest on wood sleepers before attachment. Attach neoprene pads to lower side of sleeper using epoxy cement.
- 5. Place sleepers around the perimeter of the stage. Place balance of the sleepers in parallel rows on 16" centers across the stage area. Lay sleepers in upstage/downstage direction.
- 6. Attach plywood subfloor layers to the sleepers with flat head wood screws on 16" centers leaving 1/4" space at plywood joints. Lap seams between layers 16" in both directions.
- 7. Apply Plyron flooring with flat head wood screws on 16" centers around perimeter of each 4' x 8' sheet. Countersink all screw heads. Leave 3/32" space at all joints. Use no adhesives. Lay 8-foot panels in a stage left to stage right pattern.
- 8. Plyron seam joints should align with the centerline of the proscenium opening and with the plaster line of the proscenium opening
- 9. Coordinate with other vendors to ensure that all floor boxes with cover plates have the cover plates installed so that top surfaces are flush with finish surface of stage floor. Cut away top surface as required to make cover plates flush.

3.3 FINISHING

- A. Allow installed stage floor to acclimate to ambient conditions for a minimum period of 10 days before finishing.
- B. Lightly sand top Plyron top floor surface prior to painting for maximum adhesion.
- C. Final finish.
 - 1. Apply two coats of Rosco Tough Prime Black sealer/paint to edges of top layer of finish flooring prior to installation in accordance with manufacturer's instructions.

2. Apply Rosco Tough Prime Black to clean, dry surface. Apply by brush or roller. Apply in even, uniform coats using overlapping strokes, change roller direction often to avoid patterns and streaking. Do not apply heavy coat. Apply in a minimum of 3 thin coats, allowing each to dry thoroughly dry between applications. Apply per manufacturer's instructions. Rosco Tough Prime is final finished surface.

3. Do not cover wood flooring after finishing until finish reaches full cure.

D. Do not apply plastic coatings of any type. Final finish shall be dark and low luster.

3.4 COMPLETION

A. Install base and shoe moldings.

B. Install extruded, mill finished 1/4-inch thick by width and length required beveled edge aluminum thresholds where necessary.

3.5 CLEANING AND PROTECTION

A. Prior to final acceptance, repair any flooring defects and remove any stains that have penetrated the new finish.

B. Protect completed flooring during construction period with heavy Kraft paper or other suitable covering to prevent damage to or deterioration of flooring and finish until final facility acceptance. Do not use plastic sheet or film that could cause condensation.

END OF SECTION

SECTION 09 64 66

WOOD ATHLETIC FLOORING

1. PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Sheet vapor retardant on substrate surface.
- B. Cushion blocks.
- C. Plywood sheathing.
- D. Sleepers.
- E. Hardwood strip flooring.
- F. Multi sport wood flooring.
- G. Ventilating base.
- H. Thresholds.
- I. Game lines and mascot logo.
- J. Game insert devices.
- K. Surface sanding and finish coating.
- L. Maintenance service.

1.2 REFERENCES

- A. ALSC - American Lumber Standards Committee.
- B. APA - The Engineered Wood Association
- C. FSC - Forest Stewardship Council.
- D. ASTM F1869 - Standard Test Method for Measuring Moisture Vapor Emission Rate of Concrete Subfloor Using Anhydrous Calcium Chloride.
- E. ASTM F2170 - Determining Relative Humidity in Concrete Floor Slabs Using In Situ Probe.
- F. MFMA - Maple Flooring Manufacturers Association.

1.3 SUBMITTALS

- A. Submit shop drawings under provisions of Section 01 33 00.
- B. Submit shop drawings indicating floor joint pattern, grain direction, and termination details. Indicate provisions for expansion and contraction, base, base corner details and game insert or socket devices.
- C. Indicate location, size, design, and color of colored game lines and mascot.
- D. Submit product data under provisions of Section 01 33 00.
- E. Submit product data for resilient blocks, floor materials, floor coating, game, insert socket devices.
- F. Submit samples under provisions of Section 01 33 00.

- G. Submit two samples 12 x 12 inch in size illustrating floor finish, color, game line colors, and sheen.
- H. Submit copies of MFMA Inspection Service Reports.

1.4 MAINTENANCE DATA

- A. Submit maintenance data under provisions of Section 01 77 00.
- B. Include recommended cleaning and stain removal methods, materials, and waxes.

1.5 MAINTENANCE SERVICE

- A. Perform repainting and refinishing of floor after twelve months after date of final completion.
- B. Repainting and refinishing to be performed in compliance with requirements for new floor.

1.6 QUALITY ASSURANCE

- A. Perform Work in accordance with the following:
 - 1. Lumber Grading Agency: Certified by ALSC.
 - 2. Plywood Grading Agency: Certified by APA.
 - 3. Maple Grading: According to MFMA.
- B. Conform to MFMA - Cushioned Subfloor Flooring.
- C. Provide MFMA Flooring Inspection Service. Provide an inspection prior to and after installation of the wood floor. MFMA fees charged for the inspections are the responsibility of the flooring installer.
- D. Comply with the current applicable regulations for VOC content for coatings of the California Air Resources Board (CARB) and the Environmental Protection Agency (EPA).
- E. Accredited certification bodies shall be one of the following:
 - 1. Rainforest Alliance, www.rainforest-alliance.org.
 - 2. SCS Global Services, www.scsglobalservices.com.

1.7 QUALIFICATIONS

- A. Manufacturer: Member company of the MFMA specializing in manufacturing the products specified in this Section with minimum fifteen years documented experience.
- B. Installer: Company specializing in applying the work of this Section with minimum ten years documented experience and approved by the flooring products manufacturer.

1.8 DELIVERY, STORAGE, AND HANDLING

- A. Deliver, store and protect products to site under provisions of Section 01 61 00.
- B. Deliver materials in time to permit moisture content to stabilize to ambient conditions.

1.9 ENVIRONMENTAL REQUIREMENTS

- A. Do not install wood flooring until wet construction work is completed.

- B. Moisture Testing: Perform tests as recommended by manufacturer and as follows. Proceed with installation only after substrates pass testing.
 - 1. Subfloor Moisture Conditions: Moisture emission rate of no more than 3 lb/1000 sq. ft./24 hours when tested by the Quantitative Anhydrous Calcium Chloride Test, ASTM F1869, with subfloor temperature not less than 65 degrees F.
 - 2. Subfloor Humidity Conditions: Relative humidity level of no more than 75 percent when tested by in situ drilled probes according to ASTM F2170.
 - 3. Subfloor Alkalinity Conditions: pH range of between 5 to 9 when subfloor is wetted with potable water and pHdrion paper is applied.
- C. Provide permanent heat, light, and ventilation prior to installation.
- D. Maintain minimum room temperature 65 degrees F and a maximum humidity level of 50 percent for a period of ten days prior to delivery of materials and during installation.
- E. Maintain minimum room temperature and maximum humidity level after flooring is installed for duration of project construction period.

2. PART 2 PRODUCTS

2.1 GYMNASIUM WOOD FLOOR MANUFACTURERS/SYSTEMS

- A. Basis of Design: Action Floor Systems, Inc., Action Cush II Plus, www.actionfloors.com.
- B. Other Acceptable Manufacturers:
 - 1. Connor Sports Flooring, Inc., www.connorfloor.com.
 - 2. Horner Flooring Co., www.hornerflooring.com.
 - 3. Robbins, Inc., www.robbinsfloor.com.
 - 4. Tarkett, www.tarkett-sports.com
- C. Substitutions: Under provisions of Section 01 25 13.

2.2 MULTI SPORT WOOD FLOOR MANUFACTURERS/SYSTEMS

- A. Basis of Design: Action Floor Systems, Inc., Action Wood Flex, www.actionfloors.com.
- B. Other Acceptable Manufacturers:
 - 1. Connor Sports Flooring, Inc., www.connorfloor.com.
 - 2. Horner Flooring Co., www.hornerflooring.com.
 - 3. Robbins, Inc., www.robbinsfloor.com.
 - 4. Tarkett, www.tarkett-sports.com
- C. Substitutions: Under provisions of Section 01 25 13.

2.3 WOOD MATERIALS

- A. Lumber Materials: FSC – Forest Stewardship Council certified sustainable harvested wood.

- B. Strip Flooring: Species and grade stamped on underside of each piece, conforming to the following:

Species: White Hard Maple (*Acer Saccharum*).

Grade: Second and Better.

Cut: Plain Sawn.

Moisture Content: 6 to 9 percent.

Actual Thickness: 25/32 inch.

Actual Width: 2-1/4 inches.

Edge: Tongue and Groove.

End: Tongue and Groove.

Length: Random.

- C. Multi Sport Wood Flooring: 7/16 inch thick x 7/8 inch wide x 9 inch long panels comprised of single directional slats of edge-grain MFMA hard maple, Second and Better grade, held together by edge bonding, with elastic joint material between each row of slats.
- D. Plywood Sheathing: APA rated, Structural I, Grade C-D Exposure I, 1/2 inch thick.
- E. Wood Sleepers: 2 inch x 3 inch x 4 foot Fir, Hemlock or Pine, KD, 10 to 15 percent moisture content, treated with Woodlife F preservative.

2.4 BASE MATERIALS

- A. Ventilating Base: Molded rubber, 4 inch high with a 3 inch toe, ventilating type, with premolded outside and inside corners. Adhesives and accessories required. Color as selected.

2.5 ACCESSORIES

- A. Cushion Blocks: 3/8 inch x 2-1/4 inch x 3 inch resilient pads, rubber or PVC material, unsealed air slots for resiliency, compressible to 1/16 inch under a 40 psi load with full and immediate recovery.
- B. Threshold: Extruded, anodized aluminum, 1/4 inch thick x width and length required; beveled edge.
- C. Sheet Vapor Retardant: 6 mil thick, black polyethylene, with 2 inch wide self adhesive, reinforced tape for lap joint sealing.
- D. Crosslinked closed-cell polyethylene foam, 1/4 inch thick.
- E. Nails: Type recommended by flooring manufacturer.
- F. Adhesive for Multi Sport Flooring: As recommended by flooring manufacturer.
- G. Game Socket Insert Devices: As specified in Section 11 90 00.

2.6 FINISHES

- A. Sealer: Water based acrylic latex, equivalent to "Hydrolite Sealer", manufactured by Basic Coatings, www.basiccoatings.com.

- B. Finish: Water based urethane, equivalent to "Hydrolite Wood Floor Finish", gloss, as manufactured by Basic Coatings.
- C. Paint for Gamelines, Colored Areas and Mascot Logo: Type recommended by the finishing materials manufacturer, compatible with finish. Test paint for compatibility and dry time before using.
- D. Mascot Logo 10' diameter, four color artwork to be provided during submittal.

3. PART 3 EXECUTION

3.1 EXAMINATION

- A. Verify that surfaces are ready to receive work.
- B. Verify that recessed subfloor surface is smooth and flat to a tolerance of 1/8 inch per 10 feet maximum.
- C. Verify that concrete substrate moisture and humidity level content are within limits specified.
- D. Beginning of installation means installer accepts existing surfaces.

3.2 PREPARATION

- A. Broom clean substrate.

3.3 INSTALLATION - GYMNASIUM WOOD FLOORING SYSTEMS

- A. Place vapor retardant, lap edges and ends 6 inches, tape seal joints. Spot glue in place. Turn edges up onto adjacent walls.
- B. Panel System:
 - 1. Install first layer of 1/2 inch sheathing with cushion blocks 12 inches on center and 6 inches from edges of plywood. Install perpendicular to finish flooring.
 - 2. Install second layer of 1/2 inch sheathing at 45 degree angle over first layer and nail securely at 12 inches on center in both directions.
 - 3. All sheathing joints shall be staggered and spaced 1/4 inch apart.
 - 4. Install continuous strips of nominal 1 x 3 wood blocking at 12 inches on center between cushion blocks beneath all wheeled assemblies of bleachers. Extend blocking the full length of bleacher travel. Top of blocking to be 1/8 inch below bottom of first layer of sheathing for areas beneath extended position of bleachers and full height for areas beneath bleacher assembly in closed position.
- C. Sleeper System:
 - 1. Install sleepers across short dimension of room at right angles to finish flooring on cushion blocks 12 inches o.c.
 - 2. Install sleepers 9 inches o.c. with ends butted, leaving 1/4 inch space at ends with joints staggered.
 - 3. Install additional sleepers beneath all wheel assemblies of bleachers. Extend sleepers full length of bleacher travel.
- D. Sleeper Subfloor System:
 - 1. Install sleepers across short dimension of room, at right angle to finish flooring on cushion blocks 12 inches o.c.
 - 2. Install sleepers 12 inches o.c. with ends butted, leaving 1/4 inch space at ends with joints staggered.

3. Install additional sleepers beneath all wheel assemblies of bleachers. Extend sleepers full length of bleacher travel.
4. Attach plywood to sleepers using 2 inch cleated nails with 1/4 inch spacing between adjoining sheets.
- E. Provide 2 inch expansion space at walls and other interruptions.
- F. Lay flooring strips parallel to length of room areas with joints set flush and tight.
- G. Predrill and blind nail flooring with a power driver in accordance with manufacturer's instructions.

3.4 INSTALLATION - MULTI SPORT WOOD FLOORING

- A. Place vapor retardant, lap edges and ends 6 inches, tape and seal joints. Spot glue in place.
- B. Install closed cell polyethylene foam sheet. Adhere to vapor retardant material with compatible adhesive recommended by manufacturer.
- C. Install first layer of 1/2 inch plywood sheathing with long dimension perpendicular to finish flooring length.
- D. Install second layer of 1/2 inch plywood sheathing at a 45 degree angle over the first layer and nail securely in place at 12 inches on center in both directions.
- E. All sheathing joints shall be spaced 1/4 inch apart.
- F. Lay finished flooring panels with adhesive. Install flooring parallel to length of room with joints set flush and tight.

3.5 INSTALLATION - ACCESSORIES

- A. Provide threshold at centerline of door openings and where flooring terminates with other floor areas.
- B. Install base at floor perimeter to cover expansion space in accordance with manufacturer's instructions.
- C. Install floor sockets inserts cover plates to a depth sufficient to ensure flush top surface with sanded floor surface.

3.6 FINISHING

- A. Sand flooring to smooth even finish with no evidence of sander marks. Take precautions to contain dust. Remove dust by vacuum. Sand flooring with drum sander, edger, buffer, and hand scraper.
 1. Use coarse, medium and fine sandpaper.
 2. After sanding with drum sander, buff entire floor using 100 grit screen back or equal grit sandpaper with a heavy-duty buffing machine.
 3. Vacuum floor before first coat of finish.
 4. Floor shall present a smooth surface without drum stop marks, gouges, streaks or shiners.
- B. Mask off adjacent surfaces.
- C. Apply two coats of sealer in accordance with manufacturer's instructions. Buff and clean floor between each coat.
- D. Abrade floor and apply three coats of paint in colored areas and on gamelines and mascot logo after the sealer coats, in strict compliance with paint manufacturer's recommendations in accordance with layout indicated on the drawings.
- E. Apply three coats of urethane floor finish over paint in accordance with manufacturer's instructions.

- F. At the termination of the initial one year warranty period for the work, reapply painted game lines and any colored areas. Include final floor finish over paint in accordance with manufacturer's instructions.

3.7 RECYCLING CONSTRUCTION WASTE

- A. Recycle lumber waste under the provisions of Section 01 74 19.

3.8 SCHEDULE

- A. Hardwood Strip Flooring:
 - 1. Main Gymnasium C101.
 - 2. Auxiliary Gymnasium C146.
- B. Mascot Logo:
 - 1. Main Gymnasium C101.
- C. Multi-Sport Wood Floor:
 - 1. Dance Room C 103.

END OF SECTION

SECTION 09 65 00

RESILIENT FLOORING

1. PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Resilient tile flooring.
- B. Resilient top set and self coved base.

1.2 REFERENCES

- A. 2010 Americans with Disabilities Act (ADA) Standards for Accessible Design.
- B. CBC - California Building Code, (CCR) California Code of Regulations, Title 24, Part 2, California State Accessibility Standards.
- C. CDH - California Department of Health Standard Practice Method V1.1-2010 for the Testing of Volatile Organic Emissions.
- D. ASTM D2047 - Static Coefficient of Friction of Polish-Coated Floor Surfaces as Measured by the James Machine.
- E. ASTM E648 - Test Method for Critical Radiant Flux of Floor-Covering Systems using a Radiant Energy Source.
- F. ASTM E662 - Test Method for Specific Optical Density of Smoke Generated by Solid Materials.
- G. ASTM F710 - Practice for Preparing Concrete Floors and other Monolithic Floors to Receive Resilient Flooring.
- H. ASTM F1066 - Specification for Vinyl Composition Floor Tile.
- I. ASTM F1303 - Specification for Sheet Vinyl Floor Covering
- J. ASTM F1344 - Specification for Rubber Floor Tile.
- K. ASTM F1700 - Standard Specification for Solid Vinyl Floor Tile.
- L. ASTM F1861 - Standard Specification for Resilient Wall Base.
- M. ASTM F1869 - Standard Test Method for Measuring Moisture Vapor Emission Rate of Concrete Subfloor Using Anhydrous Calcium Chloride.
- N. ASTM F2170 - Determining Relative Humidity in Concrete Floor Slabs Using In Situ Probe.
- O. FS RR-T-650 - Treads, Metallic and Non-metallic, Non-skid.
- P. FS SS-T-312b - Tile, Floor: Asphalt, Rubber, Vinyl, Vinyl Composition.

1.3 REGULATORY REQUIREMENTS

- A. Resilient flooring to comply with the following fire performance characteristics as determined by testing products per ASTM test method indicated below:
 - 1. Critical Radiant Flux: 0.45 watts per sq cm or more per ASTM E648.
 - 2. Smoke Density: Less than 450 per ASTM E662.

- B. Maximum volatile organic compound (VOC) emissions shall meet the CDPH test results obtained at the 14 day time period when tested by Method V1.1-2010.
- C. Resilient flooring products shall have a coefficient of friction when tested according to ASTM D2047 of 0.60 for flat floors and 0.80 for ramped surfaces.
- D. Conform to CBC, California Building Code, (CCR) Title 24, Part 2, and the 2010 ADA Standards for Accessible Design for accessibility requirements.

1.4 SUBMITTALS

- A. Submit shop drawings and product data under provisions of Section 01 33 00.
- B. Provide seaming and pattern plan.
- C. Submit samples under provisions of Section 01 33 00.
- D. Submit two samples 3 x 3 inches in size, illustrating color and pattern for each floor material specified.
- E. Submit two 2 inch long samples of base material for each material specified.
- F. Submit manufacturer's written installation instructions.
- G. Submit Owner's written acceptance of final floor finish of vinyl composition tile to Architect under provisions of Section 01 77 00.

1.5 OPERATION AND MAINTENANCE DATA

- A. Submit cleaning and maintenance data under provisions of Section 01 77 00.
- B. Include maintenance procedures, recommended maintenance materials, and suggested schedule for cleaning, stripping, and re-waxing.

1.6 ENVIRONMENTAL REQUIREMENTS

- A. Concrete subfloor to be allowed to cure for a minimum of 90 days to achieve acceptable dryness.
- B. Store materials for three days prior to installation in area of installation to achieve temperature stability.
- C. Maintain ambient temperature required by adhesive manufacturer three days prior to, during, and 24 hours after installation of materials.
- D. Moisture Testing: Perform tests as recommended by manufacturer and as follows. Proceed with installation only after substrates pass testing.
 - 1. Subfloor Moisture Conditions: Moisture emission rate of no more than 3 lb/1000 sq. ft./24 hours when tested by the Quantitative Anhydrous Calcium Chloride Test, ASTM F1869, with subfloor temperature not less than 65 degrees F.
 - 2. Subfloor Humidity Conditions: Relative humidity level of no more than 75 percent when tested by in situ drilled probes according to ASTM F2170.
 - 3. Subfloor Alkalinity Conditions: pH range of between 5 to 9 when subfloor is wetted with potable water and pHdrion paper is applied.

1.7 EXTRA MATERIALS

- A. Provide 200 sq ft of flooring and 100 lineal feet of base of each material specified under provisions of Section 01 77 00.

2. PART 2 PRODUCTS

2.1 MANUFACTURERS-RUBBER TILE FLOORING

- A. Activa (Pirelli), www.rubberflooring.ca.
- B. Allstate Rubber Corporation, www.allstaterubber.com.
- C. Burke Flooring Products, www.burkeflooring.com.
- D. Flexco Company, www.flexcofloors.com.
- E. Interface Flor, LLC, www.interfaceflor.com.
- F. Johnsonite, www.johnsonite.com.
- G. Mannington Commercial, www.manningtoncommercial.com.
- H. Mohawk Group, www.mohawkgroup.com.
- I. Mondo, www.mondocontractflooring.com.
- J. Roppe Corporation, www.roppe.com.
- K. R.C. Musson Rubber Co., Inc., www.mussonrubber.com.
- L. R.C.A. Rubber Co., www.rcarubber.com.
- M. VPI, LLC, www.vpiflooring.com.
- N. Substitutions: Under provisions of Section 01 25 13.

2.2 RUBBER TILE FLOORING MATERIALS

- A. Rubber Tile: ASTM F1344, Class I, Type A solid color 39.37 x 39.37 inch size, 5/8 inch thick.
- B. Pattern equivalent to BJ Profile manufactured by Activa.

2.3 LUXURY VINYL FLOOR TILE MANUFACTURERS

- A. Amtico, www.manningtoncommercial.com.
- B. Armstrong World Industries, www.armstrong.com.
- C. Forbo Industries, Inc., www.forbo.com.
- D. Harbinger, www.harbingerfloors.com.
- E. Interface Flor, LLC, www.interfaceflor.com.
- F. Johnsonite, www.johnsonite.com.
- G. Mannington Commercial, www.manningtoncommercial.com.
- H. Mohawk, www.mohawkflooring.com.
- I. Parterre Flooring Systems, www.parterreflooring.com.
- J. Tandus / Centiva, www.tandus-centiva.com.
- K. Shaw Industries, Inc., www.shawcontractgroup.com.

- L. Substitutions: Under provisions of Section 01 25 13.

2.4 LUXURY VINYL FLOOR TILE MATERIALS

- A. Solid vinyl floor tile (LVT) : ASTM F1700, Class III, printed vinyl tile Type: B, embossed surface.
- B. Thickness: .125 inch.
- C. Size: 18 x 18 inches.
- D. Colors and Patterns: Pattern as selected by Architect from manufacturer's standard range for materials indicated. Pattern equivalent to Natural Creations Mystix as manufactured by Armstrong. Color as selected by Architect from manufacturer's standard color range.
- E. Warranty: 20-year commercial resilient limited warranty.

2.5 ACCEPTABLE MANUFACTURERS - BASE MATERIALS

- A. Allstate Rubber Corporation, www.allstaterubber.com.
- B. Armstrong World Industries, www.armstrong.com.
- C. Burke Flooring Products, www.burkeflooring.com.
- D. Flexco Company, www.flexcofloors.com.
- E. Roppe Corporation, www.roppe.com.
- F. VPI, LLC; www.vpiflooring.com.
- G. Substitutions: Under provisions of Section 01 25 13.

2.6 BASE MATERIALS

- A. Base: ASTM F1861, Type TS rubber; Group 1 solid; Style B coved; 4 inch high; 0.125 inch thick; top set, in maximum practical lengths.
- B. Corners: Factory pre-formed corners ASTM F1861, Type TS rubber, Style B coved; 4 inch height; 0.125 inch thick; top set.

2.7 ACCESSORIES

- A. Subfloor Filler: White premix Portland Cement latex type as recommended by flooring material manufacturer.
- B. Primers and Adhesives: Waterproof; types recommended by flooring manufacturer for high moisture application. Shall meet South Coast Air Quality Management District (SCAQMD) Rule #1168.
- C. Edge Strips: Rubber.
- D. Sealer and Wax: Types recommended by flooring manufacturer. Coordinate selection of floor wax with Owner's maintenance program.

3. PART 3 EXECUTION

3.1 EXAMINATION

- A. Verify that concrete slabs comply with ASTM F710 and are as specified herein.
- B. Verify concrete floors exhibit acceptable moisture emission rate and humidity level; and exhibit negative alkalinity, carbonization, or dusting.

- C. Verify that surfaces are smooth and flat and are ready to receive Work.
- D. Beginning of installation means acceptance of existing substrate and site conditions.

3.2 PREPARATION

- A. Prepare concrete substrate according to ASTM F710 and flooring manufacturer's recommendations..
- B. Remove sub-floor ridges and bumps. Fill low spots, cracks, joints, holes, and other defects with subfloor filler.
- C. Apply, trowel, and float filler to leave a smooth, flat, hard surface.
- D. Prohibit traffic from area until filler is cured.
- E. Vacuum clean substrate.
- F. Apply primer to concrete slab surfaces if recommended by flooring manufacturer.

3.3 INSTALLATION - TILE MATERIAL

- A. Install in accordance with manufacturer's instructions.
- B. Mix tile from container to ensure shade variations are consistent.
- C. Spread only enough adhesive to permit installation of materials before initial set.
- D. Set flooring in place, press with heavy roller to attain full adhesion.
- E. Install tile to square grid pattern with all joints aligned to ashlar/staggered pattern. Allow for 25 percent accent color tile for pattern to be selected by Architect.
- F. Pattern grain basket weave for all units and parallel to length width of room. Allow minimum 1/2 full size tile width at room or area perimeter.
- G. Terminate flooring at centerline of door openings where adjacent floor finish is dissimilar.
- H. Install edge strips at unprotected or exposed edges, and where flooring terminates.
- I. Scribe flooring to walls, columns, cabinets, floor outlets, and other appurtenances to produce tight joints.
- J. Install flooring in pan type floor access covers. Maintain floor pattern.
- K. Install flooring under movable partitions and under cabinetry without interrupting floor pattern.
- L. Install flooring in open cabinet recesses.
- M. Install feature strips, edge strips, and floor markings where indicated. Fit joints tightly.

3.4 INSTALLATION - BASE MATERIAL

- A. Fit joints tight and vertical.
- B. Install material in maximum practical lengths.
- C. Maintain minimum measurement of 18 inches between joints.
- D. Miter internal corners.
- E. Install pre-formed corners. "V" cut back surface to 2/3 its thickness.
- F. Install base on solid backing. Bond tight to wall and floor surfaces.

- G. Scribe and fit to door frames and other interruptions.

3.5 CLEANING

- A. Remove excess adhesive from floor, base and wall surfaces without damage.
- B. Sweep or vacuum floor thoroughly.
- C. Damp mop with a neutral detergent solution.
- D. Carefully remove black marks with a scrubbing pad or brush.

3.6 PROTECTION

- A. Prohibit traffic on floor finish for 48 hours after installation.
- B. Protect floor finish until final completion with a non-asphaltic building paper.
- C. Maintain protective covering until final completion.

3.7 COMPLETION

- A. At final completion, remove floor protection and correct any damage.
- B. Apply sealer and wax to vinyl composition tile in accordance with Owner's maintenance program.
- C. Obtain Owner's written acceptance of final floor finish at completion of sealer and wax application.
- D. Submit copy of Owner's acceptance of floor finish to architect.

END OF SECTION

SECTION 09 66 23

THIN-SET EPOXY TERRAZZO FLOORING

1. PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Thin-set epoxy matrix terrazzo floor finish
- B. Thin-set epoxy matrix terrazzo base and borders.
- C. Recycled Glass aggregate.
- D. Flexible reinforced crack bridging membrane.
- E. Divider and control joint strips.
- F. Abrasive safety inserts at stair treads.
- G. Thin-set precast epoxy terrazzo base unit.

1.2 REFERENCES

- A. ASTM D2047 - Static Coefficient of Friction of Polish Coated Floor Surfaces as Measured by the James Machine.
- B. NTMA (National Terrazzo and Mosaic Association, Inc.) - Terrazzo Information Guide.

1.3 SUBMITTALS

- A. Submit shop drawings, product data, and samples under provisions of Section 01 33 00.
- B. Shop Drawings: Indicate divider strip, control joint layout, and details of adjacent components.
- C. Review proposed divider strip and control joint strip layout with indicated pattern. Provide additional strips of either type if recommended by manufacturer. Indicate on shop drawings.
- D. Product Data: Provide data for divider strips, control joint strips, safety inserts, flexible membrane and sealer.
- E. Samples for Initial Selection: Submit samples of the full range of glass aggregate available.
- F. Samples for Verification: Submit two finished samples 6x6 inch in size illustrating each glass color selected, aggregate size, variation, flexible membrane and typical divider strip.
- G. Applicator Qualifications: Proof of NTMA membership with signed certificate from manufacturer that applicator is approved by them for installation.

1.4 OPERATION AND MAINTENANCE DATA

- A. Submit cleaning and maintenance data in accordance with Section 01 77 00.
- B. Include procedures for stain removal, stripping and sealing.

1.5 QUALITY ASSURANCE

- A. Perform work in accordance with NTMA recommendations contained in "Terrazzo Information Guide" unless more stringent requirements are specified.
- B. Applicator Qualifications: NTMA member company specializing in performing the work of this section with minimum 5 years of documented experience and approved by manufacturer.

1.6 DELIVERY, STORAGE AND PROTECTION

- A. Transport, handle, store and protect products in accordance with Section 01 61 00.
- B. Store resin materials in a dry, secure area.
- C. Maintain minimum temperature of 60 degrees F.

- D. Keep products away from fire or open flame.

1.7 ENVIRONMENTAL REQUIREMENTS

- A. Do not install terrazzo when temperature is below 60 degrees F or above 90 degrees F.
- B. Maintain temperature within specified range 24 hours before, during and 72 hours after installation of flooring.
- C. Provide ambient lighting level of 50 ft candles measured at floor surface.
- D. Control and collect dust produced by grinding. Provide temporary enclosures to limit dust migration.

1.8 REGULATORY REQUIREMENTS

- A. Flooring shall have a coefficient of friction when tested to ASTM D2047 of 0.60.

2. PART 2 PRODUCTS

2.1 MANUFACTURERS

- A. American Specialty Glass, Inc. www.americanspecialtyglass.com.
- B. EnviroGLAS Products, Inc. www.enviroglasproducts.com.
- C. Heritage Glass, Inc. www.heritageglass.net.
- D. Ice Stone, www.icestone.biz.
- E. Substitutions: Under provisions of Section 01 25 13.

2.2 GLASS AGGREGATE EPOXY TERRAZZO

- A. Aggregate: 100 percent recycled glass aggregate.
- B. Aggregate Size: To conform to NTMA gradation standards for Size 0, 1, and 2.
- C. Proportions of Terrazzo Mix: Eighty 50lb. bags of glass aggregate; 125 gallons of epoxy resin and 600 lbs. of epoxy filler per 1,000 square feet of area.
- D. Floors: Epoxy matrix, 3/8 inch thick.
 - 1. Matrix Color: As selected from up to 4 colors.
 - 2. Glass Aggregate Color: As selected from up to 4 colors.
 - 3. Aggregate Size: 1.
- E. Borders: Same type and thickness as floors.
- F. Base: Same type and thickness as floors. 4 inch height with 3/4 inch cove radius with rounded, finished top edge.

2.3 ACCESSORIES

- A. Divider Strips: Angel or T-shape, 1/8 inch thick white zinc exposed top strip, zinc coated steel concealed bottom strip, with anchoring features.
- B. Control Joint Strips: Double L type angles, 1/8 inch white zinc exposed top strips, zinc coated steel concealed bottom strips, 1/4 inch wide neoprene filler strip between vertical strips, with anchoring features.
- C. Strip Height: To suit thickness of terrazzo topping, with allowance for grinding.
- D. Abrasive Safety Inserts: Silicone carbide in epoxy resin binder set in channel of matching divider strip material of depth required by terrazzo .
- E. Flexible Reinforcing Mesh: Resinous membrane for substrate crack preparation and reflective crack reduction with fiberglass scrim reinforcement.
- F. Divider -Strip Adhesive: Epoxy-resin adhesive.
- G. Finishing Grout: Resin based.

- H. Primer: Manufacturer recommended type for use indicated.
- I. Joint Sealants: Silicone type as specified in Section 07 92 00.
- J. Cleaner: Chemically neutral cleaner with pH factor of between 7 and 10, biodegradable, phosphate free, recommended for use by terrazzo manufacturer.

3. PART 3 EXECUTION

3.1 EXAMINATION

- A. Verify that substrate surfaces are ready to receive work.
- B. Beginning of installation means acceptance of existing conditions.

3.2 PREPARATION

- A. Clean substrate of foreign matter.
- B. Prepare concrete in accordance with manufacturer's written instruction.
- C. Fill voids and chipped areas with mortar to produce smooth surface.
- D. Install flexible membrane to produce full coverage.
- E. Apply primer in accordance with manufacturer's instructions.

3.3 INSTALLATION - ACCESSORIES

- A. Install divider and control joint as indicated on the shop drawings.
- B. Install strips straight and level.
- C. Install control-joint strips back to back with 1/4 inch gap between strips. Install black neoprene filler between strips.
- D. Abrasive Strips: Install with abrasive strip positioned 1/16 inch higher than terrazzo.
- E. Abrasive safety lines at stair treads shall be three-line abrasive inserts.
- F. Two inch wide abrasive insert located not more than one inch from face of riser of contrasting color and texture shall be installed on top and bottom tread.

3.4 APPLICATION - TERRAZZO

- A. Apply each component of system in accordance with manufacturer's written installation instructions and NTMA guide Specification.
- B. Grind terrazzo surfaces with power disc machine; sequence with course to fine grit abrasive, using wet or dry method.
- C. Apply patch mix to match mortar over ground surface to fill honeycomb exposed during grinding.
- D. Remove patch coat by grinding, using fine grit abrasive.
- E. Hand grind base and cove similarly.
- F. Delay final fine grinding until all construction traffic through area is restricted.

3.5 PRECAST EPOXY TERRAZZO

- A. Set units using method recommended by NTMA.
- B. Set units true to alignment and level.
- C. Back butter for full contact with substrate.
- D. Seal joints with joint sealant.

3.6 CURING

- A. Cure terrazzo topping as recommended by manufacturer.
- B. Close area to allow undisturbed curing.

3.7 FINISHING

- A. Finish terrazzo to NTMA requirements.
- B. Grind terrazzo surfaces with power disc machine; sequence with coarse to fine grit abrasive, using a wet method.
- C. Produce terrazzo finish surface to match samples.
- D. Apply patch mix to match mortar over ground surface to fill honeycomb exposed during grinding.
- E. Remove patch coat by grinding, using a fine grit abrasive.
- F. Hand grind base and cove in similar manner.

3.8 INSTALLATION TOLERANCES

- A. Maximum Variation from Flat Surface: 1/8 inch in 10 feet.
- B. Maximum Variation from Level: 1/8 inch.

3.9 CLEANING

- A. Clean work under provisions of Section 01 77 00.
- B. Remove grinding dust from installation and adjacent areas.
- C. Scrub and clean terrazzo surfaces with cleaner in accordance with manufacturer's instructions. Let dry.

3.10 PROTECTION OF FINISHED WORK

- A. Protect finish installation under provisions of Section 01 61 00.
- B. Do not permit traffic over finished terrazzo surfaces.

END OF SECTION

SECTION 09 68 13

TILE CARPETING

1. PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Modular carpet tile installed by pressure sensitive adhesive system.
- B. Accessories.

1.2 REFERENCES

- A. ASTM D1335 - Tuft Bind of Pile Floor Coverings.
- B. ASTM E648 - Critical Radiant Flux of Floor Covering Systems Using a Radiant Heat Energy Source.
- C. ASTM E662 - Specific Optical Density of Smoke Generated by Solid Materials.
- D. ASTM F1869 - Standard Test Method for Measuring Moisture Vapor Emission Rate of Concrete Subfloor Using Anhydrous Calcium Chloride.
- E. ASTM F2170 - Determining Relative Humidity in Concrete Floor Slabs Using In-Situ Probe.
- F. CRI 104 - Carpet and Rug Institute Standard for Installation of Commercial Textile Floorcovering Materials.
- G. FTC - Federal Trade Commission Guides, Part 260, Guides for Use of Environmental Marketing Claims.
- H. NFPA - National Fire Protection Association.
- I. NSF / ANSI 140-2007e Sustainable Carpet Assessment.

1.3 SUBMITTALS

- A. Submit product data under provisions of Section 01 33 00.
- B. Provide product data on specified products, describing physical characteristics; sizes, patterns, colors available, and method of installation.
- C. Submit samples under provisions of Section 01 33 00.
- D. Submit two samples minimum 18 x 18 inch in size illustrating color and pattern for each carpet material specified.

1.4 RECYCLED CONTENT

- A. Carpet must contain a minimum of 40 percent recycled content by weight.
- B. Recycled content to be calculated by the following formula:
$$(\text{Recycled Content Weight}) / (\text{Total Product Weight}) \times 100 = \text{Percent recycled content.}$$
- C. Recycled content to be certified by Scientific Certification Systems (SCS) or National Sanitation Foundation International. Product must carry label certifying overall recycled content.
- D. Recycled content statements shall comply with FTC Part 260 Guidelines with respect to labeling, product inserts, and catalog representations.

1.5 RECYCLED PROGRAM

- A. Manufacturer shall have an existing established collection and recovery system for carpet in operation.
- B. Collection and recovery system shall be capable of reclaiming and recycling 100 percent of a vinyl backed carpet.
- C. Current recycling program to be in accordance with FTC Guides, Section 260.7(d).

1.6 PRODUCT CERTIFICATION

- A. Carpet must be certified with NSF 140-207(e) Sustainable Carpet Assessment Standards. Platinum level of certification.

1.7 OPERATION AND MAINTENANCE DATA

- A. Submit maintenance data under provisions of Section 01 77 00.
- B. Include maintenance procedures, recommended maintenance materials, and suggested schedule for cleaning and shampooing.

1.8 QUALITY ASSURANCE

- A. Perform work in accordance with CRI 104.
- B. Maintain one copy of document on site.
- C. Carpet shall have an average tuft bind of 20 pounds when tested in accordance with ASTM D1335.
- D. Carpet shall bear CRI Indoor Air Quality Carpet Testing Program Green Label Plus.

1.9 REGULATORY REQUIREMENTS

- A. Floor covering to have an NFPA Class I rating with a minimum radiant flux of 0.45 watt per square centimeter when tested in accordance with ASTM E648.
- B. Floor covering to have a smoke developed rating of less than 450 when tested in accordance with ASTM E662.

1.10 DELIVERY, STORAGE AND HANDLING

- A. Deliver, store, and protect products to site under provisions of Section 01 61 00.
- B. Comply with requirements of CRI 104 Section 5.

1.11 PROJECT/SITE CONDITIONS

- A. Comply with requirements of CRI 104, Section 7.
- B. Concrete subfloor to be allowed to cure for a minimum of 90 days to achieve acceptable dryness.
- C. Store materials for three days prior to installation in area of installation to achieve temperature stability.
- D. Moisture Testing: Perform tests as recommended by manufacturer and as follows. Proceed with installation only after substrates pass testing.
 - 1. Subfloor Moisture Conditions: Moisture emission rate of no more than 3 lb/1000 sq. ft./24 hours when tested by the Quantitative Anhydrous Calcium Chloride Test, ASTM F1869, with subfloor temperature not less than 65 degrees F.
 - 2. Subfloor Humidity Conditions: Relative humidity level of no more than 75 percent when tested by in situ drilled probes according to ASTM F2170.
 - 3. Subfloor Alkalinity Conditions: pH range of between 5 to 9 when subfloor is wetted with potable water and pHdrion paper is applied.

1.12 WARRANTY

- A. Provide manufacturer's standard lifetime or 20 year non-prorated warranty under provisions of Section 01 77 00.
- B. Performance Warranty: Manufacturer's warranty covering delamination of secondary backing, edge ravel and tuft bind of carpet under both wet and dry conditions.
- C. Wear Warranty: Manufacturer's warranty that carpet will lose no more than 10 percent by weight of face yarn.

1.13 EXTRA MATERIALS

- A. Provide full modular tiles equal to 5 percent of amount installed for each type and color but not less than 10 square yards under the provisions of Section 01 77 00.

2. PART 2 PRODUCTS

2.1 MANUFACTURERS

- A. Interface Flor, LLC, Style: To Scale with Glassbac RE Backing, www.interfaceflor.com.
- B. The Mohawk Group, Lees, Style: Sequences II Collection, Pattern: Ground Strata II Modular with Eco Flex NXT backing, www.themohawkgroup.com.
- C. Mannington Mills, Inc., Style: Infinity RE Modular Tile, Pattern: New Possibilities II, www.mannington.com.
- D. Tandus, Collins and Aikman Corp., Style: Ethos 3 / Omnicoat Modular Tile, Pattern: Haphazard II, www.tandus.com.
- E. Shaw Industries, Inc., Style: Ecoworx Tile, Collection: No Rules, Pattern: Disperse, www.shawcontractgroup.com.
- F. Substitutions: Under provisions of Section 01 25 13.

2.2 MATERIALS

- A. Carpet shall conform to published specification characteristics of named manufacturer as modified by requirements specified in this section.
- B. Size: 18 x 18 inches up to 24 x 24 inches.
- C. Fiber Type: Invista Antron Legacy, Antron Lumena or Universal Nylon Type 6, 6.
- D. Pile Height: Maximum 1/2 inch.
- E. Backing: Synthetic, non-woven, 100 percent recycled content. No latex backing to be used.
- F. Soil-Resistance Treatment: Manufacturer's standard integral stain resistant treatment.

2.3 ACCESSORIES

- A. Sub-Floor Filler: White premix portland cement and latex; type as recommended by carpet manufacturer.
- B. Manufacturer's recommended pressure-sensitive adhesive system components.
- C. Edge Strips: Vinyl type, color as selected. Strip shall be beveled with a slope no greater than 1 inch unit vertical to 2 units horizontal (50 percent slope).

3. PART 3 EXECUTION

3.1 EXAMINATION

- A. Examine subfloors and conditions for compliance with requirements for moisture content, humidity levels, alkalinity range and other conditions affecting performance of carpet.
- B. Verify that subfloor surfaces are smooth and flat and are ready to receive work.
- C. Beginning of installation means acceptance of subfloor and site conditions.

3.2 PREPARATION

- A. Remove subfloor coatings, including curing compounds, and other substances that are incompatible with adhesives and that contain soap, wax, oil, or silicone.
- B. Remove subfloor ridges and bumps. Fill low spots, cracks, joints, holes, and other defects with sub-floor filler.
- C. Apply, trowel, and float filler to leave smooth, flat, hard surface.

- D. Prohibit traffic until filler is cured.
- E. Apply subfloor primer compatible with adhesive where recommended by carpet manufacturer.
- F. Vacuum floor surface.

3.3 INSTALLATION

- A. Apply carpet and adhesive in accordance with manufacturer's instructions and CRI 104, Section 10.2.
- B. Fully adhere carpet tile to substrate.
- C. Lay carpet on floors with tiles laid in straight pattern.
- D. Install pattern parallel to walls.
- E. At doorways, center seams under door in closed position.
- F. Fit seams straight, not crowded or peaked, free of gaps.
- G. Extend carpet into toe spaces, door reveals, open-bottomed obstructions, alcoves and similar openings.
- H. Cut and fit carpet around interruptions.
- I. Fit carpet tight to intersection with vertical surfaces without gaps.

3.4 CLEANING

- A. Remove excess adhesive from floor, base, and wall surfaces without damage.
- B. Vacuum carpet surfaces.

3.5 PROTECTION

- A. Comply with requirements of CRI 104, Section 16.
- B. Prohibit traffic from carpet areas for 24 hours after installation.

END OF SECTION

SECTION 09 77 10

FRAMED DECORATIVE PANEL SYSTEMS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes: Decorative 7/16" (11 mm) thick prefinished panel mechanically and adhesively applied directly to a solid substrate, utilizing a pre-engineered application process.
 - 1. Hardware: Extruded aluminum joinery moldings, extruded aluminum perimeter trim moldings and mechanical fasteners.
 - 2. Panels:
 - a. Fire-Rated HPL laminated to Fire-Rated wood fiber substrate, with balancing backer.
 - b. Non Fire-Rated HPL laminated to wood fiber substrate, with balancing backer.
- B. Products Not Furnished or Installed under This Section:
 - 1. Wood Veneer casework.
 - 2. Gypsum Board backup.

1.2 RELATED SECTIONS

- A. Section 09 21 16 - Gypsum Wallboard.
- B. Section 09 90 00 - Painting & Transparent Finishes.
- C. Section 09 65 00 - Resilient Base.

1.3 REFERENCES

- A. American Society for Testing and Materials: Standard Specifications (ASTM)
 - 1. ASTM E 84 - Standard Test Method for Surface Burning Characteristics of Building Materials.
- B. Architectural Woodwork Standards as published by the Architectural Woodwork Institute, the Architectural Woodwork Manufacturers Association of Canada, and the Woodwork Institute.
 - 1. Architectural Woodwork Standards - Edition 1.
- C. National Electrical Manufacturers Association (NEMA) LD-3-2000 for HPL Laminate

1.4 SUBMITTALS

- A. Product Data: Submit sufficient manufacturer's data to indicate compliance with these specifications, including:
 - 1. Preparation instructions and recommendations.
 - 2. Storage and handling requirements and recommendations.
 - 3. Installation methods.
- B. Shop Drawings: Submit elevations of each wall showing location of paneling and trim members with respect to all discontinuities in the wall elevation.

- C. Selection Samples: Submit manufacturer's standard color and pattern selection samples representing manufacturer's full range of available colors and patterns pertinent to the project.
- D. Samples for Verification: Submit 6" (154mm) by 10" (254mm) section of panel for each panel selected indicating the color, texture, and pattern required.
 - 1. Submit complete with specified applied finish.
 - 2. Exposed Molding and Trim: Include 4" (101mm) long samples of each type, finish, and color.
- E. Maintenance Instructions

1.5 QUALITY ASSURANCE

ASTM E 84 Definition: Strict interpretation of the ASTM E 84 fire rating applies only to surface burning characteristics of a panel. Marlite Connections Fire-Rated panels and trim are intended to provide a Class A Fire-Rated application, as defined by ASTM E 84 classification, but are not intended to be included in the creation of Fire-Rated demising wall construction. ASTM E 84 fire rating for a Class A material requires a flame spread 25 or less, along with a smoke development maximum of 450. ASTM E-84 fire rating for a Class C material requires a flame spread of between 26 and 200, along with a smoke development maximum of 450.

As all current U.S. building fire rating codes are pertinent only to surface burning characteristics of applied materials, the balancing backer is not subject to scrutiny within fire ratings.

- A. Conform to building code requirements for interior finish for smoke and flame spread requirements as tested in accordance with:
 - 1. ASTM E 84 (Method of test for surface burning characteristics of building Materials)
 - 2. Required Rating – Class A.

1.6 DELIVERY, STORAGE AND HANDLING

- A. Deliver panels and associated materials factory packaged on strong pallets and properly packaged or protected.
 - 1. Upon delivery carefully inspect all cartons, packages, pallets and protective wrap for damage or material shortage.
 - 2. Open and inspect suspect packages, cartons or wrapped pallets for damage.
 - 3. Contact shipper immediately to report any damaged or missing materials.
 - 4. Contact Marlite @ (800) 377-1221 immediately to report any damaged or missing materials.
 - 5. Contact Marlite @ (800) 377-1221 with any questions, problems or concerns.
- B. Store products in manufacturer's unopened packaging until ready for installation.
 - 1. Maintain plastic or other protective wrap in place during on site handling until ready for installation.
 - 2. Keep panels clean and do not stack panels after removal of protection.
- C. Store and dispose of solvent-based materials, and materials used with solvent-based materials, in accordance with requirements of local authorities having jurisdiction.

1.7 PROJECT CONDITIONS

- A. Wood composite panels are subject to the effects of humidity and temperature. Do not use in kitchens, rest rooms, or other high humidity areas.
- B. Partition walls are to be finished and the building completely closed. Walls shall be thoroughly dry, and concrete cured and dry before starting installation.
- C. HVAC system must be operable and installation area must be balanced to normal operating conditions.
- D. Maintain environmental conditions (temperature, humidity, and ventilation) within limits recommended by manufacturer for optimum results. To ensure product performance, a temperature range of 60°-80°F (16°C-27°C) and a humidity range of 35-55% must be maintained during storage, installation and product life cycle. Do not install products under environmental conditions outside manufacturer's absolute limits.

1.8 COORDINATION AND SEQUENCING

- A. Except as specified by the architect, it's recommended to locate trim members so that panel lines coordinate with doors, headers, jambs and other discontinuities in a wall.
- B. Vapor barrier shall be used on exterior walls behind backing to discourage warping.
Delete the following if panels are not used on casework
- C. Coordinate with casework manufacturer. Deliver material to the fabrication shop.

1.9 WARRANTY

For longer warranties contact Marlite.

- A. Standard Warranty: All products shall be warranted to be free from defects for a period of 30 days after installation.

PART 2 - PRODUCTS

2.1 ACCEPTABLE PRODUCT

- A. Marlite; 1 Marlite Drive, Dover, OH 44622. 800-377-1221 FAX (330) 343-4668 Email: info@marlite.com
www.marlite.com.
 - 1. Product: Sieva Wall System
- B. Substitutions: Under provisions of Section 01 25 13.

2.2 HARDWARE

- A. Horizontal and Vertical alignment framing
 - 1. CP-4 Retro Reveal (2 piece) to create 3/4" reveals. Base and Cap furnished in full 10' (3m) lengths.
- B. Panel Trim: Aluminum profiles furnished in full 10' (3m) lengths
 - 1. Horizontal Edge Cap – Marlite part #CP270
- C. Hardware and Trim Material:
 - 1. Heavy weight extruded aluminum 6063-T5 alloy and prefinished at the factory
 - a. Concealed Aluminum – Mill finish

2.3 PANELS

- A. Panel Configuration:
 - 1. Face dimensions: Full sheets [48" (122cm) wide x 96" (244cm) high] [48" (122cm) wide x 120" (305cm) high]
 - 2. Panel thickness - .44" (11mm) thick
- B. Wood Fiber Substrate:
 - 1. Class A
 - a. Marlite panels are typically manufactured using various wood fiber substrates having either 75%, 82% or 100 % recycled wood waste. When available as Fire-Rated, a higher percentage may be specified if required for environmental credits.
- C. High Pressure Laminate: vertical grade high pressure plastic laminate adhered to wood fiber substrate
 - 1. Edges – Square for the CP-4. Kerfed for the CP-3 and CP-6 reveals

2. Balancing Backer: Kraft paper that doesn't not contribute to or pose an unusual additional fire hazard.
3. Color and Pattern: As selected by Architect from manufacturer's standard selection

2.4 ADHESIVES

- A. Marlite Brand C-109 solvent based adhesive or as otherwise approved by Marlite

2.5 FABRICATION

- A. All framing, panels, hardware and accessories shall be factory finished and ready to install except for field fabrication as required by jobsite and perimeter conditions.
 1. Refinish field cut panel edges in accordance with manufacturer's instruction before installation.
 2. For all cut-outs, drill corners for a minimum 1/8" radius.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Installer's Examination: Examine conditions under which construction activities of this section are to be performed. Submit written notification to Architect and system manufacturer if such conditions are unacceptable. Beginning erection constitutes installer's acceptance of conditions.
 1. Verify that a vapor barrier has been provided on exterior walls behind backing to prevent warping.
 2. Verify backing and mounting surfaces are smooth, solid, and flat. [All drywall joints are to be taped and finished].
 3. Verify that walls are sealed, primed before installation begins.
 4. Verify mechanical, electrical, and building service and/or items affecting work of this section are placed and ready to receive this work.
 5. Verify that structural stud spacing does not exceed 24" on-center.
- B. Structural walls are to be finished, with building completely closed. Walls shall be thoroughly dry before starting installation.

3.2 PREPARATION

- A. Conditioning: Panels must be allowed to acclimate to a balanced environment in the installation location for 72 hours prior to installation.
- B. Protect existing surfaces with drop cloths.
- C. Except as directed by the architectural drawings, before installing, examine panels and arrange to achieve best combination of color, pattern, texture and grain.

3.3 INSTALLATION

- A. Install all materials in strict accordance with the manufacturer's installation instructions and recommendations, with hardware straight, plumb, and level.
 1. Anchor units rigidly and securely in place.
 2. Cut sheets to meet existing supports.

- B. Fasten supports and trim using appropriate fasteners into a stud or other solid substrate at centers as specified by the manufacturer. Where screws do not hit the studs, fasten with adhesive in accordance with the manufacturer's recommendations. Pre-drill holes thru the members and fasten the screw flush with the flange on the aluminum profile. Where necessary countersink for the screw head to seat flush with the flange.
- C. Avoid contamination of the panel faces with adhesives, solvents or cleaners during installation.

3.4 CLEANING AND PROTECTION

- A. Clean and remove dust and other foreign matter from panel and framing surfaces. Clean finishes in accordance with manufacturer's instructions.

END OF SECTION

SECTION 09 77 33

FIBER REINFORCED PLASTIC PANELS

1. PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Fiberglass reinforced plastic (FRP) panels.
- B. Panel moldings.

1.2 REFERENCES

- A. ASTM E84 - Surface Burning Characteristics of Building Materials.

1.3 SUBMITTALS

- A. Submit product data under provisions of Section 01 33 00.
- B. Submit product data for panels and accessories.
- C. Submit samples under provisions of Section 01 33 00.
- D. Submit two samples 4 x 4 inches in size illustrating panel pattern and color. Submit two 12 inch long samples of panel moldings.
- E. Submit manufacturer's installation instructions under provisions of Section 01 33 00.

1.4 OPERATION AND MAINTENANCE DATA

- A. Submit maintenance data under provisions of Section 01 77 00.
- B. Include data for cleaning and stain removal.
- C. Include manufacturer's recommendations for cleaning materials, polishes, and waxes.

1.5 REGULATORY REQUIREMENTS

- A. Conform to flame/smoke developed rating of 25/450 when tested in accordance with ASTM E84.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Deliver, store, and protect products to site under provisions of Section 01 61 00.

1.7 ENVIRONMENTAL REQUIREMENTS

- A. Do not install fiberglass reinforced plastic panels when temperatures are below 60 degrees F or above 90 degrees F.
- B. Maintain temperature range for 24 hours before, during, and 72 hours after installation of panels.

1.8 WARRANTY

- A. Provide one year warranty under provisions of Section 01 77 00.
- B. Include coverage for surface staining and finish deterioration.

2. PART 2 PRODUCTS

2.1 MANUFACTURERS

- A. Crane Composites, Inc., www.cranecomposites.com.
- B. Glasteel Inc., www.glasteel.com.
- C. Lasco Products, www.lascoboard.com.
- D. Marlite, www.marlite.com.
- E. Nudo Products, Inc., www.nudo.com.
- F. Panolam Industries, www.panolam.com.
- G. Substitutions: Under provisions of Section 01 25 13.

2.2 MATERIALS

- A. Fiberglass reinforced plastic panels of 0.090 inch thickness in 4 x 10 foot sheet sizes.
- B. Panels to have pebble textured surface finish in color selected by Architect.
- C. Panels to have a flame/smoke rating of 25/450 for a Class A finish when tested according to ASTM E84.

2.3 ACCESSORIES

- A. Moldings: Extruded aluminum or plastic panel accessories in maximum practical lengths. Finish to match panels.
- B. Adhesive: Latex based non-flammable construction adhesive.
- C. Sealant: Silicone sealant specified in Section 07 92 00.
- D. Substitutions: Under provisions of Section 01 25 13.

3. PART 3 EXECUTION

3.1 EXAMINATION

- A. Verify that surfaces and openings are ready to receive work.
- B. Verify that field measurements and tolerances are as instructed by manufacturer.
- C. Verify that required utilities are available, in proper location, and ready for use.
- D. Beginning of installation constitutes acceptance of existing substrate surface conditions by installer.

3.2 PREPARATION

- A. Clean substrate surfaces.
- B. Protect elements of work adjacent to work of this Section from damage or disfiguration.

3.3 INSTALLATION

- A. Install panels and accessories in accordance with manufacturer's instructions.
- B. Coordinate location of panel joints to minimize interference with fixtures and accessories.

- C. Apply panel adhesive at 6 inches on center over entire field of panel.
- D. Set panel ends and edges in moldings.
- E. Seal moldings and panel joints with sealant.

3.4 FIELD QUALITY CONTROL

- A. Panels shall lay flush with substrate, without air pockets or warpage.
- B. Remove and replace panels not conforming to manufacturer's installation guidelines.

3.5 CLEANING

- A. Clean work under provisions of Section 01 77 00.

3.6 PROTECTION

- A. Protect finished installation under provisions of Section 01 61 00.

END OF SECTION

SECTION 09 84 33

SOUND-ABSORBING WALL PANELS

1. PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Cement/wood fiber sound panels.
- B. Wood furring strips.
- C. Fiberglass insulation.
- D. Attachments and accessories.

1.2 REFERENCES

- A. ASTM C423: Standard Test Method for Sound Absorption and Sound Coefficients by the Reverberation Room Method.
- B. ASTM E-84: Standard Test Method for Surface Burning Characteristics of Building Materials.
- C. ASTM E-1264: Standard Classification for Acoustical Ceiling Products.
- D. FSC – Forest Stewardship Council.

1.3 PERFORMANCE REQUIREMENTS

- A. Meet the requirements of ASTM E-84 for flame spread of 25 or less and smoke developed of less than 450.
- B. Meet the requirements of ASTM C423 for NRC value listed.

1.4 SUBMITTALS

- A. Submit shop drawings under provisions of Section 01 33 00.
- B. Submit shop drawings indicating layout of panels furring and support clips.
- C. Submit product data under provisions of Section 01 33 00.
- D. Submit product data for panels and supports.
- E. Submit four samples 12 x 12 inches in size illustrating panel composition, support method, and finish.
- F. Submit test reports under provisions of Section 01 33 00.
- G. Submit test report indicating flame spread and sound absorption.
- H. Submit manufacturer's certificate under provisions of Section 01 33 00 that products meet or exceed specified requirements.
- I. Submit manufacturer's installation instructions under provisions of Section 01 33 00.

1.5 OPERATION AND MAINTENANCE DATA

- A. Submit maintenance data under provisions of Section 01 77 00.
- B. Include cleaning and replacement of damaged sound blocks.

- C. Include cleaning and stain removal methods and recommended cleaning materials.
- 1.6 QUALITY ASSURANCE
- A. Install in accordance with manufacturer's instructions.
 - B. Maintain one copy of document on site.
- 1.7 QUALIFICATIONS
- A. Manufacturer: Company specializing in the manufacture of products specified in this Section with minimum five years documented experience.
 - B. Installer: Company specializing in applying the work of this Section with minimum five years documented experience and approved by manufacturer.
- 1.8 DELIVERY, STORAGE, AND HANDLING
- A. Deliver, store and protect products to site under provisions of Section 01 61 00.
 - B. Store and protect products under provisions of Section 01 61 00.
 - C. Accept packaged panel assemblies on-site. Verify damage.
 - D. Protect all material from weather by storing indoors in properly ventilated area.
- 1.9 WARRANTY
- A. Provide five year warranty under provisions of Section 01 77 00.
 - B. Warranty: Include coverage for panel deterioration and support failure.

2. PART 2 PRODUCTS

2.1 MANUFACTURERS

- A. Tectum Inc. www.tectum.com.
- B. Substitutions: Under provisions of Section 01 25 13.

2.2 MANUFACTURED UNITS

- A. Lumber Materials: FSC – Forest Stewardship Council certified sustainable harvested wood.
- B. Interior Wall Panel
 - 1. Material: Aspen wood fibers bonded with inorganic hydraulic cement.
 - 2. Thickness: 1 inch.
 - 3. Edge: All ends and edges beveled.
 - 4. Width: 47-3/4 inches.
 - 5. Length: 8'-0".
 - 6. Color: Field painted with latex dry-fall eggshell acoustic coating under provisions of Section 09 90 00.
 - 7. Mounting Style: C20.
 - 8. NRC Rating: 0.80.

2.3 ACCESSORIES

- A. Furring Strips: Douglas Fir Species, No. 1 grade as specified in Section 06 10 00.
- B. Insulation: Owens Corning Fiberglass No. 703 fiberglass insulation.

- C. Screws: Bolts, screws and washers as indicated, galvanized and pre-painted where exposed.

3. PART 3 EXECUTION

3.1 EXAMINATION

- A. Verify that substrate is ready to receive work.
- B. Verify field measurements are as shown on shop drawings.
- C. Verify that required electrical and other utilities are in place, in proper locations, and ready for use.
- D. Verify that all painting and other surface treatment has been satisfactorily completed prior to beginning installation.
- E. Verify that all supporting material is in proper locations as shown on shop drawings.
- F. Beginning of installation means installer accepts existing substrate conditions.

3.2 PREPARATION

- A. Clean surfaces to be covered.
- B. Protect elements surrounding the work of this Section from damage or disfiguration.

3.3 INSTALLATION

- A. Install in accordance with manufacturer's recommendations and instructions.
- B. Secure wood furring to wall substrate as indicated.
- C. Back prime wood furring installed on cementitious surfaces.
- D. Adhere insulation to wall substrate.
- E. Apply adhesive at all wood furring strips.
- F. Secure panels to furring strips as indicated.
- G. Install sound blocks at 24 inches on center.

3.4 INTERFACE WITH OTHER PRODUCTS

- A. Coordinate with installation of finish electrical work and other work that impacts panel installation.

3.5 TOLERANCES

- A. Maximum Variation From Level: 1/8 inch in 4 feet.
- B. Maximum Offset From True Alignment: 1/4 inch.

3.6 CLEANING

- A. Clean work under provisions of Section 01 77 00.
- B. Clean panel surfaces.

3.7 PROTECTION

- A. Protect finished installation under provisions of Section 01 61 00.
- B. Provide poly-wrap or other protective means.
- C. Do not permit traffic in contact with surfaces and protect as necessary.

END OF SECTION

SECTION 09 85 50

FIBERGLASS ACOUSTICAL WALL PANELS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes shop-fabricated, acoustical wall panels with decorative fabric facings.

1.2 SUBMITTALS

- A. Product Data: For each type of core and facing material, and mounting indicated.
- B. Samples: For each type of core and facing material, and mounting indicated assembled in panels approximately 6 by 6 inches.

1.3 WARRANTY

- A. Warranty Period: One year.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. NOISE S.T.O.P. FABRISORB Decorative Acoustical Wall Panels:
 - 1. Decorative Fabric Wrapped Custom Acoustical Wall Panels by Acoustical Surfaces, Inc.
 - a. 123 Columbia Court North Suite 210.
 - b. Chaska, MN 55318
 - c. (952) 448 – 5300.
 - d. www.AcousticalSurfaces.com
 - 2. Substitutions: Under provisions of Section 01 25 13.

2.2 NOISE S.T.O.P. FABRISORB DECORATIVE ACOUSTICAL WALL PANELS

- A. Panel Materials:
 - 1. Core Material: 6 to 7 lb. density glass fiber.
 - 2. Core Thickness: 2 inch, 3 inch, or 4 inch as indicated on drawings.
 - 3. Sizes: Custom sizes as indicated on Drawings.
 - 4. Mounting: Concealed Splines.
 - 5. Edge Details: Half Bevel.
 - 6. Edge Treatments: Chemically Hardened.
 - 7. Acoustical Properties for 6 to 7 pcf glass fiber:
 - a. For 2 inch thickness: NRC of 1.15.
 - b. For 3 inch thickness: NRC of 1.15
 - c. For 4 inch thickness: NRC of 1.15
 - 8. Fire Resistance: This pattern meets the requirements of National Fire Protection Association (NFPA) Class A or 1.
 - 1) Flame Spread: 15.
 - 2) Smoke Developed: 40.

- B. Fabric Facing Materials:
 - 1. Type: Guilford FR 701 2100 Fabric Facings or Guildfor 2335 Fabric Facings
 - 2. Style and Color: As selected by Architect from manufacturer's standard selection of either type.
 - 3. Fire Resistance: This pattern meets the requirements of National Fire Protection Association (NFPA) Class A or 1.
 - a. Flame Spread: 5.
 - b. Smoke Developed: 70.
- C. Attachment Materials:
 - 1. Splines.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. General: Comply with decorative acoustical wall panel manufacturer's written instructions for installation and type of mounting specified.

3.2 CONCEALED SPLINES

- A. Panels with concealed spline attachment are provided with kerfs along the edges of the panels. The spline then inserts into one panel and is mounted onto the wall. Adjoining panels are inserted into the remaining half of the spline.

END OF SECTION

SECTION 09 90 00

PAINTING

1. PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Surface preparation.
- B. Products and application.
- C. Surface finish schedule.

1.2 SUMMARY OF PAINTED SUBSTRATES

- A. Section includes the application of paint systems on the following interior substrates:

- 1. Concrete.
- 2. Clay masonry.
- 3. Concrete masonry units (CMU).
- 4. Primed or unprimed steel.
- 5. Cast iron.
- 6. Galvanized metal.
- 7. Steel handrails, guardrails and fittings.
- 8. Steel roof deck.
- 9. Steel lintels and shelf angles.
- 10. Intumescent fireproofing.
- 11. Aluminum (not anodized or otherwise coated).
- 12. Steel doors, frames and lights.
- 13. Glass frames in steel and wood doors.
- 14. Wood doors.
- 15. Access doors and frames.
- 16. Overhead coiling doors and frames.
- 17. Sectional overhead doors and frames.
- 18. Rolled steel windows.
- 19. Wood windows.
- 20. Wood.
- 21. Glu Lam beams.
- 22. Horizontal and vertical gypsum board.

23. Plaster.
24. Spray-textured ceilings.
25. Suspended acoustic ceilings.
26. Applied acoustic ceilings.
27. Wall louvers.
28. Cotton or canvas insulation covering.
29. Mechanical equipment.
30. Electrical panel board covers.

B. Section includes the application of paint systems on the following exterior substrates:

1. Concrete.
2. Clay masonry.
3. Concrete masonry units (CMU).
4. Primed or unprimed steel.
5. Galvanized metal.
6. Steel handrails, guardrails, and fittings.
7. Steel roof deck.
8. Steel lintels and shelf angles.
9. Decorative metal fencing.
10. Bollards.
11. Sheet metal flashing and trim.
12. Sheet metal gutters and downspouts.
13. Steel pipe downspouts.
14. Intumescent fireproofing.
15. Aluminum (not anodized or otherwise coated).
16. Steel doors, frames and lights.
17. Glass frames in steel and wood doors.
18. Wood doors.
19. Access doors and frames.
20. Overhead coiling doors and frames.
21. Sectional overhead doors and frames.
22. Rolled steel windows.

- 23. Wood windows.
- 24. Wood.
- 25. Glu Lam beams.
- 26. Portland cement plaster (stucco).
- 27. Horizontal or vertical gypsum board or sheathing.
- 28. Wall louvers.
- 29. Mechanical roof mounted equipment.
- 30. Electrical panel board covers.

- C. Substrate listings are for principal surfaces only. Refer to drawings, details and individual specification sections for items, surfaces, and substrates not specifically listed.

1.3 REFERENCES

- A. ASTM D16 - Definitions of Terms Relating to Paint, Varnish, Lacquer, and Related Products.
- B. SSPC - The Society for Protective Coatings.

1.4 SYSTEM DESCRIPTION

- A. Preparation of all surfaces to receive final finish.
- B. Painting and finishing work of this section using coating systems of materials including primers, sealers, fillers, and other applied materials whether used as prime, intermediate, or finish coats.
- C. Surface preparation, priming, and finish coats specified in this Section are in addition to shop-priming and surface treatment specified under other Sections.
- D. Painting and finishing all exterior and interior surfaces of materials including structural, mechanical, and electrical work on site, in building spaces, and above or on the roof.
- E. Paint exposed surfaces except where a surface or material is specifically indicated not to be painted or is to remain natural. Where an item or surface is not specifically mentioned, paint the same as similar adjacent materials or surfaces.

1.5 DEFINITIONS

- A. Conform to ASTM D16 for interpretation of terms used in this Section.

1.6 QUALITY ASSURANCE

- A. Product Manufacturer: Company specializing in manufacturing quality paint and finish products with five years experience.
- B. Applicator: Company specializing in commercial painting and finishing with five years documented experience.
- C. Coats: The number of coats specified is the minimum number acceptable. If full coverage is not obtained with the specified number of coats, apply such additional coats as are necessary to produce the required finish.
- D. Employ coats and undercoats for all types of finishes in strict accordance with the recommendations of the paint manufacturer.
- E. Provide primers and undercoat paint produced by the same manufacturer as the finish coat.

- F. The minimum dry film thickness of each coat of paint shall comply with the manufacturer's recommendations for each type of paint used.

1.7 REGULATORY REQUIREMENTS

- A. Comply with applicable codes and regulations of governmental agencies having jurisdiction including those having jurisdiction over airborne emissions and industrial waste disposal. Where those requirements conflict with this specification, comply with the more stringent provisions.
- B. Comply with the current applicable regulations of the California Air Resources Board (CARB) and the Environmental Protection Agency (EPA).
- C. Comply with South Coast Air Quality Management District (SCAQMD) Rule 1113. A copy of this regulation can be obtained from <http://www.aqmd.gov/rules/reg/reg11/r1113.pdf>.
- D. In the South Coast Air Quality Management District (SCAQMD), where lower VOC contents are specified for a number of categories, certain products may be covered under the manufacturer's SCAQMD - approved Averaging Program. As a result, certain products may be fully compliant with SCAQMD Rule 1113, despite having VOC contents higher than specified limits.

1.8 SUBMITTALS

- A. Submit product data under provisions of Section 01 33 00.
- B. Product data for each coating type shall include as a minimum the following items. Listing shall be by manufacturer's catalog number:
 - 1. Solvent type.
 - 2. Resin type and percentage.
 - 3. Prime pigments by percent of weight.
 - 4. Reinforcing pigment by percent of weight
 - 5. Solids and volume by weight.
 - 6. VOC and RAVOC limits.
 - 7. Coverage rates and film thickness both wet and dry.
 - 8. Conformance to environmental standards listed.
 - 9. Surface preparation recommendations.
 - 10. Application, storage, clean up and disposal recommendations.
 - 11. Special instructions from the manufacturer for proper preparation and application.
- C. Provide manufacturer's technical information and instructions for application of each material proposed for use by catalog number.
- D. List each material by catalog number and cross-reference specific coating with specified finish system.
- E. Technical data sheets and all container labels must match and shall contain the same product identification numbers. The term "Series " is not acceptable.
- F. Provide manufacturer's written and signed certificate that products proposed meet or exceed specified materials.
- G. Submit samples under provisions of Section 01 33 00.

- H. Submit two samples 8-1/2 x 11 inch in size of each paint color and texture applied to cardboard. Resubmit samples until acceptable color, sheen and texture is obtained.
- I. On same species and quality of wood to be installed, submit two 4 x 8 inch samples showing system to be used for varnishes and stains.

1.9 FIELD SAMPLES

- A. Provide field samples under provisions of Section 01 33 00.
- B. On wall surfaces and other exterior and interior components, duplicate specified finishes on at least 100 sq.ft. of surface area.
- C. Provide full-coat finishes until required coverage, sheen, color and texture are obtained.
- D. Simulate finished lighting conditions for review of field samples.
- E. After finishes are accepted, the accepted surface may remain as part of the work and will be used to evaluate subsequent coating systems applications of a similar nature.

1.10 DELIVERY, STORAGE, AND HANDLING

- A. Deliver products to site and store and protect under provisions of Section 01 61 00.
- B. Deliver products to site in sealed and labeled containers; inspect to verify acceptance.
- C. Container labeling to include manufacturer's name, type of paint, brand name, brand code, coverage, surface preparation, drying time, cleanup, color designation, and instructions for mixing and reducing. Paint containers not displaying product identification will not be acceptable.
- D. Store paint materials at minimum ambient temperature of 50 degrees F and a maximum of 90 degrees F, in well ventilated area, unless required otherwise by manufacturer's instructions.
- E. Take precautionary measures to prevent fire hazards and spontaneous combustion.

1.11 ENVIRONMENTAL REQUIREMENTS

- A. Provide continuous ventilation and heating facilities to maintain interior surface and ambient temperatures above 50 degrees F with a maximum humidity level of 50 percent for 24 hours before, during, and 48 hours after application of finishes, unless required otherwise by manufacturer's instructions.
- B. Do not apply exterior coatings during rain or snow, or when relative humidity is above 50 percent, unless required otherwise by manufacturer's instructions.
- C. Minimum Application Temperatures for Latex Paints: 50 degrees F for interiors; 50 degrees F for exterior; unless required otherwise by manufacturer's instructions.
- D. Minimum Application Temperature for Varnish and Urethane Finishes: 65 degrees F for interior or exterior, unless required otherwise by manufacturer's instructions.
- E. Provide lighting level of 80 foot candles measured mid-height at substrate surface.

1.12 EXTRA MATERIAL

- A. Provide a five gallon unopened container of each color and surface texture to Owner.
- B. Label each container with color, texture, and room locations in addition to the manufacturer's label.

2. PART 2 PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS - PAINT

- A. Unless specifically identified otherwise, product designations included in this section are those that are manufactured and distributed by the Dunn-Edwards Corporation, www.dunnedwards.com and shall serve as the basis of design standard for kind, quality, performance and function.
- B. Subject to full compliance with specified requirements, other manufacturers offering equivalent products are:
 - 1. Behr Process Corp., www.behrpaint.com.
 - 2. Benjamin Moore Paints, www.benjaminmoore.com.
 - 3. Glidden Professional, www.gliddenprofessional.com.
 - 4. Kelly-Moore Paint Company, www.kellymoore.com.
 - 5. Pittsburgh Paints, www.ppg.com.
 - 6. Sherwin Williams, www.sherwin-williams.com.
 - 7. Tnemec Company, Inc., www.tnemec.com.
 - 8. Vista Paint Corporation, www.vistapaint.com.
- C. Substitutions: Under provisions of Section 01 25 13.

2.2 MATERIALS

- A. Ready mixed, except field catalyzed coatings. Process pigments to a soft paste consistency, capable of being readily and uniformly dispersed to a homogeneous coating.
- B. Good flow and brushing properties; capable of drying or curing free of streaks or sags.
- C. "Deep Tone" colors to be composed of 100 percent acrylic pigments with a colored base.
- D. Accessory Materials: Linseed oil, shellac, turpentine, paint thinners and other materials not specifically indicated but required to achieve the finishes specified, of commercial quality.

2.3 FINISHES

- A. Refer to schedule at end of Section for surface finish schedule.

3. PART 3 EXECUTION

3.1 INSPECTION

- A. Verify that surfaces are ready to receive work as instructed by the product manufacturer.
- B. Examine surfaces to be finished prior to commencement of work. Report any condition that may potentially affect proper application.

- C. Measure moisture content of surfaces using an electronic moisture meter. Do not apply finishes unless moisture content of surfaces are below the following maximums:
- | | | |
|---|---|-------------|
| 1. Plaster and Gypsum Wallboard | : | 12 percent. |
| 2. Masonry, Concrete, and Concrete Unit Masonry | : | 12 percent. |
| 3. Interior Located Wood | : | 15 percent. |
| 4. Exterior Located Wood | : | 15 percent. |
- D. Beginning of installation means acceptance of existing surfaces.

3.2 SURFACE PREPARATION

- A. Remove electrical plates, hardware, light fixture trim, and fittings prior to preparing surfaces or finishing.
- B. Remove all finish hardware from doors and frames prior to preparing surfaces or finishing.
- C. Correct minor defects and clean surfaces which affect work of this Section.
- D. Shellac and seal marks which may bleed through surface finishes.
- E. Impervious Surfaces: Remove mildew by scrubbing with solution of tri-sodium phosphate and bleach. Rinse with clean water and allow surface to dry.
- F. Insulated Coverings: Remove dirt, grease, and oil from canvas and cotton.
- G. Concrete Floors: Remove contamination, acid etch, and rinse floors with clear water. Verify required acid-alkali balance is achieved. Allow to dry.
- H. Gypsum Board: Repair all voids, nicks, cracks and dents with patching materials and finish flush with adjacent surface. Latex fill minor defects. Spot prime defects after repair.
- I. Galvanized Surfaces: Remove surface contamination and oils and wash with solvent. Pretreat with phosphoric acid etch or vinyl wash. Apply coat of etching primer the same day as pretreatment is applied.
- J. Concrete and Unit Masonry: Remove dirt, loose mortar, scale, salt or alkali powder, and other foreign matter. Remove oil and grease with a solution of tri-sodium phosphate; rinse well and allow to dry. Remove stains caused by weathering of corroding metals with a solution of sodium metasilicate after thoroughly wetting with water. Allow to dry.
- K. Plaster: Fill hairline cracks, small holes, and imperfections with latex patching plaster. Make smooth and flush with adjacent surfaces. Wash and neutralize high alkali surfaces.
- L. Shop Primed Steel: Sand and scrape to remove loose primer and rust. Feather edges to make touch-up patches inconspicuous. Clean surfaces with solvent. Prime paint steel surfaces.
- M. Interior Wood: Wipe off dust and grit prior to priming. Seal knots, pitch streaks, and sappy sections with sealer. Fill nail holes and cracks after primer has dried; sand between coats.

3.3 PROTECTION OF ADJACENT WORK

- A. Protect elements surrounding the work of this Section from damage or disfiguration.
- B. Repair damage to other surfaces caused by work of this Section.
- C. Furnish drop cloths, shields, and protective methods to prevent spray or droppings from disfiguring other surfaces.
- D. Remove empty paint containers from site.

3.4 WORK NOT TO BE PAINTED

- A. Painting is not required on surfaces in concealed and inaccessible areas such as furred spaces, foundation spaces, utility tunnels, pipe spaces and duct shafts.
- B. Do not paint metal surfaces such as stainless steel, chromium plate, brass, bronze, and similar finished metal surfaces.
- C. Do not paint anodized aluminum or other surfaces which are specified to be factory pre-finished.
- D. Do not paint sandblasted or architecturally finished concrete surfaces.
- E. Do not paint prefinished acoustic materials or acoustic suspension systems.
- F. Do not paint over Underwriters Laboratories, Factory Mutual or other code-required labels or identifications.

3.5 APPLICATION

- A. Apply products in accordance with manufacturer's instructions.
- B. Do not apply finishes to surfaces that are not dry.
- C. Apply prime coat to surfaces which are to be painted or finished.
- D. Apply each coat to uniform finish.
- E. Apply each coat of paint slightly darker than preceding coat unless otherwise approved.
- F. Sand lightly between coats to achieve required finish.
- G. Allow applied coat to dry before next coat is applied.
- H. The number of coats specified is the minimum that shall be applied. Apply additional coats when undercoats, stains or other conditions show through final paint coat, until paint film is of uniform finish, color and appearance.
- I. Where clear finishes are required, tint fillers to match wood. Work fillers into the grain before set. Wipe excess from surface.
- J. Prime back surfaces of interior and exterior woodwork with primer paint.
- K. Prime back surfaces of interior woodwork scheduled to receive stain or varnish finish with gloss varnish reduced 25 percent with mineral spirits.
- L. Paint mill finished door seals to match door or frame.
- M. Paint primed steel glazing stops in doors to match door or frame.
- N. Cloudiness, spotting, lap marks, brush marks, runs, sags, spikes and other surface imperfections will not be acceptable.
- O. Where spray application is used, apply each coat of the required thickness. Do not double back to build up film thickness of two coats in one pass.
- P. Where roller application is used, roll and redistribute paint to an even and fine texture. Leave no evidence of roller laps, irregularity of texture, skid marks, or other surface imperfections.

3.6 FINISHING MECHANICAL AND ELECTRICAL EQUIPMENT

- A. Refer to Section 22 05 53, 23 05 53, 26 05 53, and 27 05 53 for schedule of color coding and identification banding of equipment, ductwork, piping, and conduit.

- B. Paint shop primed equipment. Do not paint shop prefinished items.
- C. Remove unfinished louvers, grilles, covers, and access panels on mechanical and electrical components and paint separately.
- D. Prime and paint insulated and exposed pipes, conduit, boxes, insulated and exposed ducts, hangers, brackets, collars and supports, except where items are prefinished.
- E. Replace identification markings on mechanical or electrical equipment when painted accidentally.
- F. Paint interior surfaces of air ducts, and connector and baseboard heating cabinets that are visible through grilles and louvers with one coat of flat black paint, to limit of sight line. Paint dampers exposed behind louvers, grilles, and connector and baseboard cabinets to match face panels.
- G. Paint exposed conduit and electrical equipment occurring in finished areas.
- H. Paint both sides and edges of plywood backboards for electrical and telephone equipment before installing equipment.
- I. Color code equipment, piping, conduit, and exposed ductwork in accordance with requirements indicated. Color band and identify with flow arrows, names, and numbering.
- J. Replace electrical plates, hardware, light fixture trim, and fittings removed prior to finishing.
- K. Paint grilles, registers, and diffusers which do not match color of adjacent surface.
- L. Paint all mechanical and electrical equipment, vents, fans, and the like occurring on roof.
- M. Do not paint moving parts of operating units; mechanical or electrical parts such as valve operators; linkages; sensing devices; and motor shafts.
- N. Do not paint over labels or equipment identification markings.
- O. Do not paint mechanical room specialties such as compressors, boilers, pumps, control panels, etc.
- P. Do not paint switch plates, light fixtures, and fixture lenses.

3.7 CLEANING

- A. As Work proceeds, promptly remove paint where spilled, splashed, or spattered.
- B. During progress of Work maintain premises free of unnecessary accumulation of tools, equipment, surplus materials, and debris.
- C. Collect cotton waste, cloths, and material which may constitute a fire hazard, place in closed metal containers and remove daily from site.

3.8 PROTECTION OF COMPLETED WORK

- A. Protect finished installation under provisions of Section 01 61 00.
- B. Erect barriers and post warning signs. Maintain in place until coatings are fully dry.
- C. Confirm that no dust generating activities will occur following application of coatings.

3.9 PATCHING

- A. After completion of painting in any one room or area, repair surfaces damaged by other trades.
- B. Touch-up or re-finish as required to produce intended appearance.

3.10 FIELD QUALITY CONTROL

- A. Field inspection and testing will be performed under provisions of Section 01 45 29.
- B. The Owner reserves the right to invoke the following test procedure at any time and as often as the Owner deems necessary.
- C. The Owner will engage the services of an independent testing agency to sample paint material being used.
- D. Samples of material delivered to the Project will be taken, identified, sealed, and certified in the presence of the Contractor.
- E. The testing agency will perform appropriate quantitative materials analysis and other characteristic testing of materials as required by the Owner.
- F. If test results show materials being used and their installation do not comply with specified requirements or manufacturer's recommendations, the Contractor may be directed to stop painting, remove noncomplying paint, pay for testing and repaint surfaces to acceptable condition.

3.11 COLOR SCHEDULE

- A. Paint and finish colors shall be selected by the Architect from manufacturer's entire range of standard and custom color selections and special colors selected to match or compliment the colors of other materials, equipment, or components which comprise the work.
- B. Access doors, registers, exposed piping, electrical conduit and mechanical/electrical panels: Generally the same color as adjacent walls.
- C. Exterior and interior steel doors, frames and trim: Generally a contrasting color to adjacent walls.
- D. Doors generally are all the same color, but of a contrasting color from frame and trim.
- E. Exterior and interior steel fabrications: Generally a contrasting color to adjacent walls.
- F. Exposed interior mechanical/ductwork: Generally a contrasting color to adjacent walls or ceiling.
- G. Ceilings are generally to be painted a different color than walls.
- H. Account for different color schemes for painting of walls.
- I. Approximately 20 percent of overall painting work will be required to be "Deep Tone" colors. This work will require one additional coat of paint beyond that as specified.

3.12 SCHEDULE - EXTERIOR SURFACES

- A. Steel - Primed or Unprimed (Semi-Gloss Urethane Alkyd Enamel)
 - 1st coat: BRPR00 Bloc-Rust Premium
 - 2nd coat: ASHL50 Aristoshield
 - 3rd coat: ASHL50 Aristoshield
- B. Steel - Galvanized (Semi-Gloss Urethane Alkyd Enamel)
 - 1st coat: Supreme Chemical Metal Clean and Etch SCME-01
 - 2nd coat: ULGM00 Ultrashield Galvanized Metal Primer
 - 3rd coat: ASHL50 Aristoshield
 - 4th coat: ASHL50 Aristoshield

3.13 SCHEDULE - INTERIOR SURFACES

- A. Wood - Transparent (Stain - Semi-Gloss Polyurethane)
- | | |
|-------------------------------------|------------------------------------|
| 1st coat: | V109 Stainseal - Minwax Stain |
| Filler coat (Open grain wood only): | Valspar Wood Filler VSP 0109 |
| 2nd coat: | Cabot W.B. Polyurethane CAB 8087-1 |
| 3rd coat: | Cabot W.B. Polyurethane CAB 8087-1 |
| 4th coat: | Cabot W.B. Polyurethane CAB 8087-1 |
- B. Concrete Masonry Units (Eggshell, Acrylic)
- | | |
|-----------|-------------------------------|
| 1st coat: | SBPROO Smooth Blocfil Premium |
| 2nd coat: | SPMA30 Suprema |
| 3rd coat: | SPMA30 Suprema |
- C. Steel - Primed or Unprimed (Semi-Gloss Urethane Alkyd Enamel)
- | | |
|-----------|--------------------------|
| 1st coat: | BRPR00 Bloc-Rust Premium |
| 2nd coat: | ASHL50 Aristoshield |
| 3rd coat: | ASHL50 Aristoshield |
- D. Steel - Galvanized (Semi-Gloss Urethane Alkyd Enamel)
- | | |
|-----------|--|
| 1st coat: | ULGM00 Ultrashield Galvanized Metal Primer |
| 2nd coat: | ASHL50 Aristoshield |
| 3rd coat: | ASHL50 Aristoshield |
- E. Gypsum Board (Eggshell Acrylic)
- | | |
|-----------|---------------------------|
| 1st coat: | VNPROO Vinylastic Premium |
| 2nd coat: | SPMA30 Suprema |
| 3rd coat: | SPMA30 Suprema |
- F. Gypsum Board (Semi-Gloss Acrylic)
- | | |
|-----------|---------------------------|
| 1st coat: | VNPROO Vinylastic Premium |
| 2nd coat: | SPMA50 Suprema |
| 3rd coat: | SPMA50 Suprema |

END OF SECTION

SECTION 09 96 23

GRAFFITI RESISTANT COATING

1. PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Anti-graffiti coating system on exterior surfaces.
- B. Application schedule.

1.2 REFERENCES

- A. SCAQMD - South Coast Air Quality Management District

1.3 SUBMITTALS

- A. Provide submittals in accordance with Section 01 33 00.
- B. Samples: Submit samples of coating system.
- C. Furnish samples on the same materials to which coating will be applied. Coat one-half of each sample with the other half non-coated.
- D. Product Data: Submit manufacturer's technical data and installation instructions, recommended coverage rates, and evidence that coatings conform to all requirements specified. Submit evidence of regulatory agency approvals.
- E. Installer: Submit written evidence that installer is a certified applicator by the manufacturer of the anti-graffiti coating system specified in this section and has completed at least 10 projects of similar complexity within the past 5 years.
- F. Certificate and Summary Statement: Before Substantial Completion, submit a certificate stating that coatings applied conform to all specified requirements. Provide a summary statement setting forth the following:
 - 1. Number of square feet of each surface treated with coating, classified as to the kind of material treated, open pore or closed pore type, and whether vertical or horizontal.
 - 2. The number of gallons of each type, class, or grade of coating required to treat all involved surfaces, based on the number of square feet of each type and orientation of the material coating was installed on.
 - 3. Total gallons of each coating type, class, or grade installed.
- G. Maintenance Instructions: Furnish manufacturer's recommended graffiti removal instructions, and recommendations for recoating. Furnish names and addresses of cleaning firms and of suppliers of maintenance materials.
- H. Maintenance Material: Furnish five gallons of each coating system component and remover.

1.4 QUALITY ASSURANCE

- A. Installer: Applicator shall be certified by the manufacturer of the anti-graffiti coating system.
- B. Manufacturer: Shall have been regularly engaged in manufacture of anti-graffiti coating system for at least 10 years. Manufacturer shall supply references of at least 50 satisfactory installations in which anti-graffiti coating has been in service for at least 5 years.

- C. Manufacturer's Observation: Start coating application under the observation of the coating manufacturer's technical representative. Notify the Architect at least 72 hours before starting installation.
- D. Preliminary Tests: Perform tests on surface to be treated to establish the actual application rates required to provide the surface resistant to defacing and meet warranty requirements. Test shall demonstrate the coating does not yellow, darken, mottle, or discolor any treated surface and those surfaces to be treated are dry. Established application rates shall not be less than those recommended in the coating manufacturer's technical data for the kind and surface orientation of the material.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Deliver, store, and protect products to site under provisions of Section 01 61 00.
- B. Deliver all coating materials to the Project site in containers bearing name and batch number of manufacturer, with seals intact.
- C. Protection: Install temporary coverings and protection and do not allow any coating to contact plastic, planting soil, plants, asphaltic paving, roofing membranes, or other materials damaged by coating.

1.6 PROJECT CONDITIONS

- A. Weather Conditions: Do not install coating during windy, wet, or excessively hot or dry weather conditions.
- B. Air temperature limitations are between 40 and 100 degrees F with a humidity level of no more than 85 percent.

1.7 WARRANTY

- A. Provide 10 year warranty under provisions of Section 01 77 00.
- B. Warranty shall include coverage for failure of system to withstand complete graffiti removal, ghosting, shadowing, chemical staining, yellowing, and normal environmental effects.

2. PART 2 - PRODUCTS

2.1 MANUFACTURER

- A. Basis of Design: Graffiti Solution System (GSS) manufactured by GSS Coatings, LLC, www.gsscoatings.com.
- B. Substitutions: Under provisions of Section 01 25 13.

2.2 COATING MATERIALS

- A. Primer: GSS500 Aqua-lock WB siloxane penetrating water sealer.
- B. GSS-10 Undercoating: GSS307, clear VU water based high solids base coat.
- C. GSS-10 Top Coat: GSS100 clear matte.
- D. Graffiti Remover: GSS-Erasol, non-flammable, biodegradable graffiti remover.

2.3 PROPERTIES

- A. Coating shall not darken or discolor treated surfaces and shall be non-toxic, compatible with all standard polymer type caulking and sealing materials.

- B. Coating system shall conform to AQMD Rule 1113.
- C. Coatings shall be non-sacrificial.

3. PART 3 - EXECUTION

3.1 EXAMINATION

- A. Do not start installation of coating if conditions are present that prevent or interfere with the correct preparation of surfaces or installation of coating system.

3.2 PREPARATION

- A. Remove dust, dirt, oil, grease, other deleterious substances and stain, efflorescence and laitance from surfaces.
- B. Mask and protect adjoining surfaces and glass.

3.3 APPLICATION

- A. Install anti-graffiti coating system to surface areas in locations as indicated on drawings and in application schedule.
- B. Primer: Apply coating in one continuous successive wet-on-wet application in accordance with manufacturer's instructions. Minimum coating thickness of 3 to 4 mils dry film thickness.
- C. Undercoating and Top Coat Application Rates: Install base and finish coats in a minimum of one coat each as recommended by manufacturer, in the quantity of coating and coverage rates per coat established by preliminary tests. Total quantity shall not be less than the rate recommended for the involved surface in manufacturer's technical data.
- D. Spray Application: Install each coat by airless spray with nominal 20 psi nozzle pressure. Obtain complete coverage of each coat. Document areas that are coated when application is stopped or at the end of the day.
- E. Apply anti-graffiti coating from finished exterior grade line full height of wall surface

3.4 CLEANING

- A. Remove rubbish, debris, and waste materials and legally dispose of off site.

3.5 FIELD QUALITY CONTROL

- A. Apply an alkyd based graffiti to a 2 square foot treated area as selected by Architect.
- B. Apply graffiti a minimum of 5 days after anti-graffiti coating application.
- C. Demonstrate complete removal of graffiti in presence of Architect.

3.6 PROTECTION

- A. Protect the Work of this section until Substantial Completion.

3.7 APPLICATION SCHEDULE

- A. Apply anti-graffiti coating system to the following exterior surfaces:
 - 1. Integrally colored concrete unit masonry building walls.
 - 2. Integrally colored concrete unit masonry yard walls.

3. Concrete yard walls.
4. Concrete building walls.

END OF SECTION

SECTION 10 11 19

MARKERBOARDS AND TACKBOARDS

1. PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Markerboards.
- B. Tackboards.
- C. Trim, chalkrail, and accessories.

1.2 REFERENCES

- A. ANSI A208.1 - Mat Formed Wood Particleboard.
- B. ASTM B221 - Aluminum-Alloy Extruded Bars, Rods, Wire, Shapes, and Tubes.
- C. ASTM A424 - Steel Sheets for Porcelain Enameling.
- D. ASTM C208 - Insulation Board (Cellulose Fiber).
- E. ASTM E84 - Test Method for Surface Burning Characteristics of Building Materials.
- F. CFFA-W-101-A - Chemical Fabrics and Film Association Quality Standard for Vinyl Coated Fabric Wallcovering.
- G. FS CCC-W-408 A and B - Wall Covering, Vinyl-Coated.
- H. Porcelain Enamel Institute - Performance Specifications for Porcelain Enamel Chalkboards.
- I. UL - Underwriters Laboratories, Inc.

1.3 REGULATORY REQUIREMENTS

- A. Conform to flame/fuel/smoke rating of 25/0/25 for vinyl fabric covered tackboards when tested in accordance with ASTM E84 by UL.

1.4 MAINTENANCE DATA

- A. Submit maintenance data under provisions of Section 01 77 00.
- B. Include maintenance information on regular cleaning and stain removal.

1.5 WARRANTY

- A. Provide five year warranty under provisions of Section 01 77 00.
- B. Warranty: Include coverage for discoloration of surfaces due to cleaning, crazing or cracking and staining.

2. PART 2 PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

- A. AARCO Products, Inc., www.aarco.com.
- B. Claridge Products and Equipment, Inc., www.claridgeproducts.com.
- C. Lemco, www.adplemco.com.

- D. Nelson Adams, www.nelsonadamsnaco.com
- E. Platinum Visual Systems, www.pvsusa.com.
- F. Tri-Best Visual Display Products, www.tri-best.com.
- G. Substitutions: Under provisions of Section 01 25 13.

2.2 MATERIALS

- A. Steel Sheet: ASTM A424, Type I, commercial quality.
- B. Aluminum Extrusions: ASTM B221, 6063 alloy, T5 temper.
- C. Cork: Fine grain natural cork, homogeneous composition.
- D. Particle Board: ANSI A208.1; wood shavings set with waterproof resin binder, sanded faces.
- E. Fiberboard: Industrial insulation board, ironed and prime coated, ASTM C208, cellulosic, 3/8 inch thick, 4 foot wide x required length, made with binder containing no urea formaldehyde.
- F. Foil Backing: Aluminum foil sheet.
- G. Honeycomb: Honeycell/Honeycomb.
- H. Tackboard Covering: Koroseal Wallcoverings, www.koroseal.com conforming to FS CCC-W-408 A and B and CFFA W-101-B, Type II and the following:
 - 1. Total Weight: 20 oz/lin yd
 - 2. Roll Width: 54 inches
 - 3. Pattern: Spellbound Muratone
 - 4. Color: As selected
- I. Adhesives: Type recommended by manufacturer.

2.3 ACCESSORIES

- A. Map Rail Accessories: Formed aluminum display hooks, map roller brackets, and flag holder. Sliding type to fit map rail. One pair of display hooks and map roller brackets for every two feet of map rail. One flag holder per map rail.
- B. Protective Cover: Sheet polyethylene, 8 mil thick.
- C. Blocking Pads: Manufacturer's standard padding designed to prevent deflection.
- D. Metal Mounting Clips: Steel angle clips, 2 inches long x 16 gage thick.

2.4 FABRICATION - MARKERBOARDS

- A. Outer Face Sheet: Steel, 24 gage thick. Equivalent to Claridge LCS.
- B. Core: Particle Board, 3/8 inch thick
- C. Backing Surface: Aluminum foil, 0.005 inch thick.
- D. Units up to 16 feet in length to be one piece construction, no joints.

2.5 FABRICATION - TACKBOARDS

- A. Outer Facing: Tackboard covering.
- B. Underlayment: Cork, 1/8 inch thick.
- C. Core: Fiberboard, 3/8 inch thick.
- D. Units up to 16 feet in length to be one piece construction, no joints.

2.6 FRAME AND TRIM

- A. Frame: Extruded aluminum, equivalent to Claridge Series 5 profile; concealed fasteners; map rail with 1/4 inch thick cork insert over markerboard surfaces.
- B. Chalkrail: Extruded aluminum, equivalent to Claridge 992 profile; one piece, full length of markerboard; concealed fasteners.

2.7 FINISHES

- A. Porcelain Enamel: Glass fibered enamel, baked to vitreous surfaces; Porcelain Enamel Institute Type A; low gloss; color as selected from manufacturer's standard range.
- B. Tackboard Surface: Vinyl of color as selected from manufacturer's standard range.
- C. Aluminum Frame and Accessories: Clear satin finish.

3. PART 3 EXECUTION

3.1 INSPECTION

- A. Verify that surfaces and internal wall blocking are ready to receive work, and dimensions are as instructed by the manufacturer.
- B. Beginning of installation means acceptance of substrate construction.

3.2 INSTALLATION

- A. Install markerboards and tackboards in accordance with manufacturer's instructions and as indicated on drawings.
- B. Install blocking pads behind markerboards and tackboards at 16 inches on center both vertically and horizontally.
- C. Install metal clips at 16 inches on center at sides and bottom of boards.
- D. Secure units level and plumb.
- E. Butt markerboard panels tight with concealed spline to hairline joint.

3.3 CLEANING

- A. Clean markerboard and tackboard surfaces in accordance with manufacturer's instructions.
- B. Cover markerboard surfaces with protective cover, taped to frame.
- C. Remove protective cover at Date of Substantial Completion.

END OF SECTION

SECTION 10 11 43

TACKABLE WALLBOARD SYSTEMS

1. PART 1 GENERAL

1.1 WORK INCLUDED

- A. Tackable wall board.
- B. Aluminum trim.

1.2 REFERENCES

- A. ASTM C208 - Insulation Board (cellulose fiber)
- B. ASTM C557 - Adhesive for Fastening to Wood Framing.
- C. ASTM E84 - Test Method of Surface Burning Characteristics of Building Materials.
- D. ASTM D-1308 - Effect of Household Chemicals on Clear and Pigmented Organic Finishes.
- E. CFFA-W-101-B - Chemical fabrics and Film Association Quality Standard for Vinyl Coated Fabric Wallcovering.
- F. FS CCC-W-408 A and B - Wall Covering, Vinyl Coated.
- G. FS L-P-1040-B - Plastic Sheets and Strips (Polyvinyl Fluoride).
- H. UL - Underwriters Laboratories, Inc.

1.3 QUALITY ASSURANCE

- A. Applicator: Company specializing in Tackable Wallboard work with ten years documented experience.
- B. Stain Resistance: ASTM D1308, spot test open; shall show no staining by reagents when cleaned using soap and water.

1.4 REGULATORY REQUIREMENTS

- A. Conform to flame spread and smoke developed ratings of no more than 25/50 for vinyl fabric covered tack surfaces when tested in accordance with ASTM E84 by UL.

1.5 SUBMITTALS

- A. Submit shop drawings and product data under provisions of Section 01 33 00.
- B. Provide product data on vinyl coated fabric and fiberboard.
- C. Submit samples under provisions of Section 01 33 00.
- D. Submit full range of manufacturers color selection for vinyl wallcovering specified.
- E. Submit test reports verifying flame/smoke ratings.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Deliver, store, and protect products to site under provisions of Section 01 61 00.
- B. Deliver tackable wallboard panels to site in unbroken and undamaged factory wrappings, clearly labeled with manufacturers lot number.

- C. Protect tackable wallboard panels from moisture during shipment, storage, and installation.

1.7 ENVIRONMENTAL REQUIREMENTS

- A. Do not begin installation of tackable wall board system until spaces have been enclosed and are ventilated and heated to maintain substrate surface temperature.
- B. Maintain constant temperature of no less than 60 degrees F and humidity level of 30 to 50 percent 72 hours prior to, during and after installation of the work of this section.

1.8 EXTRA STOCK

- A. Provide 25 lineal feet of each pattern and color of wallcovering under provisions of Section 01 77 00.
- B. Package and label each roll by manufacturer, color, and pattern, and designated room number; store where directed.
- C. Provide 50 lineal feet of aluminum panel trim under provisions of Section 01 77 00.
- D. Provide 10 panels of each pattern and color under provisions of Section 01 77 00.

2. PART 2 PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS - WALLBOARD SYSTEM

- A. ABC School Equipment Co., www.abcschoolequipment.com.
- B. Chatfield Clarke Co., www.chatfield-clarke.com.
- C. Fabricmate Systems, www.fabricmate.com.
- D. InWest Manufacturing, www.inwestmfg.com.
- E. Lamvin Inc., www.lamvin.com.
- F. LBI-Boyd, www.lbiboyd.com.
- G. Nelson Adams, www.nelsonadamsnaco.com.
- H. Substitutions: Under provisions of Section 01 25 13.

2.2 ACCEPTABLE MANUFACTURERS - WALLCOVERING

- A. Bolta Wallcoverings, www.omnova.com.
- B. Brewster Wall Coverings, www.brewsterwallcoverings.com.
- C. Contract Wallcoverings Inc., www.contract-wallcoverings.com.
- D. Essex Wallcoverings, www.omnova.com.
- E. Genon, www.muraspecna.com.
- F. Guard, www.muraspecna.com.
- G. Koroseal Wallcoverings, www.koroseal.com.
- H. JM Lynne Co., www.jmlynne.com.
- I. Metro Wallcoverings, www.metrowallcoverings.com.

- J. Trikes, www.trikes.com.
- K. Vicrtex Wallcovering, www.koroseal.com.
- L. Wolf-Gordon, Inc., www.wolf-gordon.com.
- M. Substitutions: Under provisions of Section 01 25 13.

2.3 MATERIALS - WALLCOVERING

- A. Vinyl Wallcovering: Koroseal Wallcoverings, conforming to FS CCC-W-A08 A and B and CFFA W-101-B for Type II vinyl wallcovering. Composition as follows:
 - 1. Total Weight 20 oz./lin yd
 - 2. Roll Width 54 inches
 - 3. Fire Rating, ASTM E84: Class A
 - (a) Flame Spread 15
 - (b) Smoke Developed 20
 - 4. Pattern Muratone
 - 5. Color As selected
 - 6. Formulation Mildew inhibitorized with early warning effect formulation.
- B. Acoustic Wallcovering: Wolf Gordon Inc., Silent Running SRI Series wall carpet conforming to the following:
 - 1. Total Weight 21 oz./lin yd
 - 2. Roll Width 54 inches
 - 3. Acoustical Rating .60 NRC
 - 4. Fire Rating, ASTM E84: Class A
 - (a) Flame Spread 15
 - (b) Smoke Developed 15
 - 5. Color As selected
- C. Substitutions: Under provisions of Section 01 25 13.

2.4 ACCESSORIES

- A. Fiberboard: Industrial Insulation Board, ironed and prime coated, ASTM C208, cellulosic, 1/2 inch thick, 4 foot wide x required length, square edges, 16 lb/cu ft density made with binder containing no urea formaldehyde; flame spread and smoke developed rating of 20/30 when tested according to ASTM E84.
- B. Wallcovering Adhesive: Manufacturer's standard for use with specified wallcovering and substrate application. Mildew-resistant, nonstaining, and strippable. Shall meet South Coast Air Quality Management District (SCAQMD) Rule #1168.
- C. Panel Adhesive: ASTM C557.
- D. Trim: Clear anodized, Kynar finish, color as selected, aluminum "J" molding at bottom, aluminum "L" molding at top and where indicated. All other edges vinyl wrapped.
- E. Substitutions: Under provisions of Section 01 25 13.

3. PART 3 EXECUTION

3.1 FABRICATION

- A. Machine apply vinyl wallcovering continuous over length of fiberboard sheet.
- B. Wrap vinyl continuous around edges. Return vinyl a minimum of 2 inches on back of panel.
- C. No seams permitted on individual panels.
- D. Field application of vinyl is not permitted.
- E. Laminate wall covering in numbered sequence of covering.
- F. Laminate wall covering to core free from bubbles, sags, wrinkles, distortion and free of adhesive.

3.2 INSPECTION

- A. Verify that site conditions are ready to receive work and opening dimensions are as indicated on shop drawings.
- B. Insure backing materials are firmly attached, free from warps and surface defects and ready to receive individual panels.
- C. Beginning of installation means acceptance of substrate.

3.3 INSTALLATION

- A. Erect fiberboard in vertical direction. Install in full length sections with no horizontal joints.
- B. Install panels beginning at center point of wall and working to room corners.
- C. Install panels in order of sequence of wall covering.
- D. Install panels with vertical surfaces and edges plumb, top edges level and in alignment with other panels.
- E. Install panels butted tight to adjacent materials; casework, chair rail, door frames, ceilings, floors, and soffits as indicated on the Drawings. Provide lap beneath other tack or chalk board systems to conceal unfinished edges.
- F. Provide cutouts for electrical outlets, switches, thermostats, and other services.
- G. Attachment: Secure fiberboard to substrate with adhesive and sufficient support to hold in place. Apply adhesive in accordance with manufacturer's instruction.

3.4 TOLERANCES

- A. Maximum Variation from True Flatness: 1/8 inch in 10 feet in any direction.

3.5 CLEANING PROCEDURES

- A. Remove by rubbing lightly with a moistened cloth, sponge, or stiff bristle brush using a mild soap, detergent, or non-abrasive cleanser and clean water.
- B. Strong organic solvents (such as Ketones) and harsh abrasive cleaners are not to be used.
- C. Contact wall covering manufacturer for special cleaning problems and follow their recommendations if required.

END OF SECTION

SECTION 10 14 00

SIGNAGE

1. PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Plastic/acrylic signs.
- B. Metal signs.
- C. Letters and numbers.
- D. Cast metal plaques.
- E. Fire wall barrier identification signs.
- F. Precast Concrete Monument Sign.

1.2 REFERENCES

- A. CBC - California Building Code, (CCR) California Code of Regulations, Title 24, Part 2.
- B. 2010 Americans with Disabilities Act (ADA) Standards for Accessible Design.

1.3 SUBMITTALS

- A. Submit shop drawings under provisions of Section 01 33 00.
- B. Submit shop drawings listing sign styles, lettering and locations, spacing and installation method.
- C. Submit samples under provisions of Section 01 33 00.
- D. Submit two samples illustrating full size sample sign, of type, style and color specified including method of attachment.
- E. Submit manufacturer's installation instructions under provisions of Section 01 33 00.
- F. Include installation templates and hardware.

1.4 REGULATORY REQUIREMENTS

- A. Conform to CBC - California Building Code, (CCR), Title 24, Part 2 and the 2010 Americans with Disabilities Act (ADA) Standards for Accessible Design for accessibility requirements.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Deliver, store, and protect products to site under provisions of Section 01 61 00.
- B. Package signs, labeled in name groups.

1.6 ENVIRONMENTAL REQUIREMENTS

- A. Do not install adhesive mounted signs when ambient temperature is below 70 degrees F. Maintain this minimum during and after installation of signs.

2. PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Acrylic Signs:

1. Architectural Sign Identity, www.architecturalsignidentity.com.
2. ASI - Sign Systems, www.asisignage.com.
3. Best Manufacturing, www.bestsigns.com.
4. Bravo Sign and Design, www.bravosign.com.
5. CA Signs, www.casigns.com.
6. Mohawk Sign Systems, www.mohawksign.com.
7. Neiman and Company, www.neimanandco.com.
8. Signs and Lucite Products, Inc., www.adasignscalifornia.com
9. Signtec, www.signtec.com.
10. Southwell Company, www.southwellco.com.
11. Vomar Products, Inc., www.vomarproducts.com.
12. Substitutions: Under provisions of Section 01 25 13.

B. Letters and Numbers:

1. ARK Ramos, www.arkramos.com.
2. ASI - Sign Systems, www.signage.com.
3. Bravo Sign and Design, www.bravosign.com.
4. Gemini, www.gemini.signproducts.com
5. Matthews, www.matthewssigns.com.
6. Nelson-Harkins Ind., www.nelson-harkins.com.
7. Neiman and Company, www.neimanandco.com.
8. Southwell Company, www.southwellco.com.
9. Signs and Lucite Products, Inc., www.adasignscalifornia.com.
10. Signtec, www.signtec.com.
11. Vomar Products, Inc., www.vomarproducts.com.
12. Substitutions: Under provisions of Section 01 25 13.

C. Cast Metal Plaques:

1. ARK Ramos, www.arkramos.com.
2. Bravo Sign and Design, www.bravosign.com.

3. Gemini, www.geminisignproducts.com.
4. Matthews, www.matthewsbronze.net.
5. Signs and Lucite Products, Inc., www.adasignscalifornia.com
6. Signtec, www.signtec.com.
7. Southwell Company, www.southwellco.com.
8. Substitutions: Under provisions of Section 01 25 13.

D. Metal and Traffic Signs:

1. Four S Company, (877) 597-1288. No URL available.
2. Signs and Lucite Products, Inc., www.adasignscalifornia.com
3. Signtec, www.signtec.com.
4. Traffic Management Inc., www.trafficmanagement.com.
5. Substitutions: Under provisions of Section 01 25 13.

E. Precast Concrete Monument Sign.

1. Quickcrete Products Corp., www.quickcrete.com.
2. Wausau Tile, www.wausautile.com
3. Substitutions: Under provisions of Section 01 25 13.

F. Fire Wall Barrier Identification Sign:

1. Fire Wall Signs, Inc., www.firewallsigns.com.
2. Fire Safety Signs, www.mysafetysign.com.
3. Substitutions: Under provisions of Section 01 25 13.

2.2 MANUFACTURED UNITS

- A. Exterior Wall Graphics: Size indicated on drawings. Aluminum letters: Style Kabel 502, mounting CMU PM-1, metal studs PM-1A.
- B. Room Control Signage: Mohawk Sign Systems, Series 200A, Format D Sand Carved Process, with 1/32 inch raised border and letters with integral California round top contracted Grade 2 braille dots with dot spacing in compliance with CBC Table 11B-703.3.1 raised a minimum of 1/ 40 inch. Material shall be 1/8 inch thick x 6 inch high MP plastic plate of length required with 1 inch high helvetica medium lettering; adhesive and mechanical mounting with copy centered on plate. Provide one sign for each door shown on the drawings. Allow for twelve letters and three numerals for each sign. Signage to be in compliance with the requirements of Article 703 of the 2010 ADA Standards for Accessible Design and CBC, California Building Code (CCR), Title 24, Part 2, Section 11B-703.
- C. Tactile Exit Signage: Mohawk Sign Systems, Series 200A, Format D Sand Carved Process, with 1/32 inch raised border and letters with integral California round top contracted Grade 2 braille dots with dot spacing in compliance with CBC Table 11B-703.3.1 raised a minimum of 1/ 40 inch. Material shall be 1/8 inch thick x 6 inch high MP plastic plate of length required with 1 inch high helvetica medium lettering; adhesive and mechanical mounting with copy centered on plate. Provide signs at locations shown on the drawings. Signage to be in compliance with the requirements of Article 703 of the 2010 ADA Standards for Accessible Design and CBC, California Building Code (CCR), Title 24, Part 2, Section 1011.4 and 11B-703.

- D. Pictorial Symbol Signage: Mohawk Sign Systems, Series 200A, Format D Sand Carved Process, with 1/32 inch raised border and letters with integral California round top contracted Grade 2 braille dots with dot spacing in compliance with CBC Table 11B-703.3.1 raised a minimum of 1/40 inch. Material shall be 1/8 inch thick MP plastic plate of size indicated with lettering and symbols as indicated; adhesive and mechanical mounting with copy centered on plate. Provide sign in locations shown on the drawings. Signage to be in compliance with the requirements of Article 703 of the 2010 ADA Standards for Accessible Design and CBC, California Building Code (CCR), Title 24, Part 2, Section 11B-703.
- E. Rescue Assistance Sign: Mohawk Sign Systems. Series 200A, Format D Sand Carved Process, with 1/32 inch raised letters with integral California round top contracted Grade 2 braille dots with dot spacing in compliance with CBC Table 11B-703.3.1 raised a minimum of 1/40 inch. Material shall be 1/8 inch thick MP plastic plate of size indicated with lettering indicated, mechanical mounting with copy centered on plate. Provide sign in locations as shown on the drawings. Signage shall be in compliance with requirements of Article 703 of the 2010 ADA Standards for Accessible Design and CBC, California Building Code (CCR), Title 24, Part 2, Section 11B-703.5.
- F. Entrance and Restroom Signage:
1. Restroom Doors: Acrylic plastic signs equivalent to that as detailed on the drawings; 12 inch circle and triangle with international symbol of accessibility in accordance with CBC, California Building Code, (CCR), Title 24, Part 2, Section 11B-216.8 and 11B-703.7.2.6.
 2. Building Entrance: Equivalent to 5 inch square, reflective plastic accessible sign in accordance with CBC, California Building Code (CCR), Title 24, Part 2, Section 11B-216.6 and 11B-703.7.2.1.
- G. Exterior Directional Signage: 0.080 inch thick aluminum sheet sign of size indicated. Paint with reflectorized paint. Graphics and text to be as indicated. Mount sign to wall with four countersunk vandal resistant screws or on free standing 2-inch diameter standard weight galvanized steel pipe post as indicated. Signs shall be in conformance with CBC, California Building Code (CCR), Title 24, Part 2, Section 11B-216.9.2 and 11B-703.5.
- H. Accessible Gate Signage: 0.080 inch thick aluminum sheet sign of size indicated. Paint with reflectorized paint. Graphics and text to be as indicated. Attach sign to adjacent fence with 12 gage wire ties at each corner. Mount sign at 5'-0" from grade to center of sign. Sign shall be in conformance with CBC, California Building Code (CCR), Title 24, Part 2, Section 11B-206.4.7 and 11B-404.1.1.
- I. Fire Wall Barrier Identification Sign: 11 x 15 inch adhesive backed vinyl sign with minimum 3 inch high letters identifying wall as a fire and or smoke barrier; listing hourly rating of fire wall; with specific language stating that all openings in wall are to be protected. Sign shall be in conformance with CBC, California Building Code (CCR), Title 24, Part 2, Section 703.7.
- J. Safe Dispersal Area Sign: 0.080 inch thick aluminum sheet sign in size indicated. Paint with reflectorized paint. Text to be as indicated. Mount and attach sign to adjacent fence fabric, post, or wall as indicated on drawings. Sign shall be in conformance with CBC, California Building Code (CCR), Title 24, Part 2, Section 1028.5.
- K. Storage Room Sign: Mohawk Sign Systems, Series 200A, Format A, Sand Carved Process. Material shall be 1/8 inch thick MP plastic plate of size indicated with lettering indicated, mechanical and adhesive mounting with copy centered on plate. Provide signs in locations as shown on drawings. Signage shall be in conformance with CBC, California Building Code, (CCR), Title 24, Part 2, Section 3005.4. 1. 6.
- L. Traffic Signage:
1. Van Parking Stall: 12 inch x 18 inch 0.080 inch thick aluminum accessible sign in accordance with CBC, California Building Code, (CCR), Title 24, Part 2, Section 11B-502.6 and 11B-703.7.2.1 with separate 12 inch wide x 4 inch high sign with "Van-Accessible" wording and additional language below symbol of accessibility that states "Minimum Fine \$250.00." Mount on 2 inch diameter standard weight galvanized steel pipe post.

2. Auto Parking Stall: 12 inch x 18 inch 0.080 inch thick aluminum accessible sign in accordance with CBC, California Building Code, (CCR), Title 24, Part 2, Section 11B-502.6 and 11B-703.7.2.1 with additional language below symbol of accessibility that states "Minimum Fine \$250.00." Mount on 2 inch diameter standard weight galvanized steel pipe post
3. Drive Approach: 18 inch x 24 inch 0.080 inch thick aluminum tow-away sign with local address and police phone number in accordance with CBC, California Building Code, (CCR), Title 24, Part 2, Section 11B-502.8.1. Mount on 2 inch diameter standard weight galvanized steel pipe post.
4. Passenger Loading Zone: 12 inch x 18 inch 0.080 inch thick aluminum sign as detailed on drawings. Mount on 2 inch diameter standard weight galvanized steel pipe post.

M. Occupant Load Signage:

1. Provide maximum occupant load signs where indicated on drawings. Locate near main exit of space.
2. Material: 1/8 inch thick x 6 inch high MP plastic plate of length required with 3/4 and 1/2 inch high helvetica medium lettering: adhesive and mechanical mounting with copy centered on plate.
3. Signage to conform to the requirements of the CBC, California Building Code, (CCR) California Code of Regulations, Title 24, Part 2, Section 1004.3.

N. Cast Plaque:

1. Material: Cast Bronze.
2. Size: 30 x 36 inches.
3. Letter Style: Helvetica medium.
4. Border Style: Double line.
5. Background Texture: Travertine.
6. Mounting Method: Boss and stud.
7. Background Color: As selected by Architect.
8. Copy: As selected by Architect.

O. Precast Concrete Monument Sign:

1. Precast concrete: Sand colored concrete.
2. Double sided. Sealed surface both sides.
3. Size: 30'-8" long x 4'-6" high x 12 inches thick.
4. Text: Reverse cast lettering of helvetica medium style. Text as indicated on drawings. Painted finish.
5. Extended base: Precast concrete base of same color as sign. Sealed.

P. Accessories: Provide all anchors, adhesives, and accessories for a complete installation.

3. PART 3 EXECUTION

3.1 EXAMINATION

- A. Verify that surfaces are ready to receive work.
- B. Beginning of installation means installer accepts existing surfaces.

3.2 INSTALLATION - GENERAL

- A. Install in accordance with manufacturer's instructions.
- B. Install true, plumb, level and adequately secured to substrate.
- C. Clean and polish.

3.3 INSTALLATION - FIRE BARRIER

- A. Install fire wall barrier identification signs on fire walls in accessible concealed floor, floor-ceiling or attic space above accessible ceilings.
- B. Install at intervals not exceeding a 30' - 0" horizontal spacing.
- C. Install at maximum 15' - 0" from end of wall.

END OF SECTION

SECTION 10 21 19

PHENOLIC TOILET COMPARTMENTS

1. PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Solid phenolic toilet partitions with floor to ceiling pilaster brace.
- B. Hardware.
- C. Attachments screws and bolts.

1.2 REFERENCES

- A. 2010 Americans with Disabilities Act (ADA) Standards for Accessible Design.
- B. CBC - California Building Code, (CCR) California Code of Regulations, Title 24, Part 2, California State Accessibility Standards.
- C. ASTM A167 - Stainless and Heat-Resisting Chromium-Nickel Steel Plate, Sheet, and Strip.
- D. ASTM E84 - Test Method of Surface Burning Characteristics of Building Materials.
- E. NEMA LD-3 - High Pressure Decorative Laminates.

1.3 SUBMITTALS

- A. Submit shop drawings under provisions of Section 01 33 00.
- B. Submit shop drawings indicating partition layout and dimensions, panel and door sizes, door swings, elevations, anchorage and mounting details, and finishes.
- C. Submit product data under provisions of Section 01 33 00.
- D. Submit product data for components, hardware, and accessories.
- E. Submit samples under provisions of Section 01 33 00.
- F. Submit two samples 4 x 4 inch in size illustrating panel colors.
- G. Provide a sample of each type of hardware.
- H. Submit manufacturer's installation instructions under provisions of Section 01 33 00.

1.4 REGULATORY REQUIREMENTS

- A. Conform to CBC, California Building Code, (CCR), Title 24, Part 2, and the 2010 ADA Standards for Accessible Design for accessibility requirements.
- B. Conform to Class B flame spread rating of 26 - 75 and smoke developed rating of 0 - 450 for panel materials when tested in accordance with ASTM E84.

1.5 COORDINATION

- A. Coordinate work under provisions of Section 01 31 00.
- B. Coordinate work with support framing, anchors, and blocking.
- C. Coordinate work with placement of plumbing fixtures and floor drains.

- D. Coordinate work with placement of electrical fixtures and equipment.
- E. Coordinate work with toilet accessories.

1.6 WARRANTY

- A. Provide 10 year limited warranty under provisions of Section 01 77 00.
- B. Warranty to provide for coverage of solid phenolic panels, doors and stiles against breakage, corrosion and delamination.

2. PART 2 PRODUCTS

2.1 MANUFACTURERS

- A. Accurate Partitions Corp., www.accuratepartitions.com.
- B. Alan Lewis, Inc., www.alanlewisinc.net.
- C. AMPCO Products, LLC, www.ampco.com.
- D. Bobrick Washroom Equipment, Inc., www.bobrick.com.
- E. Designrite Partitions, www.specritedesigns.com.
- F. Global Steel Products Corp., www.globalpartitions.com.
- G. Partition Systems, Inc. of South Carolina, www.psisc.com.
- H. Weis/Robart Partitions, Inc., www.weisrobart.com.
- I. Substitutions: Under provisions of Section 01 25 13.

2.2 MATERIALS

- A. Solid Phenolic Panel: NEMA LD-3 solid phenolic core, urea-formaldehyde resin free, with melamine laminate veneer material.
- B. Stainless Steel: ASTM A167, Type 304.

2.3 ACCESSORIES

- A. Pilaster Shoe: ASTM A167, Type 304 stainless steel, with adjustable screw jack.
- B. Attachments, Screws, and Bolts: Stainless steel; tamperproof type.
- C. Through Bolts and Nuts: Stainless steel with tamperproof heads.

2.4 HARDWARE

- A. Hinges: Full height continuous, self closing, gravity type, adjustable hinges of 0.0625 inch thick stainless steel.
- B. Latch and Keeper, Standard Doors: 0.0625 inch thick stainless steel combination slide latch and bumper.
- C. Latch and Keeper, Accessible Stall Doors: 0.0625 inch thick lever handle with concealed latch not requiring twisting, grasping, or pinching.
- D. Door Stop: Vinyl coated 0.125 inch thick steel door stop.
- E. Coat Hook: 0.1094 inch thick stainless steel hook with rubber bumper tip.

- F. Door Pull: Stainless steel U-shaped door pull.
- G. Panel Brackets: Full length continuous "U" channel brackets of 0.0625 inch thick stainless steel.

2.5 FABRICATION

- A. Doors and Panels:
 - 1. Door Thickness: 3/4 inch.
 - 2. Panel Thickness: 1/2 inch.
 - 3. Door Width: 24 inch.
 - 4. Door Width for Accessible Use: 36 inch.
 - 5. Door Width for Ambulatory Use: 32 inch.
 - 6. Height: 58 inch.
 - 7. Height from Floor: 12 inches.
- B. Pilasters: 3/4 inch thick, constructed same as doors, of sizes required to suit cubicle width and spacing.
- C. Furnish units with cutouts and drilled holes to receive partition mounted hardware, accessories, and grab bars as indicated.

2.6 FINISHES

- A. Plastic Laminate: Color and pattern as selected. Edges to be black.
- B. Stainless Steel Surfaces: No. 4 finish.
- C. Aluminum: Clear anodized.

3. PART 3 EXECUTION

3.1 EXAMINATION

- A. Verify that openings are ready to receive work.
- B. Verify field measurements are as shown on shop drawings.
- C. Verify correct location of built-in framing, anchorage, bracing, electrical and plumbing fixtures.
- D. Beginning of installation means installer accepts existing conditions.

3.2 ERECTION

- A. Erect in accordance with manufacturer's instructions.
- B. Install partition components secure, plumb and level.
- C. Attach panel brackets securely to walls, floors, and ceilings using appropriate anchor devices.
- D. Attach panels and pilasters to brackets with through bolts and nuts.
- E. Provide 1/2 inch space between wall surface and panels or pilasters.
- F. Equip each toilet stall door with hinge, door latch, and pull.

- G. Equip each accessible toilet stall door with two pulls, one each side of door. Mount at a height of 3'-4" from floor line to center of pull.
- H. Install door strike keeper on each pilaster in alignment with door latch.
- I. Equip each accessible toilet stall door with coat hook and bumper. Mount at a height of 4'-0" from floor line to top of hook. Center coat hook and bumper on interior face of door.
- J. Equip each standard toilet stall door with one coat hook and bumper. Mount on interior of door at 6 inches from top of the door to top of hook and 6 inches to hook centerline from strike side of door.

3.3 ERECTION TOLERANCES

- A. Maximum Variation From Plumb or Level: 1/8 inch.
- B. Maximum Misplacement From Intended Position: 1/8 inch.

3.4 ADJUSTING

- A. Adjust work under provisions of Section 01 77 00.
- B. Adjust and align door hardware to uniform clearance at vertical edges of doors. Clearance space not to exceed 3/16 inch.
- C. Adjust door hinges so that free movement is attained and will locate in-swinging doors in partial open position when unlatched and will return out-swinging doors to closed position.

3.5 CLEANING

- A. Clean work under provisions of Section 01 77 00.
- B. Remove protective coverings.
- C. Clean surfaces and hardware.

3.6 PROTECTION OF FINISHED WORK

- A. Protect finished installation under provisions of Section 01 61 00.
- B. Field touch-up of finished surfaces will not be permitted.
- C. Replace damaged or scratched materials with new materials.

END OF SECTION

SECTION 10 22 39

FOLDING PANEL PARTITIONS

1. PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Folding acoustic panel partition, panels hinged in pairs, manual operation.
- B. Ceiling track and operating hardware.
- C. Shop applied surface finish.
- D. Pocket door(s).

1.2 REFERENCES

- A. ASTM E84 - Surface Burning Characteristics of Building Materials.
- B. ASTM E90 - Airborne Sound Transmission Loss of Building Partitions.
- C. ASTM E557 - Architectural Application and Installation of Operable Partitions.
- D. CFFA-W-101-B - Chemical Fabrics and Film Association Quality Standard for Vinyl Coated Fabric Wallcovering.
- E. FS CCC-W-408 A and B - Wall Covering, Vinyl-Coated.
- F. FS L-P-1040-B - Plastic Sheets and Strips (Polyvinyl Fluoride).

1.3 PERFORMANCE REQUIREMENTS

- A. Sound Transmission Coefficient (STC): ASTM E90, STC of 51, tested on panel size of 100 sq ft.
- B. Surface Burning of Vinyl Fabric Finish: ASTM E84; flame/smoke rating of 15/20.
- C. Install partition system track capable of supporting imposed loads, with maximum deflection of 1/360 of span.

1.4 SUBMITTALS

- A. Submit under provisions of Section 01 33 00.
- B. Shop Drawings: Indicate opening sizes, track layout, details of track and required supports, track loads, adjacent construction and finish trim, and stacking sizes.
- C. Product Data: Describe partition operation, panel construction, hardware and accessories, colors and finishes available.
- D. Samples: Two samples of panel construction with surface finish, 12 x 12 inches size, illustrating construction, color, texture, and weight.
- E. Manufacturer's Installation Instructions: Include specific installation sequence.

1.5 OPERATION AND MAINTENANCE DATA

- A. Submit under provisions of Section 01 77 00.
- B. Include recommended cleaning methods, cleaning materials, and stain removal methods.

1.6 QUALIFICATIONS

- A. Manufacturer: Company specializing in manufacturing the products specified in this Section with minimum ten years documented experience.

1.7 FIELD MEASUREMENTS

- A. Verify that field measurements are as shown on shop drawings.

2. PART 2 PRODUCTS

2.1 MANUFACTURERS

- A. Advanced Equipment Corp., Model No. 3-MC-1-4-C-1-1, www.advancedequipment.com.
- B. Other manufacturers offering equivalent products:
 - 1. Hufcor, Inc., www.hufcor.com.
 - 2. Moderco Inc., www.moderco.com.
 - 3. Modernfold, Inc., www.modernfold.com.
 - 4. Kwik-Wall, www.kwik-wall.com.
 - 5. Panelfold, Inc., www.panelfold.com.
- C. Substitutions: Under provisions of Section 01 25 13.

2.2 COMPONENTS

- A. Panel Construction:
 - 1. Facing : Vinyl fabric over steel faced panels.
 - 2. Core : 18 gauge steel face panels robotically fusion welded to 16 gauge, vertical and 14 gauge horizontal framing members. Cavity fully insulated - 51 STC acoustical performance.
 - 3. Thickness : 3-1/2 inches.
 - 4. Hinges : Semi-concealed butt hinge.
 - 5. Trim : Extruded aluminum or prefinished steel.
 - 6. Panel to Panel Seals : Continuous flexible vinyl, color to match panel finish.
- B. Track: Extruded aluminum; thickness and profile designed to support live and dead loads.
- C. Carriers: Ball bearing, steel wheels on trolley carrier at top center of every panel, with threaded pendant bolt for vertical adjustment.
- D. Hardware: Flush pull each side of door. Finish to match trim.
- E. Acoustic Seals: Fixed flexible acoustic seals top and at panel intersections. Retractable crank operated floor seal.

2.3 ACCESSORIES

- A. Pocket Door(s): Full height doors at end of partition run to conceal stacked position; of same material, finish, construction, and thickness as panel; complete with operating hardware. Including the following:

1. Rim Lock: Key-operated lock to secure pocket door in closed position. Refer to Section 08 71 00 for lock cylinder and keying requirements.
2. Acoustic seals: Soffit, floor and jamb seals required to maintain partition acoustic qualities.

2.4 PANEL FINISHES

- A. Vinyl Wallcovering: Manufacturer's standard Harborweave pattern wallcovering manufactured by Koroseal Wallcovering, www.koroseal.com.
- B. Conform to Federal Specification CCC-W-408 A and B and CFFAW-101-B for Type II wallcovering.

3. PART 3 EXECUTION

3.1 EXAMINATION

- A. Verify that field conditions are acceptable and are ready to receive work.
- B. Confirm track supports are laterally braced and will permit track to be level within 1/4 inch of required position and parallel to the floor surface.
- C. Beginning of installation means installer accepts existing conditions.

3.2 INSTALLATION

- A. Install partition in accordance with manufacturer's instructions and ASTM E557.
- B. Fit and align partition assembly level and plumb.

3.3 ADJUSTING

- A. Adjust partition assembly to provide smooth operation from stacked to drawn position.
- B. Visually inspect partition in drawn position for light leaks to identify a potential acoustic leak. Adjust to achieve light seal.
- C. Adjust pocket door to operate smoothly and easily, without binding or warping. Check and readjust operating hardware. Confirm that doors latch and engage properly.

3.4 CLEANING

- A. Clean work under provisions of Section 01 77 00.
- B. Clean finish surfaces and partition accessories.

END OF SECTION

SECTION 10 28 13

TOILET ACCESSORIES

1. PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Toilet and shower, washroom accessories.
- B. Framed mirror units.
- C. Concealed anchor devices and backing plate reinforcements furnished to other Sections.
- D. Attachment hardware.

1.2 REFERENCES

- A. 2010 Americans with Disabilities Act (ADA) Standards for Accessible Design.
- B. CBC - California Building Code, (CCR) California Code of Regulations, Title 24, Part 2, California State Accessibility Standards.
- C. ASTM A123 - Zinc (Hot-Dip Galvanized) Coatings on Products Fabricated from Rolled, Pressed, and Forged Steel Shapes, Plates, Bars and Strips.
- D. ASTM A167 - Stainless and Heat-Resisting Chromium-Nickel Steel Plate, Sheet and Strip.
- E. ASTM A366 - Steel, Carbon, Cold-Rolled Sheet, Commercial Quality.
- F. ASTM A386 - Zinc Coating (Hot-Dip) on Assembled Steel Products.
- G. ASTM B456 - Electrodeposited Coatings of Copper Plus Nickel Plus Chromium and Nickel Plus Chromium.
- H. ASTM A269 - Seamless and Welded Austenitic Stainless Steel Tubing for General Service.

1.3 SUBMITTALS

- A. Submit product data under provisions of Section 01 33 00.
- B. Provide product data on accessories describing size, finish, details of function, attachment methods.
- C. Submit manufacturer's installation instructions under provisions of Section 01 33 00.

1.4 KEYING

- A. Supply two keys for each accessory to Owner.
- B. Master key all accessories.

1.5 REGULATORY REQUIREMENTS

- A. Conform to CBC, California Building Code, (CCR) Title 24, Part 2, the 2010 Americans with Disabilities Act (ADA) Standards for Accessible Design and for accessibility requirements.
- B. Structural strength of grab bars, shower seats, fasteners and mounting devices shall conform to requirements of the CBC, California Building Code, (CCR) Title 24, Part 2, Section 11B-609, 11B-610 and shall withstand the application of a 250 lb. point load.

1.6 COORDINATION

- A. Coordinate the work of this Section under provisions of Section 01 31 00.
- B. Coordinate the work of this Section with the placement of internal wall reinforcement and reinforcement of toilet partitions to receive anchor attachments.

2. PART 2 PRODUCTS

2.1 MANUFACTURERS

- A. Bobrick Washroom Equipment, Inc., www.bobrick.com.
- B. American Specialties, Inc. (ASI), www.americanspecialties.com.
- C. Bradley Corporation, www.bradleycorp.com.
- D. Substitutions: Under provisions of Section 01 25 13.

2.2 MATERIALS

- A. Sheet Steel: ASTM A366.
- B. Stainless Steel Sheet: ASTM A167, Type 304.
- C. Tubing: ASTM A269, stainless steel, Type 304.

2.3 ACCESSORIES

- A. Adhesive: Two component epoxy type waterproof.
- B. Fasteners, Screws, and Bolts: Hot dip galvanized, tamperproof.
- C. Expansion Shields: Fiber, lead, or rubber as recommended by accessory manufacturer for component and substrate.

2.4 FABRICATION

- A. Weld and grind smooth joints of fabricated components.
- B. Form exposed surfaces from single sheet of stock, free of joints.
- C. Form surfaces flat without distortion. Maintain flat surfaces without scratches or dents.
- D. Back paint components where contact is made with building finishes to prevent electrolysis.
- E. Shop assemble components and package complete with anchors and fittings.
- F. Provide steel anchor plates, adapters, and anchor components for installation.
- G. Hot dip galvanize exposed and painted ferrous metal and fastening devices.
- H. Toilet tissue dispensers located in accessible toilet rooms or stalls shall not have their flow restricted and shall be capable of continuous flow.

2.5 FACTORY FINISHING

- A. Galvanizing: ASTM A123 to 1.25 oz/sq yd.
- B. Shop Primed Ferrous Metals: Pretreat and clean, spray apply one coat primer and bake.

- C. Enamel: Pretreat to clean condition, apply one coat primer and minimum two coats electrostatic baked enamel.
- D. Chrome/Nickel Plating: ASTM B456, Type SC 2 satin finish.
- E. Stainless Steel: No. 4 satin luster finish.
- F. Mirror Glass: FS DD-G-451 Type I, Class 1, Quality of 2, 1/4 inch thick with silver coating, copper protective coating and non metallic paint coating complying with FS DD-M-411.
- G. Stainless Steel Mirror: Type 430, 20 gage, bright annealed stainless steel.

3. PART 3 EXECUTION

3.1 EXAMINATION

- A. Verify that site conditions are ready to receive work and dimensions are as instructed by the manufacturer.
- B. Beginning of installation means acceptance of existing conditions.

3.2 PREPARATION

- A. Deliver inserts and rough-in frames to site at appropriate time for building-in.
- B. Provide templates and rough-in measurements as required.
- C. Verify exact location of accessories for installation.

3.3 INSTALLATION

- A. Install fixtures, accessories and items in accordance with manufacturers' instructions.
- B. Install plumb and level, securely and rigidly anchored to substrate.
- C. Accessories required to be accessible shall be mounted at heights according to CBC Section 11B-603.5 and as indicated on the drawings.
- D. Toilet paper dispensers and feminine napkin dispensers located on the grab bar side of an accessible toilet room or stall shall not project more than 3 inches from the finished surface of the wall nor be located closer than 1-1/2 inches clear of the tangent point of the grab bar.

END OF SECTION

SECTION 10 44 00

FIRE PROTECTION SPECIALTIES

1. PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Fire extinguishers.
- B. Non-rated and fire rated cabinets.
- C. Accessories.

1.2 REFERENCES

- A. ASTM E814 - Fire Tests of Through-Penetration Fire Stops.
- B. NFPA 10 - Portable Fire Extinguishers.
- C. CFC - California Fire Code, (CCR) California Code of Regulations, Title 24, Part 9.
- D. Title 19, State Fire Marshal Regulations.

1.3 QUALITY ASSURANCE

- A. Conform to NFPA 10 requirements.

1.4 REGULATORY REQUIREMENTS

- A. Conform to requirements of the CFC, Section 906, and Title 19 - State Fire Marshal Regulations, Chapter 3.

1.5 SUBMITTALS

- A. Submit product data under provisions of Section 01 33 00.
- B. Include physical dimensions, operational features, color and finish, mounting and anchorage details, rough-in measurements, location, and details.
- C. Submit manufacturer's installation instructions under provisions of Section 01 33 00.

1.6 OPERATION AND MAINTENANCE DATA

- A. Submit manufacturer's operation and maintenance data under provisions of Section 01 77 00.
- B. Include test, refill or recharge schedules, procedures, and re-certification requirements.

1.7 ENVIRONMENTAL REQUIREMENTS

- A. Do not install extinguishers when ambient temperatures may cause freezing.

2. PART 2 PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

- A. Amerex Corporation, www.amerex-fire.com.
- B. J. L. Industries, www.jlindustries.com.
- C. Larsen's Mfg. Co., www.larsensmfg.com.

- D. Potter-Roemer, Inc., www.potterroemer.com.
- E. Substitutions: Under provisions of Section 01 25 13.

2.2 EXTINGUISHERS

- A. Dry Chemical Type: Equivalent to J.L. Industries Cosmic Model 10E, UL 4A:80B:C nominal capacity with multi-purpose chemical agent and inert material in enameled-steel container, with pressure-indicating gage.
- B. Wet Chemical Type: Equivalent to J.L. Industries Saturn Model 25, UL 2A:K.

2.3 CABINETS

- A. Non-rated cabinets equivalent to J.L. Industries Ambassador Model No. 1017F10 with flush doors, clear acrylic glazing and red vertical lettering.
- B. Fire rated cabinets, equivalent to J.L. Industries Ambassador Model No. 1017F10 FX 2 with flush doors clear acrylic glazing and red vertical lettering. Cabinet to be fabricated according to ASTM E814 and be listed and labeled by Warnock-Hersey for one hour fire rated wall systems.

2.4 FABRICATION

- A. Form body of cabinet with tight inside corners and seams.
- B. Fabricate body of fire rated cabinet of double wall construction filled with a 5/8 inch thick layer of protective fire barrier insulation.
- C. Predrill holes for anchorage.
- D. Form perimeter trim by welding, filling, and grinding smooth.
- E. Hinge doors for 180 degree opening with continuous piano hinge. Provide nylon catch with pull handle.
- F. Glaze doors with resilient channel gasket glazing.

2.5 ACCESSORIES

- A. Steel Cable Theft Device: Model STI 6200 as manufactured by STI Inc., www.sti-usa.com.

2.6 FINISHES

- A. Extinguisher: Red enamel.
- B. Cabinet Trim and Door: Electrostatic white enamel color.

3. PART 3 EXECUTION

3.1 INSPECTION

- A. Verify rough openings for cabinet are correctly sized and located.
- B. Beginning of installation means acceptance of existing conditions.

3.2 INSTALLATION

- A. Install cabinets plumb and level in wall openings.
- B. Secure rigidly in place in accordance with manufacturer's instructions.

- C. Install fire rated cabinets in strict conformance with manufacturer's instructions and listing requirements of Warnock-Hersey.
- D. Attach steel cable theft device to each extinguisher. Locate inside cabinet.

3.3 SCHEDULE

A. EXTINGUISHERS

- 1. Dry Chemical: All locations except Kitchen.
- 2. Wet Chemical: At Kitchen.

B. CABINETS

- 1. Non-rated - where shown on non-rated walls.
- 2. Rated - where shown on rated walls.

END OF SECTION

SECTION 10 51 13

METAL LOCKERS

1. PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Locker units with hinged doors.
- B. Base, top, and filler panels.
- C. Hooks, latches, and hardware.
- D. Attachment hardware.
- E. Locker room benches.

1.2 REFERENCES

- A. 2010 Americans with Disabilities Act (ADA) Standards for Accessible Design.
- B. ASTM A653 - Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.
- C. ASTM A924 - General Requirements for Steel Sheet, Zinc-Coated (Galvanized) by the Hot-Dip Process.
- D. ASTM A 1008: Specification for Steel, Sheet, Cold-Rolled, Carbon, Structural, High-Strength Low-Alloy and High-Strength Low-Alloy with Improved Formability.
- E. CBC – California Building Code, (CCR) California Code of Regulations, Title 24, Part 2, California State Accessibility Standards.

1.3 SYSTEM DESCRIPTION

- A. Lockers: Surface mounted, free standing double multi tier lockers; on concrete base; with sloped tops; integral combination locks.
- B. All-Welded Construction: Factory preassemble metal lockers by welding all joints, seams, and connections; with no bolts, nuts, screws, or rivets used in assembly of main locker groups. Factory weld locker groups into one-piece structures. Grind exposed welds flush.

1.4 REGULATORY REQUIREMENTS

- A. Conform to CBC, California Building Code, (CCR) California Code of Regulations, Title 24, Part 2 and the 2010 ADA Standards for Accessible Design for accessibility requirements.
- B. Lockers: Five percent of all lockers shall be made accessible to persons with disabilities. Locations of lockers to be as indicated on drawings.

1.5 SUBMITTALS

- A. Submit shop drawings and product data under provisions of Section 01 33 00.
- B. Include locker types, sizes, configurations, layout of groups of lockers, accessories, and numbering plan.
- C. Submit manufacturer's installation instructions under provisions of Section 01 33 00.
- D. Submit samples under provisions of Section 01 33 00.
- E. Provide two samples 3 x 6 inches of each color selected on actual base material.

1.6 PROTECTION

- A. Store and protect lockers under provisions of Section 01 61 00.
- B. Protect locker finishes and adjacent surfaces from damage during installation.

2. PART 2 PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

- A. DeBourgh Mfg. Co., www.all-american-lockers.com.
- B. List Industries, www.listindustries.com.
- C. Lyon Metal Products, www.lyonworkspace.com.
- D. Penco Products, www.pencoproducts.com.
- E. Substitutions: Under provisions of Section 01 25 13.

2.2 MATERIALS

- A. Sheet Steel: ASTM A653, Grade 33, A60 galvanealed coating according to ASTM A924; of the following minimum thicknesses:
 - 1. Body and Shelf : 0.0598 inch.
 - 2. Doors : 0.0747 inch.
 - 3. Door Frames : 0.0747 inch.
 - 4. Hinges : 0.0747 inch.
 - 5. Base, Top, Trim : 0.0598 inch.
 - 6. End Panels : 0.0598 inch.
 - 7. Backs : 0.0478 inch.

2.3 ACCESSORIES

- A. Provide hat shelf on single tier lockers.
- B. Provide aluminum number plates with etched figures.
- C. Provide each locker with two double prong wall hooks.
- D. Provide recessed single point latching handle for integral combination lock. Locking device supplied by manufacturer.
- E. Doors shall have a magnetic catch to retain unlocked doors in the closed position.
- F. Locker doors shall have rubber bumpers riveted to door strike.
- G. Provide digital lock assembly at all accessible lockers equal to Zephyr, Model 5170 RFID Electronic Lock as manufactured by Zephyr Lock, www.zephyrlock.com.
- H. Provide accessible decal at all accessible lockers equal to Model No. RFH550 as manufactured by Flags and Banners Unlimited, www.flagsbanners.net.
- I. Fasteners: Zinc coated flush countersunk screws or bolts; unobtrusively located; consistent with design of component, except where specifically noted otherwise.

2.4 FABRICATION

- A. Team Locker (Gym): 18 inches wide x 24 inches deep x 36 inches high in size; double tier. Total overall height of 72 inches.
- B. General Locker (Field): 15 inches wide x 12 inches deep x 15 inches high in size; multi-tier. Total overall height of 60 inches.
- C. Team Locker (Stadium): 24 inches wide x 24 inches deep x 36 inches high in size; double tier. Total overall height of 72 inches.
- D. General Lockers (Perimeter): 15 inches wide x 12 inches deep x 15 inches high in size; multi-tier. Total overall height of 75 inches.
- E. Pool Lockers: 12 inches wide x 12 inches deep x 12 inches high in size; multi-tier. Total overall height of 72 inches.
- F. Bodies: Formed and flanged with stiffener ribs; electrically spot welded.
- G. Door Frame: Formed channel shape, welded and ground flush, welded to body.
- H. Doors: 1-3/16 inch thickness; channel reinforced top and bottom with intermediate stiffener ribs. Finish edges smooth.
- I. Full Loop Hinges: Three for doors 42 inches and higher, two for doors under 42 inches high. Weld securely to unit body and rivet to unit door.
- J. Number Plates: One for each locker. Mount at top of opening with pop rivets. Numbering sequence as directed by Architect.
- K. Wall Hooks: Mount to locker body with pop rivets.
- L. Provide end panels, filler panels, and sloped metal tops to close off all openings.
- M. Ventilation openings:
 - 1. Street and Box Locker: Die cut diamond perforated side walls and doors.
 - 2. Hall Lockers: Louvered doors.
- N. Finish edges smooth without burrs.

2.5 FINISHES

- A. Clean, degrease, and neutralize metal; prime and finish with two coats of anti-microbial electrostatic baked on powder coat enamel.
- B. Coat locker doors and bodies in one color throughout.
- C. Color: As selected from manufacturer's standard range.

2.6 LOCKER ROOM BENCH

- A. Hardwood Maple Bench: 9-1/2 inches wide x 1-1/4 inches thick with two coats of clear acrylic finish. Length of bench to be as indicated on drawings.
- B. Bench Support: Heavy duty cast iron tubular design anchored to top and floor with 0.0781 inch thick metal plate. Floor plate to have floor cover. Color and finish of support to match lockers.
- C. Height of Bench: 1'-6" overall.

2.7 ACCESSIBLE LOCKER ROOM BENCH

- A. Hardwood Maple Bench: 2'-0" wide x 4'-0" long x 1-1/4 inches thick bench with two coats of clear acrylic finish.
- B. Accessible Bench Support Bracket: 15 inch x 21 inch x 1/8 inch thick pre-manufactured angled steel bracket, black paint finish, minimum 1,000 lb. load support capability, with 7 predrilled anchor holes per bracket leg. Manufactured by A & M Hardware, Inc., www.aandmhardware.com.
- C. Height of Bench: 1'-7" overall.

3. PART 3 EXECUTION

3.1 PREPARATION

- A. Verify bases are properly sized and located.

3.2 INSTALLATION

- A. Install lockers secure, plumb, square, and in line. Set on prepared base provided.
- B. Anchor lockers per architectural drawings with appropriate anchor devices to suit materials encountered.
- C. Bolt adjoining locker units together to provide rigid installation.
- D. Install end panels, filler panels, sloped tops to completely close off openings.
- E. Install accessories as specified for each locker.
- F. Install one hat shelf in accessible locker at a height of 4'-0" and one at a height of 15 inches above floor line.
- G. Install benches in positions as indicated.
- H. Place accessible bench supports at 3'-0" on center, 6 inches from each end of bench. Anchor to wall with appropriate fasteners. Shim supports to slope bench 1/4 inch to drain surface water from bench.

END OF SECTION

SECTION 10 56 26

MOBILE STORAGE SHELVING

1. PART 1 GENERAL

1.1 SECTION INCLUDES

- A. High density, mobile storage shelving system.
- B. Track assemblies, low-profile wheeled carriages, and storage shelving compartments.
- C. Accessories needed for a complete and proper installation.

1.2 SYSTEM DESCRIPTION

- A. Type: High density, manually operated, mobile storage shelving system consisting of independent, mobile and stationary ranges mounted on steel track embedded in concrete floor slab, with low profile wheeled carriage that allows access aisles between storage units and storage shelving components.
- B. System A: Recessed mounted assembly. Two single sided stationary units 15 inches deep x 28'-0" long with 16 double-faced movable units 36 inches deep x 28'-0" long. All units 72 inch high with fixed pole and shelf at a 66 inch height. One 3'-8" wide access aisle.

1.3 REFERENCES

- A. ASTM A36 - Standard Specification for Carbon Structural Steel.
- B. ASTM A1008 - Steel, Sheet, Cold-Rolled, Carbon Structural, High Strength Low-Alloy and High-Strength Low-Alloy with Improved Formability.
- C. ANSI - American National Standards Institute, A-208.1: Particle Board.
- D. APA - The Engineered Wood Association.
- E. CBC - California Building Code, (CCR) California Code of Regulations, Title 24, Part 2.
- F. National Electrical Manufacturers Association (NEMA): NEMA LD3 - High Pressure Decorative Laminates.

1.4 DESIGN REQUIREMENTS

- A. Design to support live loads and seismic loads required by the CBC.
- B. Design to resist tipping in both loaded and un-loaded conditions in compliance with Occupational Safety and Health Administration (OSHA) regulations.
- C. Design to be performed under the direct supervision of a structural engineer licensed in the State of California. System anchorage per structural drawings.
- D. Design to manually move 10,000 pounds with 1 pound effort.
- E. Minimum carriage support capacity: 1,000 pounds per linear foot of carriage length.

1.5 SUBMITTALS

- A. Submit shop drawings, product data, and samples under provisions of Section 01 33 00.

- B. Submit product data for system components.
- C. Submit shop drawings showing layout plans, elevations, dimensions, anchorage, and installation details.
- D. Submit complete structural calculations by a structural engineer licensed in the State of California to demonstrate compliance with provisions for loading and overturning that includes anchorage details shown on drawings as set forth in the California Building Code (CBC).
- E. Submit two samples of metal finish and plastic laminate for color selection by Architect.
- F. Submit operation and maintenance instructions under provisions of Section 01 77 00.
- G. Submit warranty required under provisions of Section 01 77 00.

1.6 QUALITY INSURANCE

- A. Manufacturer Qualifications: System shall be manufactured by single firm regularly engaged in manufacture of mobile storage shelving with 10 years minimum experience.
- B. Installer Qualifications: Experience in installation of mobile storage systems and certified by manufacturer for installation of specified system.

1.7 WARRANTY

- A. Provide under provisions of Section 01 77 00.
- B. Provide 5-year warranty for storage system parts and materials against defects and 1-year warranty for installation labor.

2. PART 2 PRODUCTS

2.1 MANUFACTURERS

- A. Ames Color-File, www.amescolorfile.com.
- B. Aurora Mobile Storage Systems, www.ricardwilcox.com
- C. Montel, www.montel.com
- D. Nordplan USA, Inc., www.nordplan.com
- E. Spacesaver Corp., www.spacesaver.com
- F. TAB, www.tab.com
- G. Substitutions: Under provisions of Section 01 25 13.

2.2 RAIL

- A. ASTM A36 structural tee rail of cold rolled steel with a minimum hardness rating of 1035.
- B. Capable of carrying a minimum of 1,000 lbs / lineal foot.
- C. Adjustable to be level within 1/64 inch.
- D. Shall allow for use of in-rail anti tip device.

2.3 CARRIAGES

- A. Framework: ASTM A1008 steel channels, 0.1046 inch minimum thickness, welded joints.
- B. Cross Members: Similar material as frame, welded to side channels.
- C. Fabricate carriages as one piece.
- D. Wheels: Hardened steel with shielded ball bearings. Spacers at both sides of wheels to eliminate friction between wheel and carriage.
- E. Seismic Anti-Tip Device: In-rail seismic anti-tip device located at each wheel capable of withstanding all forces applied according to the California Building Code.

2.4 MANUAL DRIVE MECHANISM

- A. Type: Manually operated, geared reduction, internal drive assembly with handwheel.
- B. Mechanical Advantage: Drive mechanism shall have capacity to manually move 10,000 pounds with 1 pound effort.
- C. Housing: Drive mechanisms concealed within end panels.
- D. Handwheel: Steel wheel with textured vinyl cover allowing one hand operation.
- E. Safety Mechanism: Mechanical automatic aisle-locking mechanism that locks aisle open using an anti-reversing lock with color coded visual indicators and manual relocking button.
- F. Bumpers: Equip storage modules with 1 inch thick by 1-1/2 inches diameter resilient bumpers on storage modules to provide finger clearance between closed modules.

2.5 SHELVING

- A. Shelving System: Modular, adjustable, steel, heavy duty system consisting of uprights, shelf supports, shelf reinforcement, shelves, and file dividers to be mounted on mobile storage system carriages.
- B. Material: Cold rolled ASTM A1008 stretcher leveled steel sheet, furniture stock grade.
- C. Uprights: Each upright shall consist of front and back posts joined together.
 - 1. Posts: Cold formed from 0.0478 inch thick steel into double wall section. Inner wall to be punched with keyhole slots to receive shelf supports. Space slots at 1-1/2 inches.
 - (a) End Posts: L shapes.
 - (b) Intermediate posts: T shaped.
 - 2. Closed Uprights: Front and back posts joined with 0.0239 inch thick full-height steel sheet welded to posts. Use closed uprights for all heavy duty shelving uprights.
- D. End Panels:
 - 1. Type: Removable, 2 inches deep, flanged panels fabricated from 0.0359 inch thick steel sheet to attach to end uprights and concealing drive mechanism.
 - 2. Provide end panels in 3 sections: Top, bottom, and mid-panel accommodating handwheel.

- E. Shelves: Cold formed from steel sheet with 5/8 inch flanges on all sides. Provide shelves with two rows of slots for engaging file dividers. 0.0478 inch thick heavy duty shelves.
- F. Shelf Supports: Hot rolled steel with ears and rivets for attachment in keyhold slots of uprights.
 - 1. Standard Duty Supports: 0.0747 inch thick.
 - 2. Heavy Duty Supports: 0.1196 inch thick.
- G. Shelf Reinforcement: For heavy duty shelving, provide channel shaped 0.0598 inch thick rolled steel reinforcement to reinforce fully loaded shelves. Locate as recommended by manufacturer.
- H. Provide file stops along full width of shelf. Fabricate from 0.0598 inch thick steel with slots to receive file dividers. Provide stops at back for filing from one side and at center for double entry filing from both sides of shelf. Attach with bolts or rivets as appropriate.
 - 1. Standard Duty Stop: 2-1/4 inches high.
 - 2. Heavy Duty Stop: 7 inches high.
- I. File Dividers: Provide 0.0478 inch thick, flat steel, removable dividers with radiused corners. Bottom of divider shall have tabs to engage shelf and stop slots spaced at 2-1/2 inches.
 - 1. Standard Duty Divider: 6 inches high.
 - 2. Heavy Duty Stop: 10 inches high.
 - 3. Quantity: 6 per shelf.
- J. Top Shelf: Equip all storage modules with top shelf spanning full length and depth of module. Shelf to be flanged on all sides and without slots.
- K. Card Holders: 3 inch x 5 inch aluminum card holder. One holder for each single-face unit, two for each double-face unit.
- L. Clothes Rod: Stainless steel clothes rod, 1-1/2 inch diameter with attachment bracket each end.

2.6 FACTORY FINISHING

- A. Carriages, uprights, shelving, file dividers, and other exposed to view steel components shall receive factory applied thermoset, polyester enamel paint finish.
- B. End Panels:
 - 1. Plastic laminate complying with NEMA LD3 with color and pattern selected by Architect from manufacturer's standard range, 0.050 inch thick.
- C. All other painted steel: Color selected by Architect from manufacturer's standard range.

3. PART 3 EXECUTION

3.1 EXAMINATION

- A. Field verify dimensions and Project conditions prior to fabrication.
- B. Coordinate provision of mobile storage shelving with casting of concrete floor slab specified in Section 03 30 00 - Cast-In-Place Concrete to ensure accurate location of recesses for track installation.

- C. Verify floor slab is level and ready to receive mobile storage system.

3.2 INSTALLATION

- A. Install mobile storage system in accordance with manufacturer's recommended installation instructions and approved shop drawings.
- B. Accurately layout storage system and locations of tracks. Place shims for support of floor deck panels, grout gaps between track and floor with fast setting grout.
- C. Position steel track and concrete dams on solid grout in concrete floor recesses. Coordinate with placing of concrete fill around tracks as specified in Section 03 30 00 - Cast-In-Place Concrete. After concrete fill has cured, continue with mobile storage system installation. Coordinate with installation of floor finish specified Section 03 30 00 - Sealed Concrete.
- D. Place carriages on track. Bolt uprights to carriages and assemble drive mechanism and storage shelving. Install components plumb and level, rigid, accurately fitted, and free from distortion and defects.

3.3 FIELD QUALITY CONTROL

- A. Operate all mobile storage modules through full range of movement.
- B. Ensure proper, smooth, safe operation.
- C. Correct deficiencies and adjust as required.

3.4 CLEANING

- A. Remove protective wrappings.
- B. Clean metal surfaces using clean water and mild detergent. Do not use abrasive agent, steel wool, or harsh chemicals. Rinse with clean water.

3.5 DEMONSTRATION

- A. Demonstration to Owner's designated representatives complete operation and required maintenance for mobile storage system.

END OF SECTION

SECTION 10 75 00

FLAGPOLES

1. PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Aluminum flagpoles.
- B. Ground mount.
- C. Halyards, accessories and flag(s).

1.2 REFERENCES

- A. AAMA 611 – Specifications and Inspection Methods for Clear Anodic Finishes for Architectural Aluminum.
- B. AAMA 612 - Specifications and Inspection Methods for Integral Color Anodic Finishes for Architectural Aluminum.
- C. AAMA 2603 - Specification, Performance Requirements and Test Procedures for Pigmented Organic Coatings on Aluminum Extrusions and Panels.
- D. AAMA 2605 - Specification for Superior Performing Organic Coatings on Architectural Extrusions and Panels.
- E. AASHTO M-36 - Corrugated Metal Culvert Pipe.
- F. ASTM B241 - Aluminum and Aluminum-Alloy Seamless Pipe and Seamless Extruded Tube.
- G. ASTM C33 - Standard Specification for Concrete Aggregate.
- H. ASTM D1187 – Standard Specifications for Asphalt Based Emulsions for Use as Protective Coatings for Metal.
- I. NAAMM – National Association of Architectural Metal Manufacturers.

1.3 PERFORMANCE

- A. Pole With Flag Flying: Resistant without permanent deformation, 80 miles/hr wind velocity, non-resonant, safety design factor of 1.6.

1.4 SUBMITTALS

- A. Submit shop drawings and product data under provisions of Section 01 33 00.
- B. Indicate on shop drawings, detailed dimensions, base details, anchor requirements, and imposed loads.
- C. Provide product data on pole, accessories, and configurations.
- D. Submit manufacturer's installation instructions under provisions of Section 01 33 00.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Deliver, store, and protect products under provisions of Section 01 61 00.
- B. Spiral wrap flagpole with protective covering and pack in protective shipping tubes or containers.
- C. Protect flagpole and accessories on site from damage or moisture.

2. PART 2 PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

- A. Aabec Pole Division, Morgan Francis Co., www.morgan-francis.com.
- B. American Flagpole, www.americanflagpole.com.
- C. Concord Industries, Inc., www.concordindustries.com.
- D. Eder Flag Manufacturing Co., Inc., www.ederflag.com.
- E. Substitutions: Under provisions of Section 01 25 13.

2.2 POLE MATERIALS

- A. Aluminum: ASTM B241; 6063 alloy, T6 temper.

2.3 POLE FABRICATION

- A. Outside Butt Diameter: 7 inches.
- B. Outside Top Diameter: 3.5 inches.
- C. Wall Thickness: 3/16 inch.
- D. Type: Ground set; fixed type.
- E. Pole Design: Cone tapered.
- F. Nominal Height: 34 ft measured from ground.
- G. Halyard: Internal type.

2.4 COMPONENTS AND ACCESSORIES

- A. Finial Ball: Aluminum; 6 inch diameter.
- B. Truck Assembly: Cast aluminum; revolving; stainless steel ball-bearings, non-fouling.
- C. Flag: United States and California design, 5 x 8 feet standard size, 100 percent woven, two ply, spun polyester bunting.
- D. Cleats: 9 inch size, cast aluminum with stainless steel fastenings, one per halyard.
- E. Halyard: 5/16 inch diameter polypropylene, braided, white, with 1/16 inch diameter galvanized steel core.
- F. Cleat Cover: Cast aluminum with cylinder lock, one per cleat.
- G. Halyard Cover: Cast aluminum with cylinder lock, minimum 5'-0" in length.
- H. Connecting Sleeves For Multiple Section Poles: Same material as pole, precision fit for field assembly of pole, concealed fasteners.
- I. Flashing Collar: Spun aluminum.
- J. Sand: ASTM C33, fine aggregate.
- K. Bituminous paint: ASTM D1187, cold applied asphalt emulsion.

- L. Elastomeric Joint Sealant: Single component neutral curing silicone sealant as specified in Section 07 92 00.

2.5 MOUNTING COMPONENTS

- A. Foundation Tube Sleeve: AASHTO M-36, corrugated 16 gage steel, galvanized.
- B. Pole Base Attachment: 3/16 inch thick steel bottom plate with steel centering wedges. Galvanized.
- C. Lightning Ground Rod: 18 inch long copper rod, 3/4 inch diameter.

2.6 GENERAL FINISHES

- A. Metal Surfaces in Contact With Concrete: Asphaltic paint.
- B. Finial: Spun finish.

2.7 ALUMINUM FINISHES

- A. Natural Satin Finish: NAAMA AA-M32, fine, directional medium satin polish, buff complying with AA-M20; seal aluminum surfaces with clear, hard-coat wax.

3. PART 3 EXECUTION

3.1 INSPECTION

- A. Verify that concrete foundation is ready to receive work and dimensions are as indicated on shop drawings.
- B. Beginning of installation means acceptance of existing conditions.

3.2 PREPARATION

- A. Coat metal sleeve surfaces below grade and surfaces in contact with dissimilar materials with asphaltic paint.
- B. Excavate to neat clean lines in undisturbed soil. Remove loose soil and foreign matter from excavation and moisten earth before placing concrete. Place and compact drainage material at excavation bottom.
- C. Provide forms where required by unstable soil conditions and for perimeter of flagpole base at grade. Secure and brace forms to prevent displacement.

3.3 INSTALLATION

- A. Install flagpole, base assembly, and fittings in accordance with manufacturer's instructions.
- B. Electrically ground flagpole installation.
- C. Place foundation tube sleeve, center, and brace to prevent displacement.
- D. Place concrete in accordance with Section 03 30 00. Vibrate concrete.
- E. Trowel exposed concrete surfaces to a smooth dense finish. Provide positive slope to perimeter of base.
- F. Install flagpole plumb in foundation tube sleeve.
- G. Place tube seated on bottom plate between steel centering wedges and install hardwood wedges to secure flagpole in place.
- H. Place and compact sand in place and remove hardwood wedges.
- I. Seal top of foundation tube sleeve with a 2 inch thick layer of elastomeric joint sealant and cover with flashing collar. Secure collar in place.

3.4 TOLERANCES

- A. Maximum Variation From Plumb: One inch.

3.5 ADJUSTING AND CLEANING

- A. Clean surfaces.
- B. Adjust operating devices so that halyard and flag(s) function smoothly.

END OF SECTION

SECTION 10 82 00

GRILLES AND SCREENS

1. PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Steel louvers and frames.
- B. Bird Insect screening.

1.2 REFERENCES

- A. AMCA 500 - (Air Movement Council Association) Test Method for Louvers, Dampers, and Shutters.
- B. ASTM B221 - Aluminum-Alloy Extruded Bars, Rods, Wire, Shapes, and Tubes.
- C. ASTM A653 - Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.
- D. ASTM A924 - General Requirements for Steel Sheet, Zinc-Coated (Galvanized) by the Hot- Dip Process.

1.3 SYSTEM PERFORMANCE

- A. Fabricate louver to permit 50 percent free area.
- B. Water Penetration: Not more than 0.01 ounces of water per square foot of free area at minimum 700 ft/min face velocity during a 15 minute test period when tested by AMCA 500 test procedures.

1.4 QUALITY ASSURANCE

- A. Manufacturer: Company specializing in manufacture of AMCA certified louvers with five years experience.

1.5 SUBMITTALS

- A. Submit shop drawings and product data under provisions of Section 01 33 00.
- B. Indicate on shop drawings, layout, elevations, dimensions, and tolerances; head, jamb, and sill details; blade configuration; screening; and frames.
- C. Provide product data on preassembled louvers describing design characteristics, maximum recommended air velocity, free area, materials, and finishes.
- D. Submit manufacturer's installation instructions under provisions of Section 01 33 00.

1.6 COORDINATION

- A. Coordinate work of this Section with installation of flashings.
- B. Coordinate work of this Section with mechanical ductwork.

2. PART 2 PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

- A. Airline Products Co., www.airlinelouvers.com.
- B. The C/S Group, www.c-sgroup.com.
- C. The Airolite Co., www.airolite.com.
- D. Industrial Louvers, Inc., www.industriallouvers.com.
- E. Nystrom Building Products, www.nystrom.com.
- F. Substitutions: Under provisions of Section 01 25 13.

2.2 MATERIALS

- A. Aluminum: ASTM B221, 6063 alloy, T5 or T52 temper; extruded shape.
- B. Steel Sheet: ASTM A653, Commercial Steel, Type A, galvanized to G90 zinc coating in accordance with ASTM A924.
- C. Fasteners and Anchors: Stainless steel type.

2.3 ACCESSORIES

- A. Bird Screen: Interwoven wire mesh of steel, 0.063 inch diameter wire, 1/2 inch open weave, square design.
- B. Insect Screen: 18 x 16 size steel mesh, set in steel frame.
- C. Primer: Rust-inhibiter primer, baked-on shop coat of EPA compliant gray enamel.
- D. Flashings: Of same material as louver frame.
- E. Sealant: Polyurethane type as specified in Section 07 92 00.

2.4 FABRICATION

- A. Fixed Louvers: Airline Louvers, Model GS4V30H.
- B. Louver Size: 4 inches deep, face measurements as indicated.
- C. Louver Blade: 70 degree; Inverted 'Y' shape; minimum material thickness of 18 gage.
- D. Louver Frame: Channel shape, welded corner joints, material thickness of 18 gage.
- E. Mullions: Concealed of steel, profiled to suit louver frame.
- F. Head, Jamb, and Sill Flashings: Roll formed to required shape, one piece per location.
- G. Screens: Permanently install screen mesh in shaped frame with reinforced corner construction; screw to louver frame.

2.5 FINISHES

- A. Steel Surfaces: Factory Kynar 500 or Hylar 5000 fluorocarbon 3-coat coating system, color as selected.

3. PART 3 EXECUTION

3.1 INSPECTION

- A. Verify that prepared openings and flashings are ready to receive work and opening dimensions are as indicated on drawings.
- B. Beginning of installation means acceptance of existing conditions.

3.2 INSTALLATION

- A. Install louver assembly in accordance with manufacturer's instructions.
- B. Install louvers level and plumb.
- C. Secure louvers in opening framing with concealed fasteners, removable hinged for maintenance purposes.
- D. Install flashings and align louver assembly to ensure moisture shed from flashings and diversion of moisture to exterior.
- E. Install perimeter sealant and backing rod in accordance with Section 07 92 00.
- F. Install bird and insect screening to interior of louver. Hinge screens for access.
- G. Install insect screens to intake louvers. Install bird screens to exhaust louvers.

3.3 CLEANING

- A. Clean surfaces and components.

END OF SECTION

SECTION 10 82 10

EXTERIOR SUN CONTROL DEVICES

1. PART 1 GENERAL

1.1 DESCRIPTION

- A. Provide fixed Custom Sunshades as shown on the drawings, as specified, and as needed for a complete and proper installation.
- B. The drawings show the extent of the work, the dimensioned profile and depth of the sunshade to be provided.
- C. Related work specified elsewhere:
 - 1. Metal Fabrication - 055000

1.2 SUBMITTALS

- A. Product Data: Submit specifications, data, and installation, instructions from the manufacturer of the Sunshades.
- B. Submit shop drawings for the system. Show anchorage, details and connections for all the component parts.
- C. Drawings shall include elevations, sections and specific details for each unit, condition.
- D. Samples: Submit one sample minimum 24" long of each material to be utilized at each Sunshade with appropriate finish.
- E. Warranty: Provide written warranty to the owner that all screen products will be free of defective materials or workmanship for a period of one year from date of installation.
- F. Quality Assurance:
 - 1. Single subcontract responsibility: Subcontract the work to a single firm that has had not less than six years experience in the design and manufacturing of work similar to that shown and required.
 - 2. Performance requirements: Blade deflection is limited to L/120, 3/4", or as required by code.
 - 3. Sunshade must be mechanically assembled. Welded construction is not acceptable. Blades must be removable for repair or replacement.
 - 4. For quality and delivery control, sunshades must be purchased from a single source. Sub contracting of shade assembly is not acceptable.

2. PART 2 PRODUCTS

2.1 PRODUCTS

Sunshades shall be Model 100-3 as manufactured by;

Construction Specialties, Inc. located at
49 Meeker Avenue
Cranford, New Jersey 07016
Tel.1- 800-631 7379

2.2 MATERIALS

- A. Aluminum Extrusions: ASTM B211, Alloy 6063-T5.
- B. Fasteners: Fasteners shall be aluminum or stainless steel. Provide types, gauges and lengths to suit unit installation conditions.
- C. Anchors and Inserts: Use non-Ferrous metal or hot dip galvanized anchors and inserts for installation and elsewhere as required for corrosion resistance. Use stainless steel or lead expansion bolt devices for drill-in place anchors. Furnish inserts, as required, to be set into concrete or masonry work.

2.3 FABRICATION, GENERAL

- A. Provide fixed Sunshades and accessories of design, material, sizes, depth, arrangement, and thickness as indicated or as required for optimal performance with respect to strength; durability; and uniform appearance.
- B. Include supports, anchorage, and accessories required for complete assembly.

2.4 SUNSHADE CONSTRUCTION

- A. Components: All blades and outrigger components shall be 6063-T5 aluminum alloy.
 - 1. Outriggers shall 1/4" custom profile flat aluminum plate members, 6" high.
 - 2. Blades shall be 6" high spaced 6" on center, extruded aluminum airfoil design. Blades shall be factory assembled to outriggers using stainless steel, type F, thread cutting screws through internal screw slots in blades. Welding is not acceptable. Blades to be mechanically secured to allow for replacement in case of damage. Fasteners to be hex head.
 - 3. No Fascia. Front blade to act as fascia.
 - 4. Sunshade system to attach to Aluminum Wall Bracket to be supplied and designed by sunshade manufacturer.

2.5 ALUMINUM POWDER COAT FINISH

- A. General: Fluoropolymer finish complying with AAMA-2605-5 standards. Protect finishes on exposed surfaces prior to shipment. Remove scratches and blemishes from exposed surfaces, which will be visible after completing finishing process.

Provide Color as indicated or, if not otherwise indicated, as selected by architect from standard CS Powder Coat colors.

- B. 100% Fluoropolymer Resin Powder Coat System. Finish thickness to be 1.5 to 3.0 mils.

Finish to allow zero VOCs to be emitted into facility of application or at job site.

Finish to adhere to a 4H Hardness rating.

Furnish manufacturer's twenty (20) year warranty for finish.

Finish shall be applied in a plant owned by the manufacturer of the sunshades
All supports/ blade braces/and blades to be painted same color.

3. PART 3 EXECUTION

3.1 INSPECTION

- A. Examine openings to receive the work. Do not proceed until any unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. Comply with manufacturer's instructions and recommendations for installation of the work.
- B. Verify dimensions of supporting structure at the site by accurate field measurements so that the work will be accurately designed, fabricated and fitted to the structure.
- C. Anchor Sunscreen to building substructure as indicated on architectural drawings.
- D. Erection Tolerances:
 - 1. Variation from level: +/- 1/8" maximum in any column to column space or 20'-0" runs, non-cumulative.
 - 2. Offsets in end-to-end or edge-to-edge alignment of consecutive members 1/32".
- E. Cut and trim component parts during erection only with the approval of the manufacturer or fabricator, and in accordance with his recommendations. Restore finish completely. Remove and replace members where cutting and trimming has impaired the strength or appearance of the assembly as directed.
- F. Do not erect warped, bowed, deformed or otherwise damaged or defaced members. Remove and replace any members damaged in the erection process as directed.
- G. Set units level, plumb and true to line, with uniform joints.

END OF SECTION

SECTION 11 40 00

FOOD SERVICE EQUIPMENT

PART 1 - GENERAL

1.1 SUMMARY

- A. The work referred to in this section consists of furnishing all labor and material required to provide and deliver all food service equipment hereinafter specified into the building, uncrate, assemble, hang, set in place, level, and completely install, exclusive of final utility connections. Final utility connections to all equipment, shall be part of the work under additional appropriate sections of the work and not part of the food service work.
1. The equipment and its component parts shall be new and unused. All items of standard manufactured equipment shall be current models at the time of delivery. Parts subject to wear, breakage, or distortion shall be accessible for adjustment, replacement and repair.
 2. The materials or products specified herein by trade names, manufacturer's name or catalog number shall be provided as specified. Substitutions will not be permitted unless approved by owner's representative in writing no later than 10 days prior to bidding. This stipulation applies to all equipment and materials.
 - a. Any request for substitution or alternate must include documentation supporting that the requested substitution/alternate will perform in all aspects as well as the original specification. Alternative exhaust hood manufacturers are required to provide heat load based design exhaust volume calculations prior to alternate being considered. Request must include the following:

Grease filtration performance data and manufactureer's own airflow calculations based on convective heat load of cooking equipment beneath the hood.

Efficiency comparison data performed in accordance with ASTM Standard F1704-96 for a standard 24" high exhaust hood.

A written guarantee of compliance with Title 24 Part 6 with Kitchen Ventilation acceptance tests NA7.11.1.2 and NA7.11.1.3.
 - b. Should no request for substitution be received and approved as stated above, the project is to be provided as specified.
 3. The food service equipment contractor shall be responsible for all costs associated with the acceptable alternate or approved alternate items, if the item requires additional space or specific utilities that differ from specifications or drawings. The FSEC is responsible for all coordination, documentation and costs associated with any alternate item that was not submitted for approval and accepted by the consultant prior to bid. The FSEC shall be responsible for any costs associated with building changes, utility changes and drawings changes.
- B. Coordinate Owner and Vendor-supplied equipment noted on the drawings or in the specifications as NIFSEC, "not in food service equipment contract". Show on roughing in Plans and sizes, utilities, and other requirements as furnished in the specifications, by owner or appropriate supplier in submittals as if the equipment is contractor furnished.

- C. Bidders shall carefully examine the specifications and the project site including location and condition of existing equipment to determine cost for each "Existing-Reset" and "Existing-Modify" item to cover removal, modification (including materials), cleaning, inspection for damage, repair and resetting.
- D. Field measurements shall be made prior to fabrication or installation of any equipment item.
- E. The cutting of holes in equipment for pipe, drains, electrical outlets, etc., required for this installation, shall be part of this work. Work shall conform to the highest standards of workman-ship and shall include welded sleeves, collars, ferrules and escutcheons.
- F. Repair of all damage to the premises as a result of the equipment installation as well as the removal of all debris left by the work of this section.
- G. Food service equipment and fixtures shall be cleaned and ready for operation at the time the facility is turned over to the Owner for final inspection by the Owner's Representative.
- H. Food Service Equipment Contractor shall be responsible for coordinating with the Architect and Contractor in submitting all applicable documents.
- I. All bidders shall submit with their costing a list of the subcontractors that are included in their bids and a complete "schedule of values" for all equipment and labor.

1.2 RELATED SECTIONS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.
- B. Related Work In Other Sections by appropriate trades include the following:
 - 1. Division 5 Section "Metal Fabrications" for equipment supports.
 - 2. Division 6 Section "Interior Architectural Woodwork" for wood casework and plastic laminate substrates.
 - 3. Refer to Division 23 Sections for supply and exhaust fans; exhaust ductwork; demand control ventilation requirements; service roughing-ins; drain traps; atmospheric vents; valves, pipes, and fittings; fire extinguishing systems; and other materials required to complete food service equipment installation.
 - 4. Refer to Division 26 & 28 Sections for connections to fire alarm systems, wiring, disconnects, and other electrical materials required to complete food service equipment installation.
- C. All electric services including wiring to, and final connections to, the fixtures except, as specified differently in the specifications, drawings, or herein.
- D. All water, waste and gas services to the fixtures including shut-off valves, trim, traps, etc., and final connections to the fixtures, except as specified differently in the specifications, drawings, or herein.
- E. All hood or ventilator duct work above the connection position on such exhaust hoods or exhaust ventilators, except as specified differently in the specifications, drawings, or herein. Final welded connections at the junction point of exhaust hoods or exhausts ventilators, shall be part of the food service work.
- F. Floors, quarry tile, concrete bases, walls, ceilings, finishes and related building work, except as specified differently in the specifications, drawings or herein.

1.3 DEFINITIONS

- A. Terminology Standard: Refer to NSF 2, "Food Equipment", NSF 4, Heated Cabinets, NSF 7, Refrigerated Equipment, or other applicable NSF standards for definitions of food service equipment and installation terms not otherwise defined in this Section or in other referenced standards.
- B. FSEC: Food Service Equipment Contractor
- C. Owner-Furnished Equipment: Where indicated, Owner will furnish equipment items.
- D. Vendor-Furnished Equipment: Where indicated the Owner's or operator's vendor will furnish equipment items.
- E. NIFSEC: Not Included in Food Service Equipment Contract.

1.4 SUBMITTALS

- A. Regardless of drawing formats provided it will remain the responsibility of equipment supplier to develop submittals in accordance with the Specific Conditions and assume all required responsibilities there to. The consultant is not to be liable for errors or omissions by the FSEC's use of electronic data provided by the Consultant or the development of data used in the submittal approval process. Checking product data, rough-in drawings, wall backing drawings, shop drawings, and refrigeration drawings by Designer is for design concept only, and does not relieve the Food Service Equipment Contractor of responsibility for compliance with Contract Documents, verification of utilities with equipment requirements for conformity and location, verification of all dimensions of equipment and building conditions or reasonable adjustments due to deviations.
- B. The Food Service Equipment Contractor shall review and provide an affidavit with each submittal that such review has been completed by an authorized agent of the contractor.
- C. Product Data: For each type of food service equipment indicated. Include manufacturer's model number and accessories and requirements for access and maintenance clearances, water and drainage, power or fuel, and service-connections including roughing-in dimensions.
- D. Shop Fabrication Drawings: For food service equipment not manufactured as standard production and/or catalog items by manufacturers the fabricator of the equipment shall prepare and submit through the Food Service Equipment Contractor one electronic file or two bond or original prints of all shop drawings showing all information necessary for the fabrication and installation of the work of this section. Include plans, elevations sections, material schedule, roughing-in dimensions, fabrication details, service requirements and attachments to other work. All drawings to be fully detailed and dimensioned to a minimum scale of $\frac{3}{4}$ inch to the foot for plan and elevation views and $1 \frac{1}{2}$ inch to the foot for section views. Reduced or enlarged drawings are not acceptable. Drawings not submitted in the proper format will not be reviewed.
 - 1. Wiring Diagrams: Details of wiring for power, signal, and control systems and differentiating between manufacturer-installed and field-installed wiring.
 - 2. Piping Diagrams: Details of piping systems and differentiating between manufacturer-installed and field-installed piping.
- E. Coordination Drawings: For locations of food service equipment and service utilities. Key equipment with item numbers and descriptions indicated in Contract Documents. Include plans and elevations of equipment, access- and maintenance-clearance requirements, details of concrete, masonry or metal bases and floor depressions, and service-utility characteristics. Ventilation requirements for refrigerated equipment shall be identified in these drawings.

F. Contract Document Drawings:

1. Drawings furnished, constitute a part of these specifications and show locations of equipment and general arrangement of mechanical and electrical services. Necessary deviation from the illustrated arrangements to meet structural conditions, shall be considered a part of the work of this section. Such deviations shall be made without expense to the owner. Equipment drawings are definitive only and should not be used as construction documents or shop details.
2. The drawings are for the assistance and guidance of the Food Service Equipment Contractor. Exact locations shall be governed by the building configuration. The Food Service Equipment Contractor shall accept his contract with this understanding.
3. Should there be a conflict between the drawings and the specifications, the FSEC shall submit a "Request for Information" (RFI) for clarification.

G. Utility Roughing-in Drawings:

1. The Food Service Equipment Contractor shall prepare and submit one electronic file or two bound sets of a valid prints, of all roughing-in drawings, showing information necessary for the roughing-in of refrigerant lines, syrup/beer lines, plumbing, steam, mechanical and electrical utility requirements. Drawings shall also include construction requirements necessary for all equipment including floor depressions, raised bases, wall blocking, wall recesses and any critical dimensions for specific equipment requirements. Acceptance will be made upon the electronic file or one print which will be returned to the Food Service Equipment Contractor for reproduction purposes. Drawings not properly submitted in this format, will not be reviewed. Drawings without an "Accepted" or "Accepted as noted" stamp, will not be considered an authorized shop drawing and will not be allowed on the job site.
 - a. Furnish four (4) sets "Accepted" and/or "Accepted as Noted" shop drawings, for distribution to the field, as directed.

H. Samples for Initial Selection: Manufacturer's color charts showing the full range of colors available for exposed products with color finishes.

I. Samples for Verification: Of each type of exposed finish required, minimum 4-inch- (100-mm-) square or 6-inch- (150-mm-) long sections of linear shapes and of same thickness and material indicated for work. Where finishes involve normal color and texture variations, include Sample sets showing the full range of variations expected.

J. Product Certificates: Signed by manufacturers of refrigeration systems, refrigerated equipment or their authorized agents certifying that systems furnished comply with NSF 7 requirements and will maintain operating temperatures indicated in the areas or equipment that they will serve.

K. Maintenance Data: Operation, maintenance, and parts data for food service equipment to include in the maintenance manuals specified in Division 1. Include a product schedule as follows:

1. Product Schedule: For each food service equipment item, include item number and description indicated in Contract Documents, manufacturer's name and model number, and authorized service agencies' addresses and telephone numbers.

1.5 QUALITY ASSURANCE AND LAWS AND ORDINANCES

A. Installer Qualifications: Engage an experienced installer to perform work of this Section who has specialized in installing food service equipment, who has completed installations similar in design and extent to that indicated for this Project, and who has a record of successful in service performance.

- B. Manufacturer Qualifications: Engage a firm experienced in manufacturing food service equipment similar to that indicated for this Project and with a record of successful in-service performance.
- C. Source Limitations: Obtain each type of food service equipment through one source from a single manufacturer.
- D. Product Options: Drawings indicate food service equipment based on the specific products indicated. Other manufacturers' equipment with equal size and performance characteristics may be considered. Refer to Division 1 Section "Substitutions."
- E. Regulatory Requirements: Comply with the following National Fire Protection Association (NFPA) and California Electrical Codes (CEC) codes:
 - 1. NFPA 17, "Dry Chemical Extinguishing Systems."
 - 2. NFPA 17A, "Wet Chemical Extinguishing Systems."
 - 3. NFPA 54, "National Fuel Gas Code."
 - 4. NFPA 96, "Ventilation Control and Fire Protection of Commercial Cooking Operations."
 - 5. CEC, California Electrical Code, 2016
 - 6. The FSEC shall certify that all work and materials comply with Federal, State and Local laws, ordinances, and regulations and is confirmed by the local inspector having jurisdiction.
 - a. US PUBLIC HEALTH SERVICE
 - b. LOCAL HEALTH DEPARTMENT
 - c. NATIONAL BOARD OF FIRE UNDERWRITERS
 - d. OSHA
 - e. UL
 - f. HACCP
 - g. NFPA 96 – Current
 - h. ADA
 - i. OSHPD
 - j. DSA
- F. Listing and Labeling: Provide electrically operated equipment or components specified in this Section that are listed and labeled.
 - 1. The Terms "Listed" and "Labeled": As defined in the National Electrical Code, Article 100.
 - 2. Listing and Labeling Agency Qualifications: A "Nationally Recognized Testing Laboratory" (NRTL) as defined in OSHA Regulation 1910.7.
- G. AGA Certification: Provide gas-burning appliances certified by the American Gas Association (AGA).
- H. ASME Compliance: Fabricate and label steam-generating and closed steam-heating equipment to comply with ASME Boiler and Pressure Vessel Code.

- I. ASHRAE Compliance: Provide mechanical refrigeration systems complying with the American Society of Heating, Refrigerating and Air-Conditioning Engineers' ASHRAE 15, "Safety Code for Mechanical Refrigeration."
 - J. Food Service Equipment: Where provided, check-out aisles, sales counters, service counters, food service lines, queues, and waiting lines shall comply with CBC Sections 11B-227 and 11B-904. The top of tray slides shall be 28" minimum and 34" maximum above finish floor. Space and elements within food service employee work areas shall meet the requirements of CBC Section 11B-203.9. Food service equipment required to be accessible shall conform to all reach requirements in CBC Figures 2016, 11B-403.5.1, 11B-227.4, 11B-904.5, 11B-904.5.1, and 11B-904.5.2.
 - K. NSF Standards: Comply with applicable NSF International (NSF) standards and criteria and provide NSF, UL Sanitation or ETL Sanitation Certification Mark on each equipment item, unless otherwise indicated.
 - L. ANSI Standards: Comply with applicable ANSI standards for electric-powered and gas-burning appliances; for piping to compressed-gas cylinders; and for plumbing fittings, including vacuum breakers and air gaps, to prevent siphonage in water piping.
 - M. SMACNA Standard: Where applicable, fabricate food service equipment to comply with the Sheet Metal and Air Conditioning Contractors National Association's (SMACNA) "Food Service Equipment Fabrication Guidelines," unless otherwise indicated.
 - N. Seismic Restraints: Provide seismic restraints for food service equipment according to the Sheet Metal and Air Conditioning Contractors National Association's (SMACNA) "Food Service Equipment Fabrication Guidelines," appendix 1, "Guidelines for Seismic Restraints of Kitchen Equipment," unless otherwise indicated.
 - O. Pre-installation Conference: Conduct conference at Project site to comply with requirements of Division 1 Section "Project Meetings."
 - P. Pre-installation Conference: Conduct conference at Project site to comply with requirements of Division 1 Section "Project Meetings." Review methods and procedures related to food service equipment including, but not limited to, the following:
 - 1. Review access requirements for equipment delivery.
 - 2. Review equipment storage and security requirements.
 - 3. Inspect and discuss condition of substrate and other preparatory work performed by other trades.
 - 4. Review structural loading limitations.
 - 5. Review and finalize construction schedule and verify availability of materials, Installer's personnel, equipment, and facilities needed to make progress and avoid delays.
 - Q. Walk-in cooler and/or freezer shall comply with CBC Figures 2016, 11B-404.2.4, 11B-404.2.4.4, 11B-404.2.7 and 11B-309.4.
- 1.6 DELIVERY, STORAGE, AND HANDLING
- A. Deliver food service equipment as factory-assembled units with protective crating and covering.
 - B. Store food service equipment in original protective crating and covering and in a dry location.

1.7 PROJECT CONDITIONS

- A. Field Measurements: Verify dimensions of food service equipment installation areas by field measurements before equipment fabrication and indicate measurements on Shop Drawings and Coordination Drawings. Coordinate fabrication schedule with construction progress to avoid delaying the Work.
 - 1. Established Dimensions: Where field measurements cannot be made without delaying the Work, establish required dimensions and proceed with fabricating equipment without field measurements. Coordinate construction to ensure actual dimensions correspond to established dimensions.
 - 2. Food service aisles shall be a minimum 36" wide and tray slides shall be mounted at 34" maximum above the floor. Insure compliance with paragraphs 1.5.J and 1.5.Q.
 - 3. Pass-thru windows for food service shall conform to the reach and access requirements of paragraphs 1.5.J and 1.5.Q. Accessible pass-thru shelves shall not exceed 34-inch height above interior finished floor surface or exterior pavement.

1.8 COORDINATION

- A. Coordinate equipment layout and installation with other work, including light fixtures, HVAC equipment, and fire-suppression system components.
- B. Coordinate location and requirements of service-utility connections.
- C. Coordinate size, location, and requirements of concrete bases, positive slopes to drains, floor depressions, and insulated floors. Concrete, reinforcement, and formwork requirements are specified in Division 3 Section "Cast-in-Place Concrete."
- D. Coordinate installation of roof curbs, equipment supports, and roof penetrations. These items are specified in Division 7 Section "Roof Accessories."

1.9 WARRANTY

- A. General Warranty: The special warranty specified in this Article shall not deprive the Owner of other rights the Owner may have under other provisions of the Contract Documents and shall be in addition to, and run concurrent with, other warranties made by the Contractor under requirements of the Contract Documents. Warranty period: 1 year from date of completion.
- B. Refrigeration Compressor Warranty: 5 years from date of completion. Submit a written warranty signed by manufacturer agreeing to repair or replace compressors that fail in materials or workmanship within the specified warranty period.

PART 2 - PRODUCTS

2.1 MATERIALS - METAL

- A. Submit a certified copy of the mill analysis of materials if requested by the Architect.
- B. Finish for exposed surfaces to be #4 polished, unless otherwise specified.
- C. Protective covering shall be provided on all polished surfaces of stainless steel sheet work, and retained and maintained until time of final testing, cleaning, start-up and substantial completion.

- D. Stainless-Steel Sheet, Strip, Plate, and Flat Bar: ASTM A 666, Type 304, stretcher leveled, and in finish specified in "Stainless-Steel Finishes" Article.

1. Stainless steel finishes

- a. General: Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations relative to applying and designating finishes.
 - 1) Remove or blend tool and die marks and stretch lines into finish.
 - 2) Grind and polish surfaces to produce uniform, directional textured, polished finish indicated, free of cross scratches. Run grain with long dimension of each piece.
- b. Concealed surfaces: No. 2B finish (bright, cold-rolled, unpolished finish).
- c. Exposed surfaces: No. 4 finish (bright, directional polish).
- d. When polishing is completed, passivate and rinse surfaces. Remove embedded foreign matter and leave surfaces chemically clean.
- e. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipment.

- E. Stainless-Steel Tube: ASTM A 554, Grade MT-304, and in finish specified in "Stainless-Steel Finishes" Article.

- F. Zinc-Coated Steel Sheet: ASTM A 653, G115 (ASTM A 653M, Z350) coating designation; commercial quality; cold rolled; stretcher leveled; and chemically treated.

- G. Zinc-Coated Steel Shapes: ASTM A 36 (ASTM A 36M), zinc-coated according to ASTM A 123 requirements.

- H. Sealant: ASTM C 920; Type S, Grade NS, Class 25, Use NT. Provide elastomeric sealant NSF certified for end-use application indicated. Provide sealant that, when cured and washed, meets requirements of Food and Drug Administration's 21 CFR, Section 177.2600 for use in areas that come in contact with food.

- 1. Color: As selected by Architect from manufacturer's full range of colors.
- 2. Backer Rod: Closed-cell polyethylene, in diameter larger than joint width.

- I. Sound Dampening: NSF-certified, nonabsorbent, hard-drying, sound-deadening coating. Provide coating compounded for permanent adhesion to metal in 1/8-inch (3-mm) thickness that does not chip, flake, or blister.

- J. Gaskets: NSF certified for end-use application indicated; of resilient rubber, neoprene, or PVC that is nontoxic, stable, odorless, nonabsorbent, and unaffected by exposure to foods and cleaning compounds.

- K. Casters: NSF-certified, heavy duty, stainless-steel, swivel stem casters with 5-inch- (125-mm-) diameter wheels, polyurethane tires with 1-inch (25-mm) tread width, and 200-lb (90-kg) load capacity per caster. Provide brakes on 2 casters per unit.

2.2 MATERIALS – CASEWORK/MILLWORK

- A. Cabinet Hardware: Provide NSF-certified, stainless-steel hardware for equipment items as indicated. Pulls, Handles and Catches to be included.

- B. All wood to be thoroughly seasoned and kiln dried prior to being used for fabrication of custom casework. All wood to be free from knots, pitchy seams, or other imperfections. All exposed wood to be grade A pine.

- C. All plywood to be thoroughly seasoned and kiln dried prior to being used. All plywood to be free from knots, pitchy seams, and other imperfections. All plywood to be glued with water resistant resin. Particle board may not be substituted for plywood panels. "W.I. - Custom Grade" marine grade plywood is required on all fixtures to be installed in high humidity environments.
- D. All wood to have less than 12% moisture content and be a species listed by the national hardwood association.
- E. Plastic laminates shall be 1/16th thick, general purpose grade GP-50 as manufactured by Wilson Art or equal. Patterns, textures, and colors as specified under individual items. Semi ex-posed and cabinet liners shall be CL-20. Countertops, backsplashes and edges shall be grade GP-50 on exposed and grade BK-20 on underside of tops. Exposed vertical surfaces and cabinet liners shall be grade CL-20. Sides and edges of shelving shall be grade 50. Adhesive shall be waterproof and low VOC.
- F. Hardware that is furnished and installed shall be of solid material unless specified otherwise. The hardware shall be provided with the necessary mechanisms for locking. All locks shall be furnished with two (2) keys.
- G. Solid Surface Material (SSM) shall be Caesarstone, Silestone or approved equal and installed over 3/4" plywood per manufacturer's instructions. Provide air space, trim and /or insulation around any heat or cold producing equipment to guard against discoloration and cracking.

2.3 FABRICATION, GENERAL, METAL,

- A. Fabricate food service equipment according to NSF (standards 2, 4 & 7) requirements. Factory assemble equipment to the greatest extent possible.
- B. STAINLESS-STEEL EQUIPMENT: for all parts of custom tables, tops, benches, sinks, cabinets, etc., as drawn or as specified, shall be AICI type 304 (18-8 Austenitic). All gauges called for shall be U.S. Standard Gauges, "S/S" or "S.S." as shown in the drawings or specifications, shall indicate stainless steel.
 - 1. Edges and Backsplashes: Provide equipment edges and backsplashes indicated complying with referenced SMACNA standard, unless otherwise indicated.
 - 2. Apply sound dampening to underside of metal work surfaces, including sinks and similar units. Provide coating with smooth surface and hold coating 1 inch (25 mm) back from open edges for cleaning.
 - 3. Tables: Fabricate with reinforced tops, legs, and reinforced undershelves or cross bracing to comply with referenced SMACNA standard, unless otherwise indicated, and as follows:
 - a. Tops: Minimum #14 gauge / 0.0781-inch- (1.984-mm-) thick stainless steel, unless otherwise indicated.
 - b. Legs: 1-5/8 inch (41.3 mm) OD, minimum #16 gauge / 0.0625-inch- (1.588-mm-) thick stainless steel with stainless-steel gusset and adjustable insert bullet-type feet with minimum adjustment of 1 inch (25 mm) up or down without exposing threads, unless otherwise indicated.
 - c. Undershelves: Minimum #16 gauge / 0.625-inch- (1.588-mm-) thick stainless steel, unless otherwise indicated.
 - d. Top and Undershelf Reinforcement: Provide minimum #14 gauge / 0.0781-inch- (1.984-mm-) thick, stainless-steel reinforcing, unless otherwise indicated.

- e. Cross Bracing: 1-1/4 inch (31.75 mm) OD, minimum #16 gauge / 0.0625-inch- (1.588-mm-) thick stainless steel, unless otherwise indicated.
4. Sinks: Fabricate of minimum #14 gauge / 0.0781-inch- (1.984-mm-) thick stainless steel with fully welded, 1-piece construction. Construct 2 sides and bottom of sink compartment from 1 stainless-steel sheet with ends welded integral and without overlapping joints or open spaces between compartments. Provide double-wall partitions between compartments with 1/2-inch- (13-mm-) radius rounded tops that are welded integral with sink body. Cove horizontal, vertical, and interior corners with 3/4-inch (19-mm) radius. Pitch and crease sinks to waste for drainage without pooling. Seat wastes in die-stamped depressions without solder, rivets, or welding.
- a. Wastes: 2-inch (50-mm), stainless steel ball valve, rotary-handle waste assembly with stainless-steel strainer plate, rough chrome plated body.
 - b. Drainboards: Minimum #14 gauge / 0.0781-inch- (1.984-mm-) thick stainless steel, pitched to sink at 1/8 inch/12 inches (3 mm/300 mm) of length. Reinforce drainboards with minimum #14 gauge / 0.0781-inch- (1.984-mm-) thick stainless steel, unless otherwise indicated.
 - c. Legs: 1-5/8 inch (41.3 mm) OD, minimum #16 gauge / 0.0625-inch- (1.588-mm-) thick stainless steel with stainless-steel gusset welded to #12 gauge / 0.1094-inch- (2.779-mm-) thick, stainless-steel support plate. Provide adjustable insert bullet-type feet with minimum adjustment of 1 inch (25 mm) up or down without exposing threads, unless otherwise indicated.
 - d. Drainboard Braces: 1 inch (25 mm) OD, minimum #16 gauge / 0.0625-inch- (1.588- mm-) thick stainless steel, unless otherwise indicated.
 - e. Cross Bracing: 1-1/4 inch (31.75 mm) OD, minimum #16 gauge / 0.0625-inch- (1.588-mm-) thick stainless steel, unless otherwise indicated.
5. Wall Shelves and Overshelves: Fabricate to comply with referenced SMACNA standard, unless otherwise indicated, and with minimum #16 gauge / 0.0625-inch- (1.588-mm-) thick, stainless-steel shelf tops.
6. Drawers: Provide lift-out type, 1-piece, die-stamped drawer pan fabricated from #18 gauge / 0.050-inch- (1.27-mm-) thick stainless steel with inside corners radiused. Support drawer pan with #16 gauge / 0.0625-inch- (1.588-mm-) thick, stainless-steel channel frame welded to drawer front. Provide 1-inch- (25-mm) thick, double-wall front fabricated from #16 gauge / 0.0625-inch- (1.588-mm-) thick stainless steel and with integral recessed pull. Fill void in drawer front with semi rigid fiberglass sound dampening. Mount drawers on NSF-certified, full-extension, stainless-steel drawer slides that have minimum 100-lb (45-kg) load capacity per pair, ball-bearing rollers, and positive stop. Mount drawer slides for self-closing on drawer housing as indicated.
7. Refrigerated Bases: Unit to be all welded construction and fabricated in accordance with NSF Standard 7.
- a. Top: 18 gauge galvanized sub-top or 14 gauge stainless steel top.
 - b. Exterior: Front and Sides to be 18 gauge number 4 finish type 304 stainless steel; bottom and back to be 18 gauge galvanized (unless otherwise noted).
 - c. Interior liner: 20 gauge number 4 finish type 304 stainless steel with 3/8" radius corners.
 - d. Insulation: Minimum 2" thick polyurethane foam in place insulation (CFC free).

- e. Doors: 18 gauge front and 20 gauge door pan number 4 finish type 304 stainless steel with 2" polyurethane foam in place insulation, long-life press in place gasket.
 - f. Drawers: 300 lb. capacity with 14 gauge stainless steel track system, tandem 2" all stainless steel skate wheels, each drawer accommodates two 6" deep, 12" x 20" pans side by side.
 - g. Shelving: Each door section shall have stainless steel wire racks.
8. Refrigerated Pan Rails: Unit to be all welded construction and fabricated in accordance with NSF Standard 7.
- a. Top: 16 gauge number 4 finish type 304 stainless steel top and inner liner.
 - b. Outer liner: To be 18 gauge type 304 stainless steel; bottom and back to be 18 gauge galvanized (unless otherwise noted).
 - c. Insulation: Minimum 2" thick polyurethane foam in place insulation (CFC free).
 - d. Drain: Provide with 1" stainless steel drain
 - e. Control: Provide with on/off control to be field installed.
- C. Welding: Use welding rod of same composition as metal being welded. Use methods that minimize distortion and develop strength and corrosion resistance of base metal. Provide ductile welds free of mechanical imperfections such as gas holes, pits, or cracks.
- 1. Welded Butt Joints: Provide full-penetration welds for full-joint length. Make joints flat, continuous, and homogenous with sheet metal without relying on straps under seams, filling in with solder, or spot welding.
 - 2. Grind exposed welded joints flush with adjoining material and polish to match adjoining surfaces.
 - 3. Where fasteners are welded to underside of equipment, finish reverse side of weld smooth and underpressed.
 - 4. Coat unexposed stainless-steel welded joints with suitable metallic-based paint to prevent corrosion.
 - 5. After zinc-coated steel is welded, clean welds and abraded areas and apply SSPCPaint 20, high-zinc-dust-content, galvanizing repair paint to comply with ASTM A 780.
- D. Fabricate field-assembled equipment prepared for field-joining methods indicated. For metal butt joints, comply with referenced SMACNA standard, unless otherwise indicated.
- E. Where stainless steel is joined to a dissimilar metal, use stainless-steel welding material or fastening devices.
- F. Form metal with break bends that are not flaky, scaly, or cracked in appearance; where breaks mar uniform surface appearance of material, remove marks by grinding, polishing, and finishing.
- G. Sheared Metal Edges: Finish free of burrs, fins, and irregular projections.
- H. Provide surfaces in food zone, as defined in NSF 2, free from exposed fasteners.
- I. Cap exposed fastener threads, including those inside cabinets, with stainless-steel lock washers and stainless-steel cap (acorn) nuts.

- J. Provide pipe slots on equipment with turned-up edges and sized to accommodate service and utility lines and mechanical connections.
- K. Provide enclosures, including panels, housings, and skirts, to conceal service lines, operating components, and mechanical and electrical devices including those inside cabinets, unless otherwise indicated.
- L. Seismic Restraints:
 - 1. Fabricate to comply with details and referenced documents

2.4 FABRICATION, MILLWORK/CASEWORK

- A. Fabricate food service equipment according to the "Manual of Millwork, current edition" of the Woodwork Institute, including all amended printed revisions, and NSF Standards. All composite wood products shall meet the latest California Air Resources Board (CARB) Composite Wood Products Regulations. Factory assemble equipment to greatest extent possible. All specially fabricated equipment must be by one manufacturer/fabricator per specialty acceptable to Consultant and the Owner.
- B. Solid Surface Material (SSM) shall be Caesarstone, Silestone or approved equal and installed over 3/4" plywood per manufacturer's instructions. Provide air space, trim and /or insulation around any heat or cold producing equipment to guard against discoloration and cracking.

2.5 EXHAUST HOOD FABRICATION

- A. Definitions:
 - 1. Listed Hood: A hood, factory fabricated and tested for compliance with UL-710 by a testing agency acceptable to authorities having jurisdiction.
 - 2. Type I Hood: A hood designated for grease exhaust applications.
 - 3. Type II Hood: A hood designed for heat and steam removal and for other non-grease applications.
 - 4. Non-listed Hoods are not acceptable for this project.
- B. General: Provide listed hoods with dual wall construction and manufactured from minimum #18 gauge / 0.050-inch- (1.27-mm-) thick type 304 stainless steel, unless otherwise indicated. FSEC shall verify size and location of all connections required before fabrication.
 - 1. Exhaust hood performance tests shall be in accordance with ASTM F1704-05. Manufacturer, upon request, shall be required to submit validation that full capture and containment of appliance thermal plume and smoke can be accomplished at specified/design air volumes without modifications to duct size, filter velocity or hood/system static pressure.
 - 2. Hoods shall comply with current NFPA 96, NSF, ASHRAE 90.1, ASHRAE 154, CA-Title 24 (CA Based Projects Only), Local Applicable Codes and Manufactures Recommendations.
 - 3. Product/system must meet the design, construction, performance and operational intent of the project. It is the responsibility of the FSEC to verify interface of the system with all associated trades including, but not limited to; electrical, mechanical, sheet metal, plumbing and controls per Division 23.
 - 4. Design exhaust volume shall be based on hood manufacturers heat load based design calculations and not estimated CFM/linear foot or minimum UL-710 listed volume.

- C. Grease Removal: Provide removable, stainless-steel, single stage, baffle-type grease filter. Provide minimum #18 gauge / 0.0781-inch- (1.984-mm-) thick, stainless steel filter frame and removable collection basins or troughs. Filters/baffles shall be UL 1046 Classified and tested according to ASTM Standard F 2519-05 "Standard Test Method for Grease Particle Capture Efficiency of Commercial Kitchen Filters and Extractors" by a nationally recognized testing laboratory acceptable to authorities having jurisdiction. The filters/baffles must be single stage and have a minimum extraction rate of 93% at 5 microns and 98% at 15 microns.
- D. Sound Level Criteria: Isolated grease filter sound levels shall not exceed an NC rating of 55 at full design exhaust volume.
- E. Light Fixtures: Provide NSF, UL, CSA AND CE-certified LED fixtures, vapor-tight sealed lenses, to provide 3500K with 50 foot candles at the cooking surface. Any exposed wiring shall be concealed in stainless-steel.
- F. Appliance Interlock: Hoods to be provided with Appliance Interlock Temperature Sensor to comply with IMC 2006 requirement, section 507.2.1.1.
- G. Exhaust-Duct Collars: Minimum #18 gauge / 0.0625-inch- (1.588-mm-) thick stainless steel, FSEC shall provide all stainless steel duct collars and make final connections to hood, welded 100% grooved smooth and painted.
- H. Fires suppression system: Hoods to be provided with factory pre-piping for connection to wet chemical fire suppression system, model R102 as manufactured by "Ansul" or equal in accordance with UL300 standards.
 - 1. Surface drop exposed piping shall be stainless steel.

2.6 FIRE SUPPRESSION SYSTEM

- A. Provide complete fire suppression system conforming to NFPA and UL300. System to be connected to factory pre-piping provided as part of the exhaust hood.
- B. Automatic actuation shall be by means of fusible link with no visible conduit. Manual activation shall be made possible with remote pull stations.
- C. System shall be furnished and installed by an Ansul certified distributor in accordance with manufacturer's instructions and the authority having jurisdiction.
- D. Microswitches shall be furnished as part of the system for "tie in" of building alarm and for make-up air/fire/fuel/shutdown.
- E. Gas valves shall be electric solenoid type and support simultaneous activation.

2.7 WALK-IN COOLERS/FREEZERS

- A. Panel Construction:
 - 1. Panels shall be pre-fabricated, sectional construction (minimum 5-inches thick for Coolers and Freezers), of tongue and groove design with foamed-in-place "double bubble" PVC gaskets (not glued, stapled, or nailed) on the male side of all interior and exterior panels and rigid urethane frame. Every panel shall be NSF and UL factory approved and bear the certifying labels. Walk-in box height to be 108"; Interior Height, except freezers with pre-fab floor in combination with cooler without floor to be 104" or unless otherwise specified.

2. Gaskets shall be impervious to stains, greases, oils, and mildew and be resistant to chemical corrosion and ultraviolet radiation. Gasket operating temperature shall be -30 degrees F to 160 degrees F (-34 degrees C to +71 degrees C).
 3. Corner panels shall be 90-degree angles with coved corners; interior partition walls shall utilize 'T' panels with coved corners. All panels shall be manufactured in accordance NSF approved standards.
 4. Panels shall be completely filled with rigid 100% foamed-in-place non-CFC urethane between interior and exterior metal 'skins' which have been die-formed and gauged for uniformity in size. Rigid polyurethane blowing agents shall comply with current US EPA SNAP program listings. Slab urethane or polystyrene are not acceptable. In addition, wood shall not be acceptable in any panel including doors, walls, floor, and ceiling.
 5. Insulation shall have a 95% closed cell structure with an average in-place density of 2.2 lbs. per cubic foot, and compression strength at yield point of 19 lbs. per square inch. The R-Values of the floor, ceiling and wall panels meet the requirements under the Energy Independence and Security Act of 2009 (EISA).
 6. Floor panels: Floor panels shall be die stamped with 3/8-inch radius NSF coved corners. All plane intersections shall be drawn, not cut and welded. Panels shall be fabricated similar to other panels and designed to readily withstand uniformly distributed loads, point loads for stationary shelving, rolling loads from hand truck and mobile food racks. Where noted, pre-fabricated floors shall withstand rolling loads from either manual pallet jacks or electric pallet jacks.
- B. Door Construction: Walk-in coolers and freezers shall have entry and exit door hardware that complies with all of the requirements of CBC Section 11B-404.2.8.1 and maneuvering clearances at the exterior side per CBC Section 11B-404.2.7 & 11B-309.4. Doors shall be flush (in-fitting) type, self-closing, 36-inches by minimum 80-inches high, 20-gauge stainless steel interior and exterior.
1. Doors shall be mounted with three adjustable cam-lift hinges (Kason 1245) and hydraulic adjustable automatic hold-open (rack and pinion) door closers. Door hardware shall be chrome plated Kason model 27C. Mounting height of latching hardware shall be 34 to 44 inches above finish floor. All hardware shall meet the requirements of CBC 11B-404.2.7 & 11B-309.4.
 2. Door latches shall lock and have a safety release to prevent entrapment (one quarter turn of the release handle unlocks the door from the inside).
 3. All freezer door will be provided with a Department of Energy approved heater strip, heated sweep gaskets, and a heated pressure relief port.
 4. All door sections to have raised casings. Light fixtures to be wired through digital controllers, refer to para. 2.7.E.5 for controller requirements. Provide additional switches as required for light activation from multiple locations.
 5. The doorjamb, frames, and thresholds shall be made of durable Fiberglass Reinforced Plastic (FRP) or polyvinyl chloride (PVC).
- C. Assembly: Panels shall be assembled by Posi-Locs or equal which shall be foamed-in-place and activated by a hex wrench. Floor panels shall utilize post tension construction within the floor panels. Access ports to locking devices shall be covered by snap caps and shall be located in interior of walk-in.

- D. Finishes: Refer to the finishes shown and the Foodservice Equipment Schedule paragraph 3.5.
1. Surfaces (walls, ceiling and closure panels):
 - a. Exposed exterior 20-gauge Type 304 stainless steel, #4 finish, Rimex Windsor pattern.
 - b. Unexposed exterior surfaces to be 20 gauge smooth galvanized steel.
 - c. Interior finishes: minimum 20 gauge type 304 stainless steel on walls and white stucco aluminum on ceiling.
 - d. Interior floor: verify on finish schedule and item specification, paragraph 3.5.
- E. Accessories:
1. Provide interior and exterior doors with 14 gauge (stainless steel) kickplates to 36-inches high.
 2. Provide (s/s) closure panels to interior ceiling and all adjacent walls, finished with 90- degree angles at the box and the ceiling/wall; no raw edges will be accepted.
 3. Provide vinyl strip curtains.
 4. Include LED light fixtures to provide 20 ft. candles of light throughout compartment.
 5. Refrigerated compartments fabricated and standard, shall be fitted with flush mounted digital temperature controllers. Thermometers on such controllers shall be adjustable and calibrated after installation. All thermometers shall have an accuracy of 2 degrees. Controller shall be Modularm 75 LC, or equal, and include frame mounted door magnets for door ajar alarm, interior panic alarm button and motion detector activated automatic panic alarm. All controllers are to be programmable and have the capability of being connected to remote monitoring systems or building management systems.
 6. Per document drawings, provide 14-inches by 24-inches view port - unheated for cooler door, heated for freezer door.
 7. Freezer Door Fan Switches (at ambient facing freezer door only)
 8. When Anthony doors are specified: include Optimax Pro LED Lighting.
- F. Insulated Floor Depressions: The FSEC shall provide styrofoam insulation for cooler and freezer floors. Insulation shall be a minimum of 3 layers Dow high load 60 extruded polystyrene, 2-inch thick. Overall R-value to meet DOE requirements for freezer floors with vertical compressive strength of 69 psi and maximum water absorption of 0.1% by volume.
- G. Approvals: Fire hazard classification according to ASTM E-84 (UL723) shall be a flame spread rating of 25 or less with a certifying UL label attached to every panel showing the meeting of the fire code. Smoke development rating to be 450 or less; NSF-listed with an approved toxicity rating.
- H. Walk-in coolers and freezers shall have level maneuvering clearances at the exterior side (CBC 118-404.2.4.1) and accessible entry and exit door hardware (CBC 11B-404.2.7, 11B-309.4 & 11B-404.2.8.1).
- I. Installation: Equipment identified under this section shall be erected by individuals approved by the manufacturer who qualify as "factory certified" installers.

2.8 REMOTE REFRIGERATION SYSTEMS

- A. Furnish and install mechanical refrigeration work as indicated and specified, complete and ready for use. All systems shall comply with the latest edition of Title 24, 2016 Building Efficiency Standards. Principal items of work include:

1. Mechanical refrigeration systems, including compressor units, condensers, refrigerant piping, evaporator coils, control valves, compressor racks, weather covers and required miscellaneous items. Refrigeration equipment shall consist of two major assemblies. One is the condensing unit assembly with all necessary components, factory installed and wired including single point electrical control panel, circuit breakers and contactors, OSHA approved fan guards, aluminum flexible conduit for internal wiring, suction filter, sight glass, drier, adjustable dual pressure control, flexible pressure hoses, Rotolock compressor adaptors and necessary tubing. The other is the refrigeration coil assembly/heat exchanger with expansion valve, electronic thermostat temperature control with electronic defrost time clock and on/off power switch, completely factory mounted and factory pressure tested with dry nitrogen.
 - a. Utilize refrigerant with an ozone depleting potential of 0
 - b. R-407A Low to Medium Temperatures
 - c. Other refrigerant approved by the Department of Energy for use in remote systems after December 31, 2017.
 - d. Glycol – Food Grade
2. Furnishing of motor starters and walk-in refrigerator/freezer thermostats for installation under Electrical Section.
3. Sleeves, inserts, hangers, supports and other incidental items necessary to complete the work.
4. Cutting and patching of non-structural and other incidental items necessary to complete the work on this section.
5. Testing, charging, adjusting, operational testing and cleaning of equipment. Conduct all tests as required by local inspecting agencies concerned with this project. Each refrigeration items specification is written to provide minimum specifications and scope of work.
6. Refrigeration equipment shall be designed and installed to maintain the following general temperature unless otherwise specified.

a. Walk-In Refrigerators	1.7°C / 35°F
b. Walk-In Freezers	-23.2°C / -10°F
c. Reach-In Refrigerators	1.7°C / 35°F
d. Reach-In Freezers	-23.2°C / -10°F
e. Undercounter Refrigerators	1.7°C / 35°F
f. Undercounter Freezers	-23.2°C / -10°F
g. Cold Pan	4°C / 39°F

- B. Compressors and Condensing Unit: Factory assembled, scroll compressors with air cooled condensers operating at such speed within recommended range of section and discharge pressures for economical operation and with required BTU rating per hour, sizes and capacities in accordance with specifications. Provide units of same manufacturer and type throughout, new standard cataloged, to operate with refrigerant R-407A. 100 degrees ambient air, capacities selected on 16 hour running time basis for medium temperature fixtures and 18 hour running time basis for low temperature fixtures. For locations where the ambient exceeds 100 degrees Fahrenheit, the system is to be engineered for the maximum recorded ambient temperature. Additionally, all parallel systems shall include a minimum of one digital scroll compressor and be designed with 75% redundancy minimum.
- C. Condensing units shall be scroll air cooled condensing unit with rigid structural bases, 20 gauge weather covers, OSHA-approved fan guards and shrouds and waterproof electrical systems. Include internal inherent motor protection, suction line, shut off valves, liquid line shut off valves, oil pressure safety switches when required, adjustable dual pressure control, crank case heaters and oil separators on systems with longer than 100 lin. ft. run from condensing unit to the evaporator coil. Any outdoor installation within 20 miles of the salt air environment shall be provided with coated condenser coils.
- D. Medium temperature evaporators shall be equipped with Electronically Commutated Motors (ECM). Coils shall be low profile UL/NSF approved units with inline fans and cross fins staggered. Provide copper tubing, aluminum cased, permanently lubricated motors with thermal overload protection. Unit shall be provided with evaporator controller system capable of providing evaporator fan control, remote monitoring and diagnostics. Control system shall be interconnected to the local area network and be capable of sending alarm alerts via mobile telephone or e-mail. Water proof electrical system pre-wired to a single connection. Coils are designed to operate above 34 degrees Fahrenheit.
- E. Low Temperature evaporators shall be equipped with Electronically Commutated Motors (ECM). Coils shall be low profile UL/NSF approved units with inline fans and cross fins staggered. Provide copper tubing, aluminum cased, permanently lubricated motors with thermal overload protection. Unit shall be equipped with electric demand defrost controller system. Controller system shall provide on-demand defrost, remote monitoring and diagnostics and be interconnected to the local area network with the capability of sending alarm alerts via mobile telephone or e-mail. Water proof electrical system pre-wired to a single connection. Coils are designed to operate in a range from 30 degrees above Fahrenheit to -20 degrees Fahrenheit.
- F. Refrigerant lines shall be type "L" ACR copper tubing with wrought copper fittings assembled by silver soldering joints.
- G. Coil drains shall be 1" IPS copper. Route and pitch ½" per foot to drain. Provide electrical heaters on freezer drains.
- H. Refrigeration lines insulation shall have a minimum ¾" Armstrong Armaflex AP Pipe insulation sealed with adhesive foam insulation. For glycol systems the minimum insulation shall be ¾". Tape fittings to be sufficient thickness to prevent condensation. Lines ran externally shall include a hard white PVC cover.
- I. Installation of this refrigeration equipment shall be performed by individuals approved by the manufacturer who qualify as "factory certified" installers.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Unless expressly stipulated, and in a timely manner, no additional allowances will be made for Contractors or Manufacturers for errors, omissions or ambiguities not reported at time of bidding. Carefully review and compare the Contract Documents and at once report to Owner and/or Designer any errors, ambiguities, inconsistencies or omissions. Unless expressly stipulated, and in a timely manner, Kitchen Equipment Contractor shall be liable to Owner or Designer for any damage resulting from such errors, inconsistencies or omissions in the Contract Documents. Work shall not be done without approved Drawings, Specifications and/or Modifications and without receiving prior written receiving authorizations from Owner or Designer. Drawings and equipment specifications are intended to complement each other. Therefore, neither should be considered complete without the others.
- B. Examine areas and conditions, with Installer present, for compliance with requirements or installation tolerances, service-utility connections, and other conditions affecting installation and performance of food service equipment. Do not proceed with installation until unsatisfactory conditions have been corrected.
- C. Examine roughing-in for piping, mechanical, and electrical systems to verify actual locations of connections before installation.
- D. Verify all conditions at the building, particularly door openings and passageways for large equipment. Coordinate with General Contractor access to insure delivery of equipment to the required areas. Coordination shall include, but not be limited to, early delivery, hoisting, window removal and/or delay of wall construction. All special equipment, handling charges, window removal, etc. shall be paid for by the Food Service Equipment Contractor.
- E. Any and all food service equipment and equipment systems noted as "by owner/operator", "by purveyor", or "existing" in the food service construction documents are presented for reference only. These representations must be verified in writing by the food service equipment contractor, owner, operator, and/or general contractor prior to the release of "for construction" documentation. It will be the general contractor's responsibility to further verify and coordinate all necessary information pertaining to this equipment or systems making up, or relating to, this equipment including, but not limited to, local health department regulations, local sanitation code requirements, mechanical, structural, plumbing and electrical requirements prior to commencement of construction. Consultant or Architect take no responsibility for design, intent, function, performance, utility requirements, or code compliance of non-specified equipment.

3.2 INSTALLATION, GENERAL

- A. Install food service equipment level and plumb, according to manufacturer's written instructions, original design, and referenced standards.
- B. Complete equipment field assembly, where required, using methods indicated.
 - 1. Provide closed butt and contact joints that do not require a filler.
 - 2. Grind field welds on stainless-steel equipment smooth, and polish to match adjacent finish. Comply with welding requirements in "Fabrication, General" Article.
- C. Install equipment with access and maintenance clearances according to manufacturer's written instructions and requirements of authorities having jurisdiction.

- D. Provide cutouts in equipment, neatly formed, where required to run service lines through equipment to make final connections. Cut holes and provide sleeves for pipes on equipment, for drains, electrical, plumbing, etc., as required for proper installation. Verify sizes with Owner on the following items before ordering or fabrication: steam pans, sheet pans, trays, glass and cup racks.
- E. Except for mobile and adjustable-leg equipment, securely anchor and attach items and accessories to walls, floors, or bases with stainless-steel fasteners, unless otherwise indicated.
- F. Install hoods to comply with NFPA 96 requirements and to remain free from vibration when operating.
- G. Install seismic restraints according to referenced SMACNA standard.
- H. Install trim strips and similar items requiring fasteners in a bed of sealant. Fasten with stainless-steel fasteners at 48 inches (1200 mm) o.c. maximum.
- I. Install sealant in joints between equipment and abutting surfaces with continuous joint backing, unless otherwise indicated. Provide airtight, watertight, vermin-proof, sanitary joints.
- J. Prohibit cold storage rooms from being used by any other trade for storage or work areas. Repair or cause replacement to any damaged areas on the interior of the cold storage rooms, if the damage was caused due to the cold storage rooms being used for storage or work areas.

3.3 PROTECTING

- A. Provide final protection and maintain conditions, in a manner acceptable to manufacturer and installer that ensure food service equipment is without damage or deterioration at the time of Substantial Completion.

3.4 START-UP, TESTING AND COMMISSIONING

- A. Startup Services: Engage factory-authorized service representatives to perform startup services for all equipment.
 - 1. Coordinate food service equipment startup with service-utility testing, balancing, and adjustments. Do not operate steam lines before they have been cleaned and sanitized. Provide demonstrations for both operations and maintenance personnel.
 - 2. Remove protective coverings and clean and sanitize equipment, both inside and out, and re-lamp equipment with integral lighting. Where applicable, comply with manufacturer's written cleaning instructions.
 - 3. Test each equipment item for proper operation. Repair or replace equipment that is defective in operation, including units that operate below required capacity or that operate with excessive noise or vibration.
 - a. Start up and testing for ice making equipment to be performed by the Original Equipment Manufacturer's authorized representative after substantial completion by the FSEC prior to final testing. All issues of installation hook-up and operational conditions are to be addressed. Any conditions not meeting operational needs will be identified and reviewed with the FSEC and/or GC.
 - b. Type I grease hoods and fire protection systems are to be reviewed by the Original Equipment Manufacturer's authorized representative after substantial completion and prior to final testing. This review shall also take place prior to the start-up and demonstration of any cooking equipment under the hood. All issues of installation hook-up and operational conditions will be addressed. Any conditions not meeting operational needs will be identified and reviewed with the FSEC and/or GC. A field inspection report will be provided

as part of the Owner's equipment manual and submitted to the GC and local fire marshal when required by code.

4. Provide maintenance and proper operations training to both the client maintenance and operations staff.
5. Provide maintenance manuals, service parts manuals and product schedule in accordance with paragraphs 1.4.K and 1.4.K.1

B. Demonstration and Commissioning: Representatives of authorized service agencies, manufacturer or original equipment supplier shall provide these services with FSEC in attendance.

1. Demonstrate in the presence of the owner, owner's designated representative and owner's maintenance and operations personnel the proper initial start-up, operation clean-up, preventative maintenance safety procedures of each item of equipment.
2. FSEC is to provide a signed log or record of all demonstrations, training and start-ups conducted to the owner with equipment operations manuals.

3.5 FOOD SERVICE EQUIPMENT SCHEDULE

SIS# W010

ITEM # 1-01 EVAPORATOR COIL (COOLER) <Included>

Quantity: One (1)
Manufacturer: RDT Refrigeration
Model: ADT-120

1. One (1) Model ADT-120 Evaporator coil provided as an integral part of the remote refrigeration system.

ITEM # 1-02 REFRIGERATOR STORAGE SHELVING UNITS

Quantity: Eleven (11)
Manufacturer: Cambro
Model: CAMSHELVING

1. Eleven (11) Model CAMSHELVING (LOT) 4 tier, 21" deep shelving units, posts to be 72" high, shelving units shall have a smooth surface without any welding or crevices. Posts and traverses shall be made of steel metal core with thick polypropylene covers. Shelf plates shall have a smooth surface without any welding or crevices, be of a structural web design and removable to be washed manually or in a commercial dishwasher. Shelf plates shall contain CamGuard, antimicrobial that inhibits the growth of mold, fungus and bacteria. Posts shall have dovetails that allow shelves to be adjusted in 4" increments. Provide dunnage stands for all traverses 54" or longer and at corners where corner connectors are used. Verify evaporator coil location, shelving units below coil to have 3 shelves. Provide in the configuration shown on plans, verify final sizes of shelves and posts by field measuring prior to ordering.

ITEM # 1-03 DUNNAGE RACK

Quantity: Two (2)
 Manufacturer: Cambro
 Model: S-SERIES

1. Two (2) Model S-SERIES S-Series Dunnage Rack, slotted top, 3000 lb. load capacity, 21"D x 12"H, polypropylene, one-piece, seamless double wall construction, includes (1) Camlink®, 4" square legs, speckled gray, NSF
2. One (1) Model DRS600480 S-Series Dunnage Rack, slotted top, 3000 lb. load capacity, 21"D x 60"W x 12"H, polypropylene, one-piece, seamless double wall construction, includes (1) Camlink®, 4" square legs, speckled gray, NSF
3. One (1) Model DRS480480 S-Series Dunnage Rack, slotted top, 3000 lb. load capacity, 21"D x 48"W x 12"H, polypropylene, one-piece, seamless double wall construction, includes (1) Camlink®, 4" square legs, speckled gray, NSF

ITEM # 1-04 WALK-IN REFRIGERATOR

Quantity: One (1)
 Manufacturer: Thermalrite
 Model: CUSTOM

1. One (1) Model CUSTOM Cooler Item # 1-04 - indoor UL Listed Class 1 Panel with NSF listed construction

1) 11' 0" x 19' 6" x 9' 5" foam rail walk-in Holding cooler without floor

Dimensions:

External (O.D.): 11' 0" x 19' 6" x 9' 5" - w x d x h

Internal (I.D.): 10' 2" x 18' 8" x 9' 0" - w x d x h

Volume: 1708 ft³ / 286385

Finishes

Walls: St. Stl. Type 304 #4 finish - 20 Ga. - interior

20 ga Stainless Steel 304 #4 Rimex Windsor Pattern & Galvanized/Smooth - 20 Ga. - exterior

Ceilings: Aluminum/Embossed White - .040 - interior

Galvanized/Smooth - 20 Ga. - exterior

Panel Thickness

Walls: 5" UL Listed Class 1 Foam

Ceilings: 5" UL Listed Class 1 Foam

Door D01

Qty Description

1 Finished opening 36" x 80" hinged flush cooler door

1 Interior finish - St. Stl. Type 304 #4 finish - 20 Ga.

1 Exterior finish - St. Stl. Type 304 #4 finish - 20 Ga.

1 Interior jamb finish - St. Stl. Type 304 #4 finish - 20 Ga.

1 Exterior jamb finish - St. Stl. Type 304 #4 finish - 20 Ga.

1 Viewport- Unheated 14"x24"

1 Kick plate: 36" 16 GA Stainless steel - interior and exterior

2 Hinge- Kason 1245 Reversible Cam-Rise

1 Modularm MD-1 Motion Detector

1 Raised Door Casings

1 Door Closer - Calibre (hold open feature) 16503-AL

1 Item #287886
 1 Stub conduit through ceiling
 1 Door- Flush Mount
 1 Hinge (Additional)
 1 Temp Alarm- Modularm 75LC (120v) Multi-Monitor,
 Temperature Alarm, Door Ajar Alarm, Automatic Light
 Control, AC Failure Alarm, Panic Alarm (Low voltage 1P-1,120v
 F°/C°
 1 Gasket- Magnetic

Accessories

10 Caulk - Silicone Grey (Tubes)
 2 Light- (120v) LED 30 watt Vapor-Proof Fixture (4') - (bulbs included in price)
 7 Caulk - Butyl (Tubes) 33 Lock Wall Panels to Ceiling Panels (Factory Ceiling Caps -
 Standard)

Miscellaneous

60 6"h S/S Cove Base @ Interior & Exposed Exterior
 1 Kason Vinyl Strip Curtain
 2 1" x 6" x 113" Vertical Trim Strips 20 ga S/S 304 #4
 1 24" x 67" Removable Enclosure Panels 20 ga S/S 304 #4
 (Up to 24"h/Verify Height)
 1 Floor Attachment Angles/Anchors as per Thermalrite
 Standard Product Spec 8700

ITEM # 1-05 CORNER GUARDS

Quantity: Six (6)
 Manufacturer: Custom
 Model: STAINLESS STEEL

1. Six (6) Model STAINLESS STEEL (LOT) Provide 16 ga. stainless steel corner guards at 6'-6" in height. Stainless steel shall have a #4 finish. Fabricate and install per complete drawings, schedules, elevations, and details.

ITEM # 1-06 BUMPER RAILS

Quantity: One (1)
 Manufacturer: Custom
 Model: STAINLESS STEEL

1. One (1) Model STAINLESS STEEL (LOT) Provide 14 ga. stainless steel bumper rails guards mounted at 34" above the finished floor. Stainless steel shall have a #4 finish. Fabricate and install per complete drawings, schedules, elevations, and details.

ITEM # 1-07 EVAPORATOR COIL (FREEZER) <Included>

Quantity: One (1)
Manufacturer: RDT Refrigeration
Model: LET-140

1. One (1) Model LET-140 Evaporator coil provided as an integral part of the remote refrigeration system.

ITEM # 1-08 CONROL PANEL

Quantity: One (1)
Manufacturer: Mars Air Systems
Model: PART OF ITEM #1-14

1. One (1) Control Panel - Part of Item #1-14

ITEM # 1-09 LID STORAGE CART

Quantity: Five (5)
Manufacturer: G.A. Systems Inc.
Model: LC30

1. Five (5) Model LC30 Lid Storage Cart, 26"W x 22"D x 30-1/2"H, (8) channels to hold Speedline lids while in service, 1-1/2" square tube construction, 5" plate type casters

ITEM # 1-10 DUNNAGE RACK

Quantity: Two (2)
Manufacturer: Cambro
Model: S-SERIES

1. Two (2) Model S-SERIES S-Series Dunnage Rack, slotted top, 3000 lb. load capacity, 21"D x 12"H, polypropylene, one-piece, seamless double wall construction, includes (1) Camlink®, 4" square legs, speckled gray, NSF
2. One (1) Model DRS600480 S-Series Dunnage Rack, slotted top, 3000 lb. load capacity, 21"D x 60"W x 12"H, polypropylene, one-piece, seamless double wall construction, includes (1) Camlink®, 4" square legs, speckled gray, NSF
3. One (1) Model DRS480480 S-Series Dunnage Rack, slotted top, 3000 lb. load capacity, 21"D x 48"W x 12"H, polypropylene, one-piece, seamless double wall construction, includes (1) Camlink®, 4" square legs, speckled gray, NSF

ITEM # 1-11 FREEZER STORAGE SHELVING UNITS

Quantity: Nine (9)
 Manufacturer: Cambro
 Model: CAMSHELVING

1. Nine (9) Model CAMSHELVING (LOT) 4 tier, 21" deep shelving units, posts to be 72" high, shelving units shall have a smooth surface without any welding or crevices. Posts and traverses shall be made of steel metal core with thick polypropylene covers. Shelf plates shall have a smooth surface without any welding or crevices, be of a structural web design and removable to be washed manually or in a commercial dishwasher. Shelf plates shall contain CamGuard, antimicrobial that inhibits the growth of mold, fungus and bacteria. Posts shall have dovetails that allow shelves to be adjusted in 4" increments. Provide dunnage stands for all traverses 54" or longer and at corners where corner connectors are used. Verify evaporator coil location, shelving units below coil to have 3 shelves. Provide in the configuration shown on plans, verify final sizes of shelves and posts by field measuring prior to ordering.

ITEM # 1-12 WALK-IN FREEZER

Quantity: One (1)
 Manufacturer: Thermalrite
 Model: CUSTOM

1. One (1) Model CUSTOM Freezer Item # 1-12 (in 10" Depression w/6" Floor Insulation w/Visqueen and ASTM 15 Felt Paper and Asphalt Emulsion) - indoor UL Listed Class 1 Panel with NSF listed construction
 1) 23' 0" x 9' 5" x 10' 3" foam rail walk-in Holding freezer without floor

Dimensions:

External (O.D.): 23' 0" x 9' 5" x 10' 3" - w x d x h

Internal (I.D.): 22' 2" x 8' 7" x 9' 10" - w x d x h

Volume: 1871 ft³ / 286385

Finishes

Walls: St. Stl. Type 304 #4 finish - 20 Ga. - interior

20 ga Stainless Steel 304 #4 Rimex Windsor Pattern & Galvanized/Smooth - 20 Ga. - exterior

Ceilings: Aluminum/Embossed White - .040 - interior

Galvanized/Smooth - 20 Ga. - exterior

Panel Thickness

Walls: 5" UL Listed Class 1 Foam

Ceilings: 5" UL Listed Class 1 Foam

Door D01

Qty	Description
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1	Finished opening 36" x 80" hinged flush freezer door, 10" sill
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1	Interior finish - St. Stl. Type 304 #4 finish - 20 Ga.
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1	Exterior finish - St. Stl. Type 304 #4 finish - 20 Ga.
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1	Interior jamb finish - St. Stl. Type 304 #4 finish - 20 Ga.
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1	Exterior jamb finish - St. Stl. Type 304 #4 finish - 20 Ga.
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1	Viewport- 120v Heated 14"x24"
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1	Kick plate: 36" 16 GA Stainless steel - interior and exterior
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2	Hinge- Kason 1245 Reversible Cam-Rise
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1	Modularm MD-1 Motion Detector
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1 Fan Cut off switch
 1 Raised Door Casings
 1 Door Closer - Calibre (hold open feature) 16503-AL
 1 Item #287886 1 Stub conduit through ceiling
 1 Door- Flush Mount
 1 Heated Jamb (4 Sided) W/ Threshold
 1 Heat In Bottom Of Door 1 Hinge (Additional)
 1 Temp Alarm- Modularm 75LC (120v) Multi-Monitor,
 Temperature Alarm, Door Ajar Alarm, Automatic Light
 Control, AC Failure Alarm, Panic Alarm (Low voltage 1P-1,120v F°/C°
 1 Gasket- Magnetic

Accessories

10 Caulk - Silicone Grey (Tubes)
 2 Light- (120v) LED 30 watt Vapor-Proof Fixture (4') - (bulbs included in price)
 39 Caulk - Butyl (Tubes)
 33 Lock Wall Panels to Ceiling Panels (Factory Ceiling Caps - Standard)
 1 Vent - 115v Narrow Jamb Heated Pressure Relief Port
 (Kason 1825)

Miscellaneous

64 6"h S/S Cove Base @ Interior & Exposed Exterior
 1 Kason Vinyl Strip Curtain
 2 1" x 6" x 113" Vertical Trim Strips 20 ga S/S 304 #4
 1 24" x 67" Removable Enclosure Panels 20 ga S/S 304 #4 (Up to 24"h/Verify Height)
 1 Floor Attachment Angles/Anchors as per Thermalrite
 Standard Product Spec 8700
 1 Lot of 6" Floor Insulation w/Visqueen and ASTM 15 Felt Paper and Asphalt Emulsion

ITEM # 1-13 DRY STORAGE SHELVING UNITS

Quantity: Thirty-One (33)
 Manufacturer: Cambro
 Model: CAMSHELVING

1. Thirty-One (33) Model CAMSHELVING (LOT) 4 tier, 21" deep shelving units, posts to be 72" high, shelving units shall have a smooth surface without any welding or crevices. Posts and traverses shall be made of steel metal core with thick polypropylene covers. Shelf plates shall have a smooth surface without any welding or crevices, be of a structural web design and removable to be washed manually or in a commercial dishwasher. Shelf plates shall contain CamGuard, antimicrobial that inhibits the growth of mold, fungus and bacteria. Posts shall have dovetails that allow shelves to be adjusted in 4" increments. Provide dunnage stands for all traverses 54" or longer and at corners where corner connectors are used. Verify evaporator coil location, shelving units below coil to have 3 shelves. Provide in the configuration shown on plans, verify final sizes of shelves and posts by field measuring prior to ordering.

ITEM # 1-14 AIR CURTAIN

Quantity: One (1)
Manufacturer: Mars Air Systems
Model: NH284-2UA-TS

1. One (1) Model NH284-2UA-TS High Velocity Series 2 Air Curtain, for NSF Certified 84" wide door, Unheated, 115v/60/1-ph, Titanium Silver powder coated cabinet (Standard Production Color) cETLus, CE, NSF
2. One (1) 5 year parts warranty, standard
3. One (1) Model 99-014 Steel Mechanical Universal Surface-mounted Plunger/Roller Switch
4. One (1) Model MCPB-2U Motor Control Panel for two motors, 1 HP, Unheated, supplied with NEMA 1 Cabinet with HOA selector switch on the cover and are remote mounted

ITEM # 1-15 HAND SINK

Quantity: Two (2)
Manufacturer: Eagle Group
Model: HSAP-14-ADA-FW

1. Two (2) Model HSAP-14-ADA-FW Hand Sink, wall mount, 14" wide x 16" front-to-back x 5" deep bowl, 16/304 stainless steel construction, splash mount gooseneck faucet with wrist handles & mixer valve, marine edge on front & sides, 1/2" NPS water inlet, chrome-plated P-trap, wrist handles, soap dispenser, basket drain, skirt assembly & paper towel dispenser, PHYSICALLY CHALLENGED, NSF

ITEM # 1-16 HAND SINK FAUCET, SPLASH MOUNT

Quantity: Two (2)
Manufacturer: T&S Brass
Model: B-1146-04

1. Two (2) Model B-1146-04 Faucet Workboard, splash mounted, 4" centers, swivel gooseneck, 4" wrist action handles
2. Two (2) 4" wrist action handle, standard, nc
3. Two (2) Model B-0199-01F-15 Aerator, non-splash, flow control, 1.40 gpm, 55/64"-27 UNS female threads

ITEM # 1-17 3 COMPARTMENT POT SINK

Quantity: One (1)
Manufacturer: Custom
Model: STAINLESS STEEL

1. One (1) Model STAINLESS STEEL Approximately 17'-0" l x 2'-6" w. Provide stainless steel pot sink assembly with 1-5/8" legs with adjustable bullet feet, under and/or mid shelves, 10" high back and end splash (where required). Top shall be 14 ga stainless steel, and legs shall be 16 ga. Fabricate and install per complete drawings, schedules, elevations, and details.
2. One (1) CSS Model SINKS Provide 16 ga stainless steel sink tub measuring approximately 48" w x 26" d x 14" h. Welded in place with polished seams.
3. Two (2) CSS Model SINKS Provide 16 ga stainless steel sink tub measuring approximately 30" w x 26" d x 14" h. Welded in place with polished seams.
4. Three (3) Fisher Model 29033 DrainKing Waste Valve, flat strainer, overflow body, chrome finish

ITEM # 1-18 SPLASH MOUNTED HI-FLO UTENSIL SINK FAUCET

Quantity: Two (2)
Manufacturer: T&S Brass
Model: B-0291

1. Two (2) Model B-0291 Kettle & Pot Sink Faucet, Big-Flo, wall mounted 8" centers, 3/4" IPS model LL street EL inlets with locknuts, 18" swing nozzle, 175°F four arm handles, 1-1/4" diameter holes required in backsplash

ITEM # 1-19 DUNNAGE RACK

Quantity: Three (3)
Manufacturer: Cambro
Model: S-SERIES

1. Three (3) Model S-SERIES S-Series Dunnage Rack, slotted top, 3000 lb. load capacity, 21"D x 12"H, polypropylene, one-piece, seamless double wall construction, includes (1) Camlink®, 4" square legs, speckled gray, NSF
2. One (1) Model DRS360480 S-Series Dunnage Rack, slotted top, 1500 lb. load capacity, 21"D x 36"W x 12"H, polypropylene, one-piece, seamless double wall construction, includes (1) Camlink®, 4" square legs, speckled gray, NSF
3. Two (2) Model DRS600480 S-Series Dunnage Rack, slotted top, 3000 lb. load capacity, 21"D x 60"W x 12"H, polypropylene, one-piece, seamless double wall construction, includes (1) Camlink®, 4" square legs, speckled gray, NSF
4. Two (2) Model DRS480480 S-Series Dunnage Rack, slotted top, 3000 lb. load capacity, 21"D x 48"W x 12"H, polypropylene, one-piece, seamless double wall construction, includes (1) Camlink®, 4" square legs, speckled gray, NSF

ITEM # 1-20 SPARE NO.

ITEM # 1-21 WALL SHELF (KNIFE BRACKETS)

Quantity: One (1)
Manufacturer: Custom
Model: STAINLESS STEEL

1. One (1) Model STAINLESS STEEL Approximately 4'-6" l x 1'-0" w. Provide stainless steel wall shelf with knife brackets. Wall shelf shall be: 16 ga stainless steel with #4 finish, bracket shall be 14 ga stainless steel. Fabricate and install per complete drawings, schedules, elevations, and details.

ITEM # 1-22 UTENSIL RACK

Quantity: One (1)
Manufacturer: Custom
Model: STAINLESS STEEL

1. One (1) Model STAINLESS STEEL Approximately 9'-0" l x 1/4" w x 2" d. Provide stainless steel flatbar utensil rack with integral 1/4" x 2" mounting bracket. Include sliding hooks 8" on center. Stainless steel shall be type 304 with #4 finish. Fabricate and install per complete drawings, schedules, elevations, and details.

ITEM # 1-23 SPARE NO.

ITEM # 1-24 WALL SHELF (KNIFE BRACKETS)

Quantity: One (1)
Manufacturer: Custom
Model: STAINLESS STEEL

1. One (1) Model STAINLESS STEEL Approximately 3'-6" l x 1'-0" w. Provide stainless steel wall shelf with knife brackets. Wall shelf shall be: 16 ga stainless steel with #4 finish, bracket shall be 14 ga stainless steel. Fabricate and install per complete drawings, schedules, elevations, and details.

ITEM # 1-25 MOBILE POT STORAGE SHELVING UNITS

Quantity: Six (6)
Manufacturer: Cambro
Model: CAMSHELVING

1. Six (6) Model CAMSHELVING (LOT) 4 tier, 24" deep shelving units, posts to be 72" high, shelving units shall have a smooth surface without any welding or crevices. Posts and traverses shall be made of steel metal core with thick polypropylene covers. Shelf plates shall have a smooth surface without any welding or crevices, be of a structural web design and removable to be washed manually or in a commercial dishwasher. Shelf plates shall contain CamGuard, antimicrobial that inhibits the growth of mold, fungus and bacteria. Posts shall have dovetails that allow shelves to be adjusted in 4" increments. Provide with CSRDB donut bumper and CSCTL casters with brake. Verify sizes for shelves and posts by field measuring prior to ordering.

ITEM # 1-26 REFRIGERATOR RACK, ROLL-IN

Quantity: Seven (7)
Manufacturer: Metro
Model: RF13N

1. Seven (7) Model RF13N Roll-In Refrigerator Rack, pass-thru, 21-1/4"W x 64"H, 26"D, open frame design, slides on 1-1/2" centers, holds (36) 18" x 26" pans, sized to fit refrigerator, riveted extruded aluminum frame construction, 5" swivel casters (2) with brakes, NSF

ITEM # 1-27 MOBILE WORK TABLE

Quantity: Four (4)
Manufacturer: Custom
Model: STAINLESS STEEL

1. Four (4) Model STAINLESS STEEL Approximately 7'-0" l x 2'-6" w. Provide stainless steel mobile work table with 1-5/8" legs, and lower and/or mid shelves. Top shall be 14 ga stainless steel, and legs shall be 16 ga. Provide 5" dia. heavy-duty, non-marking casters, all with brakes. Fabricate and install per complete drawings, schedules, elevations, and details.

ITEM # 1-28 WORK TABLE

Quantity: One (1)
Manufacturer: Custom
Model: STAINLESS STEEL

1. One (1) Model STAINLESS STEEL Approximately 14'-9" l x 2'-6" w. Provide stainless steel work table with 1-5/8" legs with adjustable bullet feet, lower and/or mid shelves, 6" high back and end splash (where required). Top shall be 14 ga stainless steel, and legs shall be 16 ga. Fabricate and install per complete drawings, schedules, elevations, and details.

ITEM # 1-29 WALL SHELF (KNIFE BRACKETS)

Quantity: One (1)
Manufacturer: Custom
Model: STAINLESS STEEL

1. One (1) Model STAINLESS STEEL Approximately 14'-9" l x 1'-0" w. Provide stainless steel wall shelf with knife brackets. Wall shelf shall be: 16 ga stainless steel with #4 finish, bracket shall be 14 ga stainless steel. Fabricate and install per complete drawings, schedules, elevations, and details.

ITEM # 1-30 SPARE NO.

ITEM # 1-31 BAKER'S TABLE W/FLOUR EDGE

Quantity: One (1)
Manufacturer: Custom
Model: STAINLESS STEEL/WOOD

1. One (1) Model STAINLESS STEEL/WOOD Approximately 6'-9" l x 2'-6" w. Provide stainless steel bakers table with 1-5/8" legs with adjustable bullet feet, lower and/or mid shelves, 6" high back and end splash. Top shall be NSF approved solid maple, and legs shall be 16 ga stainless steel. Fabricate and install per complete drawings, schedules, elevations, and details.

ITEM # 1-32 WALL SHELF (KNIFE BRACKETS)

Quantity: One (1)
Manufacturer: Custom
Model: STAINLESS STEEL

1. One (1) Model STAINLESS STEEL Approximately 6'-9" l x 1'-0" w. Provide stainless steel wall shelf with knife brackets. Wall shelf shall be: 16 ga stainless steel with #4 finish, bracket shall be 14 ga stainless steel. Fabricate and install per complete drawings, schedules, elevations, and details.

ITEM # 1-33 INGREDIENT BIN

Quantity: Four (4)
Manufacturer: Cambro
Model: IBS27148

1. Four (4) Model IBS27148 Ingredient Bin, mobile, 27 gallon capacity, 1-pc seamless polyethylene bin, 2-pc sliding polycarbonate lid, S-hook on front (scoop NOT included), (4) 3" heavy duty casters (2 front swivel, 2 fixed), white with clear cover, NSF

ITEM # 1-34 2 DOOR REACH-IN REFRIGERATOR (REMOTE)

Quantity: One (1)
Manufacturer: Victory Refrigeration
Model: RS-2D-S1

1. One (1) Model RS-2D-S1 UltraSpec Series Refrigerator Featuring Secure-Temp 1.0™ Technology, Reach-in, two-section, 46.5 cu. ft. capacity, (2) full height solid hinged doors, (6) silver freeze (chrome-style) shelves, stainless steel exterior & interior, standard depth cabinet, TOUCH POINT™ electronic temperature control/indicator, LED lighting, expansion valve technology, Santoprene door gaskets with 2 year warranty, stainless steel breakers, 1/3 HP, UL, cUL, UL EPH Classified, MADE IN USA
2. One (1) 3 years parts & labor warranty (excludes maintenance items)
3. One (1) Remote refrigeration system by others (part # -R)
4. One (1) 115v/60/1-ph, 10.7 amps with cord & plug
5. One (1) Door hinging: left door hinged on left, right door hinged on right standard
6. One (1) Model 00C31-055A 6" Seismic Legs

ITEM # 1-35 FOOD PROCESSOR

Quantity: One (1)
Manufacturer: Robot Coupe
Model: R602

1. One (1) Model R602 Combination Food Processor, 7 liter stainless steel bowl with handle, continuous feed kit with kidney shaped & cylindrical shaped hoppers, includes: (1)"S" blade, (1) 3mm grating disc (28058), (1) 3mm slicing disc (28064), two speeds, 850 & 1750 RPM, 208-240v/60/3-ph, 2.6/2.8 amps, 3 HP, NEMA L15-20P, cETLus, ETL-Sanitation
2. One (1) 1 year parts & labor warranty
3. One (1) Model LP16DISC LP16Disc, (16) disc package includes: (3) slicing discs (1/32", 5/64", 5/32"), (2) grating discs (1/16", 1/8"), (1) french fry kit (3/8" x 3/8"), (3) dicing kits (3/16", 3/8", 25/32"), (3) julienne discs (5/64", 1/10", 5/32"), dice cleaning kit & disc holder

ITEM # 1-36 WORK TABLE W/2 COMPARTMENT SINK (MARINE EDGE)

Quantity: One (1)
Manufacturer: Custom
Model: STAINLESS STEEL

1. One (1) Model STAINLESS STEEL Approximately 24'-6" l x 2'-6" w. Provide stainless steel work table with marine edge around sinks 1-5/8" legs with adjustable bullet feet, lower and/or mid shelves, 6" high back and end splash (where required). Top shall be 14 ga stainless steel, and legs shall be 16 ga. Fabricate and install per complete drawings, schedules, elevations, and details.
2. One (1) CSS Model 2 COMP SINK Provide 16 ga stainless steel with 2 compartment sink tub measuring approximately 18" w x 24" d x 12" h each. Welded in place with polished seams.
3. One (1) Fisher Model 29033 DrainKing Waste Valve, flat strainer, overflow body, chrome finish

ITEM # 1-37 SPLASH MOUNTED PREP SINK FAUCET

Quantity: One (1)
Manufacturer: T&S Brass
Model: B-0231-CR

1. One (1) Model B-0231-CR Faucet, 12" swing nozzle, 8" wall mount base, 1/2" NPT female Inlets, Ceramas cartridges

ITEM # 1-38 SPARE NO.

ITEM # 1-39 SPARE NO.

ITEM # 1-40 SPARE NO.

ITEM # 1-41 TRASH RECEPTACLE W/DOLLY

Quantity: One (1)
Manufacturer: Rubbermaid Commercial Products
Model: FG262000GRAY

1. One (1) Model FG262000GRAY ProSave® BRUTE® Container, without lid, 20 gallon, 19-1/2"D x 22-7/8"H, round, reinforced rims, built in handles, double rimmed base, high-impact plastic construction, gray, NSF
2. One (1) All-plastic, professional-grade construction will not rust, chip or peel; resists dents.
3. One (1) Reinforced rims add strength and durability
4. One (1) Built-in handles allow easy, non-slip lifting and anti-jam nesting
5. One (1) Double-ribbed base increases stability and dragging capacity
6. One (1) USDA Meat & Poultry Equipment Group listed and assist in complying with HACCP guidelines.
7. One (1) Certified to NSF Standard #2 and Standard #21
8. One (1) Model FG264043BLA BRUTE® Quiet Dolly, 18-1/4"D x 6-5/8"H, non-marking blue casters, black

ITEM # 1-42 WALL SHELF (KNIFE BRACKETS)

Quantity: One (1)
Manufacturer: Custom
Model: STAINLESS STEEL

1. One (1) Model STAINLESS STEEL Approximately 16'-10" l x 1'-0" w. Provide stainless steel wall shelf with knife brackets. Wall shelf shall be: 16 ga stainless steel with #4 finish, bracket shall be 14 ga stainless steel. Fabricate and install per complete drawings, schedules, elevations, and details.

ITEM # 1-43 SPARE NO.

ITEM # 1-44 WALL CAPS

Quantity: Five (5)
Manufacturer: Custom
Model: STAINLESS STEEL

1. Five (5) Model STAINLESS STEEL (LOT) Provide 16 ga. stainless steel wall caps at 6'-6" in height. Stainless steel shall have a #4 finish. Fabricate and install per complete drawings, schedules, elevations, and details.

ITEM # 1-45 MOP HOLDER

Quantity: One (1)
Manufacturer: Advance Tabco
Model: K-242

1. One (1) Model K-242 Mop Hanger, 23", accommodates (3)

ITEM # 1-46 CHEMICAL WALL SHELF

Quantity: One (1)
Manufacturer: Custom
Model: STAINLESS STEEL

1. One (1) Model STAINLESS STEEL Approximately 2'-9" l x 1'-0" w. Provide stainless steel chemical wall shelf with knife brackets. Wall shelf shall be: 16 ga stainless steel with #4 finish, bracket shall be 14 ga stainless steel. Fabricate and install per complete drawings, schedules, elevations, and details.

ITEM # 1-47 JANITOR'S SINK FAUCET W/VACUUM BREAKER

Quantity: One (1)
Manufacturer: T&S Brass
Model: B-0655-01

1. One (1) Model B-0655-01 Service Sink Faucet, vacuum breaker nozzle with 3/4" garden hose thread, 1/2" NPT female flanged adjustable inlet with screwdriver stops, 6" wrist action handles, pail hook, bottom support, wall brace
2. One (1) 6" wrist action handle, standard, nc

ITEM # 1-48 MOP SINK

Quantity: One (1)
Manufacturer: Advance Tabco
Model: 9-OP-28

1. One (1) Model 9-OP-28 Mop Sink, floor mounted, 33"W x 25"D x 10"H (overall), 28"W x 20" front-to-back x 6" deep (bowl size), free flow drain with 2" IPS outlet, stainless steel construction

ITEM # 1-49 HAND SINK

Quantity: One (1)
Manufacturer: Eagle Group
Model: HSAP-14-ADA-FW

1. One (1) Model HSAP-14-ADA-FW Hand Sink, wall mount, 14" wide x 16" front-to-back x 5" deep bowl, 16/304 stainless steel construction, splash mount gooseneck faucet with wrist handles & mixer valve, marine edge on front & sides, 1/2" NPS water inlet, chrome-plated P-trap, wrist handles, soap dispenser, basket drain, skirt assembly & paper towel dispenser, PHYSICALLY CHALLENGED, NSF

ITEM # 1-50 HAND SINK FAUCET, SPLASH MOUNT

Quantity: One (1)
Manufacturer: T&S Brass
Model: B-1146-04

1. One (1) Model B-1146-04 Faucet Workboard, splash mounted, 4" centers, swivel gooseneck, 4" wrist action handles
2. One (1) 4" wrist action handle, standard, nc
3. One (1) Model B-0199-01F-15 Aerator, non-splash, flow control, 1.40 gpm, 55/64"-27 UNS female threads

ITEM # 1-51 CHEMICAL STORAGE SHELVING UNITS

Quantity: One (1)
Manufacturer: Cambro
Model: CAMSHELVING

1. One (1) Model CAMSHELVING (LOT) 4 tier, 21" deep shelving units, posts to be 72" high, shelving units shall have a smooth surface without any welding or crevices. Posts and traverses shall be made of steel metal core with thick polypropylene covers. Shelf plates shall have a smooth surface without any welding or crevices, be of a structural web design and removable to be washed manually or in a commercial dishwasher. Shelf plates shall contain CamGuard, antimicrobial that inhibits the growth of mold, fungus and bacteria. Posts shall have dovetails that allow shelves to be adjusted in 4" increments. Provide dunnage stands for all traverses 54" or longer and at corners where corner connectors are used. Verify evaporator coil location, shelving units below coil to have 3 shelves. Provide in the configuration shown on plans, verify final sizes of shelves and posts by field measuring prior to ordering.

ITEM # 1-52 WORK TABLE W/ PREP SINK

Quantity: One (1)
Manufacturer: Custom
Model: STAINLESS STEEL

1. One (1) Model STAINLESS STEEL Approximately 8'-6" l x 2'-6" w. Provide stainless steel work table with 1-5/8" legs with adjustable bullet feet, lower and/or mid shelves, 6" high back and end splash (where required). Top shall be 14 ga stainless steel, and legs shall be 16 ga. Fabricate and install per complete drawings, schedules, elevations, and details.
2. One (1) CSS Model PREP SINK Provide 16 ga stainless steel sink tub measuring approximately 18" w x 24" d x 12" h. Welded in place with polished seams.
3. One (1) Fisher Model 29033 DrainKing Waste Valve, flat strainer, overflow body, chrome finish

ITEM # 1-53 SPLASH MOUNTED PREP SINK FAUCET

Quantity: One (1)
Manufacturer: T&S Brass
Model: B-0231-CR

1. One (1) Model B-0231-CR Faucet, 12" swing nozzle, 8" wall mount base, 1/2" NPT female Inlets, ceramas cartridges

ITEM # 1-54 EXHAUST HOOD

Quantity: One (1)
Manufacturer: Streivor
Model: SAWCBD

1. One (1) Model SAWCBD Hood Construction
 UL 710 Listed, NFPA 96 Compliant, SmartAire Wall Canopy Box Design Hood, includes all welded and/or liquid tight canopy, filter
 drip tray below the lower edge of the filter(s) sized to the minimum needed to collect grease, pitched front to back and left to right to
 an enclosed metal container having a capacity of less than 1 gallon.
 SmartAire
 SmartAire Technology incorporates two adjustable high velocity low volume streams of air into the lower front edge of a hood which
 enhance the hood's ability to and contain cooking gases and effluents. The air streams are supplied by an internal hood fan(s)
 factory wired to an electrical junction box on top of the hood.
 18 Gauge of the same material and finish as the exposed material of the hood. Enclosed on all four sides.
 Filter
 ExtractAire High Velocity Cartridge Filter UL 1046 Listed, type 304 Stainless Steel 100% open on the bottom to allow for
 commercial dish machine washing. Includes an adjustable damper for airflow control. (0)16x16 (7)16x20
 Exposed Material
 Exposed surfaces of the hood to be manufactured from type 304 stainless steel. The hood ends will be a minimum of 16 gauge
 and the remainder not less than 18 gauge.
 Non-Exposed Material
 Non-Exposed surfaces of the hood including the exhaust plenum to be manufactured from type 304 stainless steel not less than 18
 gauge.
 Containment Panel
 On left Light-Duty Containment Panel 18 Gauge of the same material and finish as the exposed material of the hood.
 Supply Plenum
 (Front) Supply Plenum with downward supply air. 18 Gauge of the same material and finish as the exposed material of the hood.
 Light Fixtures
 (9) 36" Recessed-Mounted LED Light Fixture(s). (Lamps Not Included)
 Lamps
 Lamp(s) for Recessed-Mounted LED Light Fixture.
 Balancing Damper
 BalanceAire(s) UL 710 Listed Internally Adjustable Opposed Blade Damper with Ninety Degree Edge size and shape per hood
 drawing. 18 Gauge of the same material and finish as the non-exposed material of the hood.
 Temperature Monitor
 Facilitates fan power signaling for NFPA 96 11.1.1 compliance.
 Access Enclosure
 Access Enclosure(s) installed in the hood canopy. UL 710 Listed 18 Gauge of the same material and finish as the exposed material
 of the hood. Includes a removable cover panel that allows access to the monitors from under the hood.

ITEM # 1-55 EXHAUST HOOD TRIM AND CLOSURE PANEL

Quantity: One (1)
Manufacturer: Custom
Model: STAINLESS STEEL

1. One (1) Model STAINLESS STEEL Approximately 37'-2" l x 10'-0" w. Provide 18 ga stainless steel exhaust hood trim and closure panels with #4 finish. Provide all necessary closure, louvers and trim strips for a complete installation. Fabricate and install per complete drawings, schedules, elevations, and details.

ITEM # 1-56 FIRE PROTECTION SYSTEM

Quantity: One (1)
Manufacturer: Ansul Fire Protection
Model: R102

1. One (1) Model R102 Provide One (1) each Fire Protection System complete with nozzles, fusible links, piping, pull box, and actuators, utilizing a wet chemical extinguishing agent fabricated and installed by an approved Ansul system installer. Provide in accordance with complete drawings, details, and specifications section 114000. System to be an R-102 automatic type and be manufactured and installed per the current NFPA guidelines and be U.L. approved. Cylinders shall be mounted on wall in a stainless steel enclosure, or mounted in a stainless steel cabinet attached to the exhaust hood. All piping to be concealed with the exception of drops which shall be chrome sleeved and of as minimal exposure as possible. Size, number, and location of nozzles or fusible links to be in accordance with U.L. limits for this particular system. Fire system contractor shall provide engineered drawings, acquire permit, coordinate start-up and testing with the appropriate Fire Officials, and obtain final certification. Provide as-built drawings at completion of install. Fire System installer to provide adequate job site visits to coordinate installation of un-exposed pipe and installation of system. Include the appropriately sized and approved electronic gas shut-off valve(s).

ITEM # 1-57 FIRE PULL BOX <NIC>

Quantity: One (1)
Manufacturer: Custom
Model: PART OF ITEM #1-56

1. One (1) Model PART OF ITEM #1-56 Fire Pull Box - Box by electrician, Mechanism part of item #1-56 Fire Protection System.

ITEM # 1-58 HOOD CONTROL PANEL

Quantity: One (1)
Manufacturer: NIFSEC
Model: IN MECHANICAL SECTION

1. One (1) Model IN MECHANICAL SECTION Hood Control Panel, In Mechanical Section

ITEM # 1-59 WALL SHELF (KNIFE BRACKETS)

Quantity: One (1)
Manufacturer: Custom
Model: STAINLESS STEEL

1. One (1) Model STAINLESS STEEL Approximately 8'-6" l x 1'-0" w. Provide stainless steel wall shelf with knife brackets. Wall shelf shall be: 16 ga stainless steel with #4 finish, bracket shall be 14 ga stainless steel. Fabricate and install per complete drawings, schedules, elevations, and details.

ITEM # 1-60 SPARE NO.

ITEM # 1-61 CLASS K FIRE EXTINGUISHER <NIC>

Quantity: One (1)
Manufacturer: NIFSEC
Model: SEE ARCH. SECT

1. One (1) Model SEE ARCH. SECT Class K Fire Extinguisher - NIFSEC, See Architectural Section.

ITEM # 1-62 FLOOR TROUGH

Quantity: One (1)
Manufacturer: Custom
Model: STAINLESS STEEL

1. One (1) Model STAINLESS STEEL Approximately 13'-0" l x 1'-9" d. Provide 14 gauge type 304 stainless steel floor trough with coved corners and integrally pitched toward waste outlet with a stainless steel beehive strainer. Provide IMC Teddy ASFT-ADA stainless steel accessible grating. Fabricate and install per complete drawings, schedules, elevations, and details.

ITEM # 1-63 COMBI OVEN 6 PAN (DOUBLE STACKED)

Quantity: Two (2)
Manufacturer: RATIONAL
Model: B628206.19E

1. Two (2) Model B628206.19E (QUICK SHIP) (SCC 62NG) SelfCooking Center® Combi Oven/Steamer, natural gas, iCookingControl with 7 modes, HiDensityControl®, iLevelControl, Efficient CareControl, Combi-Steamer with 3 modes, (6) 18"x26" or (12) 12"x20" pan capacity, core temp probe with 6 point measurement, hand shower with automatic retracting system, ships with (3) grid shelves, ethernet interface, 208v/60/1-ph, 8'cord, NEMA 6-15P, 106,000 BTU (dual voltage: retrofitable to 240v/60/1-ph, 106,000 BTU) ENERGY STAR®
2. Two (2) NOTE: All discounts subject to approval by manufacturer
3. Two (2) 2 years parts and labor warranty
4. One (1) Model CAP Chef Assistance Program, a RATIONAL certified Chef conducts 4 hours/location specialized application training with personnel, no charge
5. One (1) Model 9999.9951 RCI Rational Certified Installation, new certified installation cost for a countertop model is \$1000 for the first unit (61/62/101/102) (Pricing based on a 50 mile radius, Additional charges may apply, See attached installation flyer for details) THIS ITEM IS NON-DISCOUNTABLE, USA ONLY (NET)

6. One (1) Model 9999.9812 Pre-Installation Site Survey, ensures that the site has proper space and connections for gas, electric, drain & water, includes 50 miles (100 miles round trip) from the installer, can only be purchased with a Certified Installation, THIS ITEM IS NON-DISCOUNTABLE, USA ONLY (NET)
7. One (1) Model 9999.9957 RCI Rational Certified Installation, additional countertop unit installed at same location on same day will be an additional \$800 per countertop unit (61/62/101/102) (Pricing based on a 50 mile radius, Additional charges may apply, See attached installation flyer for details) THIS ITEM IS NON-DISCOUNTABLE, USA ONLY (NET)
8. Two (2) Model 8720.1560US Installation Kit, for gas SCC WE/CMP 101G (120/60/1ph); gas SCC WE/CMP 62G (208-240/60/1ph); gas SCC WE/CMP 61G (120/60/1ph) THIS ITEM IS NON-DISCOUNTABLE, USA ONLY (NET)
9. Two (2) Model 56.00.210A Cleaner tablet without Phosphorus, for ALL SelfCookingCenter® units since 2004 & CombiMaster® Plus units with article #BXXXXXX or Serial MI series since 4/2017, goes up to 70% further than liquid cleaner, "FREIGHT CLASS 85 LIMITED QUANTITY" (minimum order quantity: 2pcs, unless ordered with a unit)
10. One (1) Model 56.00.562 Care Tablets, bucket of 150 packets for all SelfCooking Center® units from 10/2008, with CareControl - Serial SG, SH or SI series (minimum order quantity: 2pcs, unless ordered with a unit)
11. One (1) Model 1900.1150US Water Filtration Double Cartridge System, for Combi-Duo models 62/62 or 62/102 or if used for more than 2 units includes: (1) double head with pressure gauge, (2) R95H filter & (1) filter installation kit (for each additional unit add (1) additional head & additional cartridge. Maximum (4) cartridges)
12. One (1) Model 9999.8448 RCI Rational Certified Installation, additional installation cost for a Rational Water Filter System is available when purchased with Certified Installation of Rational unit (Pricing based on a 50 mile radius, additional charges may apply. See attached flyer for details) THIS ITEM IS NON-DISCOUNTABLE, USA ONLY (NET)
13. One (1) NOTE: The Rational Water Filtration Systems helps provide consistent high quality water to your RATIONAL SelfCooking Center or your CombiMaster Plus. The patented carbon block technology reduces the effects of sediment, chloramines and chlorine while providing the required flow rates
14. One (1) NOTE: All public water systems using surface water and most ground water systems treat with either chlorine/chloramine or chlorine dioxide (EPA will allow levels as high as 4ppm safe for drinking water, exceeding our maximum level of .2ppm.
15. One (1) NOTE: Chloride concentrations above 80ppm can cause corrosion. RATIONAL Water Filtration does NOT reduce chloride
16. One (1) Free Water Testing Kits are available (contact factory for info)
17. One (1) Model 60.74.156 Combi-Duo Open Stacking Kit, Mobile, casters, for gas SCC 62 or CMP 62 stacked on gas SCC 62, SCC 102, CMP 62, or CMP 102 (gas unit stacked on a gas 102 unit is not recommended)
18. One (1) Model 9999.9959 RCI Rational Certified Installation, new certified installation cost for a Combi-Duo stacked unit is \$200 for the first two units for double-stack (Pricing based on a 50 mile radius, Additional charges may apply, See attached installation flyer for details) THIS ITEM IS NON-DISCOUNTABLE. USA ONLY (NET)
19. Two (2) Door hinged on right std.
20. Six (6) Model 6010.2101 Gastronorm Grid Shelf, 2/1 size, 25-5/8" x 20-7/8", stainless steel

ITEM # 1-64 WATER FILTRATION SYSTEM <Included>

Quantity: One (1)
Manufacturer: RATIONAL
Model: PART OF ITEM 1-63

1. One (1) Model PART OF ITEM 1-63 Water Filtration System - Part of Item 1-63

ITEM # 1-65 BOILERLESS STEAMER

Quantity: One (1)
Manufacturer: Cleveland Range
Model: (2) 22CGT66.1

1. One (1) Model (2) 22CGT66.1 SteamChef™ 6 Convection Steamer, Gas, boilerless, double stacked, on ES26304466G equipment stand, (6) full size pan capacity per compartment, 60-minute electro-mechanical timer & manual (continuous steaming) bypass switch, left-hand hinged door, controls on right, automatic drain & water level controls, KleanShield™ interior, standard treated & tap water connection, stainless steel exterior, 4" adjustable legs with flanged feet, (2) 32,000 BTU, UL, NSF, ENERGY STAR®
2. One (1) 1-year parts & labor warranty, standard
3. One (1) Natural Gas
4. One (1) (2) 115v/60/1-ph, 4.0 amps each, standard

ITEM # 1-66 WATER FILTRATION SYSTEM <Included>

Quantity: One (1)
Manufacturer: Cleveland Range
Model: PART OF ITEM 1-65

1. One (1) Model PART OF ITEM 1-65 Water Filtration System - Part of Item 1-65

ITEM # 1-67 40 GAL TILTING SKILLET, NATURAL GAS

Quantity: One (1)
Manufacturer: Cleveland Range
Model: SGL40T1

1. One (1) Model SGL40T1 PowerPan™ Tilting Skillet, gas, 40-gallon capacity, bead blasted cooking surface, 10° tilt cooking feature, with easy manual hand tilt, spring-assisted cover with vent, gallon & liter markings, food strainer, stainless steel construction with open leg frame, 200,000 BTU, CE, NSF
2. One (1) 1-year parts & labor warranty, standard
3. One (1) Natural Gas
4. One (1) 120v/60/1-ph, 1.4 amp, standard

ITEM # 1-68 SPARE NO.

ITEM # 1-69 SPARE NO.

ITEM # 1-70 SPARE NO.

ITEM # 1-71 POT FILLER FAUCET

Quantity: One (1)
Manufacturer: T&S Brass
Model: B-0610

1. One (1) Model B-0610 Pot & Kettle Filler Faucet, wall mount mixing faucet with 8" adjustable centers, quarter-turn Eterna cartridges with spring checks, lever handles with color coded indexes, 3/8" NPT atmospheric vacuum breaker (B-0968), 68" flexible stainless steel hose with heat-resistant gray handle & hold down ring, hook nozzle with self-closing valve, finger hook, polished chrome-plated brass faucet body, 1/2" NPT female inlets, CSA

ITEM # 1-72 40 GALLON TILTING KETTLE

Quantity: One (1)
Manufacturer: Cleveland Range
Model: KGL40T

1. One (1) Model KGL40T Kettle, gas, tilting, 40-gallon capacity, 2/3 steam jacket design, floor mounted control console supports, stainless steel exterior finish, standard with flanged feet, 50 psi rating, electronic spark ignition, cover & draw-off optional, 140,000 BTU
2. One (1) 1-year parts & labor warranty, standard
3. One (1) Natural Gas
4. One (1) 120v/60/1-ph, 10.0 amp, electronic spark ignition, cord & plug for controls, standard
5. One (1) Model TD2 2" tangent draw-off valve with strainer
6. One (1) Model 316G1 316 stainless steel liner, for 1 - 40 gallons, per each kettle
7. One (1) Model KM2G Kettle Markings, 5 gallon increments
8. One (1) Model KAK Kettle Accessory Kit, includes: clean up brush, paddle, stainless steel whip, brush, draw-off brush, ladle

ITEM # 1-73 DOUBLE CONVECTION OVEN

Quantity: One (1)
Manufacturer: Blodgett Oven
Model: DFG-100-ES DBL

1. One (1) Model DFG-100-ES DBL Convection Oven, gas, double-deck, standard depth, capacity (5) 18" x 26" pans per compartment, (SSD) solid state digital controls, 2-speed fans, interior light, simultaneous operated doors with glass, stainless steel front, sides & top, 6" stainless steel legs, flue connector, (2) 3/4 HP, 45,000 BTU each, cETL, NSF, CE, ENERGY STAR®
2. Two (2) NOTE: Draft diverter is not required for this oven
3. Two (2) 3 year parts, 2 year labor and 2 additional year door warranty (parts only), standard
4. Two (2) Natural gas
5. Four (4) 115v/60/1-ph, 8.0 amps, 3/4 hp, 2-wire with ground, NEMA 5-15P (per deck), standard
6. Two (2) Model SSD Top Oven: Solid State digital with Pulse Plus® and Cook & Hold, standard
7. Two (2) Model SSD Bottom Oven: Solid State digital with Pulse Plus® and Cook & Hold, standard
8. Two (2) 6" plate casters (set), in lieu of legs
9. Two (2) NOTE: DO NOT deduct cost of standard legs
10. One (1) T&S Brass Model HG-4D-48SK Safe-T-Link Gas Connector Kit, 3/4" connection, 48"L, stainless steel braid with extruded coating, (1) quick disconnect, (2) SwiveLink swivels, (1) 90° elbow, ball valve, restraining cable adjustable for 3' to 5'

ITEM # 1-74 WALL FLASHING

Quantity: One (1)
Manufacturer: Custom
Model: STAINLESS STEEL

1. One (1) Model STAINLESS STEEL (LOT) Approximately 49'-6" l. Provide 20 ga. stainless steel wall flashing from floor to exhaust hood with 6" fluting (vertical) and a #4 finish. Provide all necessary closure and trim strips for a complete installation. Fabricate and install per complete drawings, schedules, elevations, and details.

ITEM # 1-75 SPREADER CABINET

Quantity: One (1)
Manufacturer: Montague Company
Model: 12-S

1. One (1) Model 12-S Legend™ Heavy Duty Range, 12", Add-A-Unit, (1) work top, open cabinet base with stainless steel front & 4" flue riser, black sides, black intermediate & bottom shelves, 6" high adjustable stainless steel legs, cETLus, NSF, CE
2. One (1) Standard warranty: one year parts and labor warranty
3. One (1) 1-1/4" Front manifold without pressure regulator, standard
4. One (1) 1-1/4" Pressure regulator only
5. One (1) Cap & stainless steel manifold cover, right

ITEM # 1-76 6 OPEN BURNER RANGE W/OVEN

Quantity: One (1)
Manufacturer: Montague Company
Model: 136-5

1. One (1) Model 136-5 Legend™ Heavy Duty Range, gas, 36", (6) 12" 30,000 BTU open burners, standard oven base, stainless steel front & 4" flue riser, black sides, 6" high adjustable stainless steel legs, 220,000 BTU, NSF, cETLus, CE
2. One (1) Standard warranty: one year parts and labor warranty
3. One (1) Lifetime door warranty, standard
4. One (1) Extended one year warranty, per section
5. One (1) Natural gas
6. One (1) 1-1/4" Front manifold without pressure regulator, standard
7. One (1) Flanged Feet (with holes, for floor mounting), per each

ITEM # 1-77 48" GRIDDLE W/CABINET BASE

Quantity: Two (2)
Manufacturer: Montague Company
Model: 2/24-8T

1. Two (2) Model 2/24-8T Legend™ Heavy Duty Range, gas, 24", Add-A-Unit, (1) fry top, 3/4" thick, manual controls, open cabinet base with stainless steel front & 4" flue riser, black sides, black intermediate & bottom shelves, 6" high adjustable stainless steel legs, 45,000 BTU
2. Two (2) Standard warranty: one year parts and labor warranty
3. Two (2) Unitized construction including: guard rail, front panels & capping strips, per seam
4. Two (2) Natural gas
5. Two (2) 1-1/4" Front manifold without pressure regulator, standard
6. Two (2) (2) Lower stainless steel shelves, (2) sides stainless steel, for add-on unit
7. One (1) 48" x 1" Plate fry top for more than one Range/Add-A-Unit, 36" deep (add Prefix 2/)
8. Two (2) Thermostat for fry top, add Suffix "T" to model number, 12", 18", 24" wide (one thermostat)
9. Two (2) Flanged Feet (with holes, for floor mounting), per each

ITEM # 1-78 SPREADER CABINET

Quantity: One (1)
Manufacturer: Montague Company
Model: 12-S

1. One (1) Model 12-S Legend™ Heavy Duty Range, 12", Add-A-Unit, (1) work top, open cabinet base with stainless steel front & 4" flue riser, black sides, black intermediate & bottom shelves, 6" high adjustable stainless steel legs, cETLus, NSF, CE
2. One (1) Standard warranty: one year parts and labor warranty
3. One (1) 1-1/4" Front manifold without pressure regulator, standard
4. One (1) Cap & stainless steel manifold cover, right
5. One (1) Flanged Feet (with holes, for floor mounting), per each
6. One (1) Tee in manifold, 1-1/4" with regulator & shut-off valve* (under spreaders & work tops only)
 *For regulator installed inside spreader cabinet.
7. One (1) Guard rail finished end, right
8. One (1) Lower stainless steel shelf, (2) sides stainless steel, for add-on unit
9. One (1) 12" Single stainless steel door for add-on unit

ITEM # 1-79 AIR CURTAIN

Quantity: One (1)
Manufacturer: Mars Air Systems
Model: NH248-1UA-TS

1. One (1) Model NH248-1UA-TS High Velocity Series 2 Air Curtain, for NSF Certified 48" wide door, Unheated, 115v/60/1-ph, Titanium Silver powder coated cabinet (Standard Production Color) cETLus, CE, NSF
2. One (1) 5 year warranty, standard
3. One (1) Options WITHOUT control panel
4. One (1) Options WITHOUT time delay
5. One (1) Model 99-014 Steel Mechanical Universal Surface-mounted Plunger/Roller Switch

ITEM # 1-80 SPARE NO.

ITEM # 1-81 HEATED CABINET

Quantity: Four (4)
Manufacturer: Cres Cor
Model: H-137-SUA-12D

1. Four (4) Model H-137-SUA-12D Cabinet, Mobile Heated, insulated, top-mount heater assembly, recessed push/pull handles, magnetic latch, (12) sets chrome plated wire universal angle slides for 12" x 20" thru 18" x 26" pans on 4-1/2" centers, adjustable 1-1/2" centers, reversible dutch doors, (4) heavy duty 5" swivel casters (2) braked, anti-microbial latches, stainless steel construction, NSF, cCSAus, ENERGY STAR®
2. Four (4) Standard Warranty: 1 year labor with 3 year parts warranty
3. Four (4) 120v/60/1-ph, 1500 watts, 12.0 amp, 10 ft power cord, NEMA 5-15P, standard
4. Four (4) Right-hand door swing, standard
5. Four (4) Model 1056-002 Corner Bumpers, add 2" to OA dimensions, non-marking, gray

ITEM # 1-82 MOBILE WORK TABLE

Quantity: Two (2)
Manufacturer: Custom
Model: STAINLESS STEEL

1. Two (2) Model STAINLESS STEEL Approximately 6'-0" l x 2'-6" w. Provide stainless steel mobile work table with 1-5/8" legs, and lower and/or mid shelves. Top shall be 14 ga stainless steel, and legs shall be 16 ga. Provide 5" dia. heavy-duty, non-marking casters, all with brakes. Fabricate and install per complete drawings, schedules, elevations, and details.

ITEM # 1-83 MOBILE WORK TABLE

Quantity: Eight (8)
Manufacturer: Custom
Model: STAINLESS STEEL

1. Eight (8) Model STAINLESS STEEL Approximately 5'-0" l x 2'-6" w. Provide stainless steel mobile work table with 1-5/8" legs, and lower and/or mid shelves. Top shall be 14 ga stainless steel, and legs shall be 16 ga. Provide 5" dia. heavy-duty, non-marking casters, all with brakes. Fabricate and install per complete drawings, schedules, elevations, and details.

ITEM # 1-84 COMPACT PREP TABLE REFRIGERATOR

Quantity: One (1)
Manufacturer: Traulsen
Model: UST7230-LR

1. One (1) Model UST7230-LR Dealer's Choice Compact Prep Table Refrigerator with low profile flat cover, Reach-in, two-section, 72" wide, holds (30) 1/6 pans 4" deep (included) can accommodate up to 6" deep pans, stainless steel exterior top, sides & doors with Santoprene® EZ-Clean Gasket, hinged left/right, anodized aluminum interior, galvanized exterior back & bottom, rear mounted, self contained refrigeration, (6) 4" casters, 1/4 HP, cULus, NSF
2. One (1) 3 year parts & labor and 5 year compressor warranty, standard
3. One (1) 115v/60/1ph, 7.5 amps, 8' cord, NEMA 5-15P

ITEM # 1-85 WORK TABLE

Quantity: One (1)
Manufacturer: Custom
Model: STAINLESS STEEL

1. One (1) Model STAINLESS STEEL Approximately 4'-3" l x 2'-6" w. Provide stainless steel work table with 1-5/8" legs with adjustable bullet feet, lower and/or mid shelves, 6" high back and end splash (where required). Top shall be 14 ga stainless steel, and legs shall be 16 ga. Fabricate and install per complete drawings, schedules, elevations, and details.

ITEM # 1-86 2 DOOR ROLL-THRU REFRIGERATOR

Quantity: Two (2)
Manufacturer: Victory Refrigeration
Model: RIS-2D-S1-PT

1. Two (2) Model RIS-2D-S1-PT UltraSpec Series Refrigerator Featuring Secure-Temp 1.0™ Technology, Roll-thru, two-section, 72.4 cu. ft. capacity, stainless exterior & interior, standard depth cabinet, full height 20 gauge stainless steel doors, TOUCH POINT™ electronic temperature control/indicator, LED lighting, expansion valve technology, Santoprene door gaskets with 2 year warranty, stainless steel breakers, stainless steel ramp, 1/2 HP, UL, cUL, UL EPH Classified, MADE IN USA
2. Two (2) 3 years parts & labor warranty (excludes maintenance items)
3. Two (2) Remote refrigeration system by others (part # -R)
4. Two (2) 115v/60/1-ph, 12.6 amps, cord with NEMA 5-20P
5. Two (2) Control/Kitchen side door hinging: left door hinged on left, right door hinged on right standard
6. Two (2) Rear/Server side door hinging: left door hinged on left, right door hinged on right standard

ITEM # 1-87 1 DOOR ROLL-THRU HEATED CABINET

Quantity: Two (2)
Manufacturer: Victory Refrigeration
Model: HIS-1D-1-PT

1. Two (2) Model HIS-1D-1-PT UltraSpec Series Heated Cabinet Featuring Secure-Temp 1.0™ Technology, Roll-thru, one-section, 36.2 cu. ft. capacity, stainless exterior & interior, standard depth cabinet, full height doors, TOUCH POINT™ electronic temperature control/indicator, stainless steel ramp, UL, UL EPH Classified, MADE IN USA
2. Two (2) 3 years parts & labor warranty (excludes maintenance items)
3. Two (2) 208-240v/60/1-ph, 6.3 amps, includes cord & plug
4. Two (2) Control/Kitchen side door hinging: standard on right
5. Two (2) Rear/Server side door hinging: on right standard

ITEM # 1-88 HAND SINK

Quantity: One (1)
Manufacturer: Eagle Group
Model: HSAP-14-ADA-FW

1. One (1) Model HSAP-14-ADA-FW Hand Sink, wall mount, 14" wide x 16" front-to-back x 5" deep bowl, 16/304 stainless steel construction, splash mount gooseneck faucet with wrist handles & mixer valve, marine edge on front & sides, 1/2" NPS water inlet, chrome-plated P-trap, wrist handles, soap dispenser, basket drain, skirt assembly & paper towel dispenser, PHYSICALLY CHALLENGED, NSF
2. One (1) Model -LS Left side splashes for handsink

ITEM # 1-89 HAND SINK FAUCET, SPLASH MOUNT

Quantity: One (1)
Manufacturer: T&S Brass
Model: B-1146-04

1. One (1) Model B-1146-04 Faucet Workboard, splash mounted, 4" centers, swivel gooseneck, 4" wrist action handles
2. One (1) 4" wrist action handle, standard
3. One (1) Model B-0199-01F-15 Aerator, non-splash, flow control, 1.40 gpm, 55/64"-27 UNS female threads

ITEM # 1-90 WORK TABLE

Quantity: One (1)
Manufacturer: Custom
Model: STAINLESS STEEL

1. One (1) Model STAINLESS STEEL Approximately 7'-4" l x 2'-6" w. Provide stainless steel work table with 1-5/8" legs with adjustable bullet feet, lower and/or mid shelves, 6" high back and end splash (where required). Top shall be 14 ga stainless steel, and legs shall be 16 ga. Fabricate and install per complete drawings, schedules, elevations, and details.

ITEM # 1-91 DOLLY CART

Quantity: Six (6)
Manufacturer: G.A. Systems Inc.
Model: LY8

1. Six (6) Model LY8 Basket Dolly/Transport Base, 27"W x 27"D x 8"H, holds 2 rows of Speedee-Serv speedline stacking baskets (not included), aluminum base, 5" swivel casters
2. One Hundred Twenty (120) Model B13202 Wire Basket, 20-11/16"W x 13-1/4"D x 2-5/16"H, rectangular, zinc wire construction
3. Sixty (60) Model B13204 Wire Basket, 20-11/16"W x 13-1/4"D x 4-9/16"H, rectangular, zinc wire construction

ITEM # 1-92 WORK TABLE W/ PREP SINK

Quantity: One (1)
Manufacturer: Custom
Model: STAINLESS STEEL

1. One (1) Model STAINLESS STEEL Approximately 12'-6" l x 2'-6" w. Provide stainless steel work table with 1-5/8" legs with adjustable bullet feet, lower and/or mid shelves, 6" high back and end splash (where required). Top shall be 14 ga stainless steel, and legs shall be 16 ga. Fabricate and install per complete drawings, schedules, elevations, and details.
2. One (1) CSS Model PREP SINK Provide 16 ga stainless steel sink tub measuring approximately 18" w x 24" d x 12" h. Welded in place with polished seams.
3. One (1) Fisher Model 29033 DrainKing Waste Valve, flat strainer, overflow body, chrome finish

ITEM # 1-93 SPLASH MOUNTED PREP SINK FAUCET

Quantity: One (1)
Manufacturer: T&S Brass
Model: B-0231-CR

1. One (1) Model B-0231-CR Faucet, 12" swing nozzle, 8" wall mount base, 1/2" NPT female Inlets, ceramas cartridges

ITEM # 1-94 MICROWAVE OVEN

Quantity: One (1)
Manufacturer: ACP
Model: RMS10TS

1. One (1) Model RMS10TS Amana® Commercial Microwave Oven, 0.8 cu. ft. capacity, 1000 watts, low volume, 3-stage cooking, (5) power levels, (20) memory settings, 60-minute max cooking time, LED display, touch control, interlock safety switch, ADA-compliant Braille touch pads, audible end of cycle signal, side hinged door with tempered glass, lighted interior, stainless steel exterior wrap & interior, 120v/60/1-ph, 13.0 amps, 15 MCA, 1500 total watts, NEMA 5-15P, cULus, ETL-Sanitation
2. One (1) 3-year limited warranty (1 year full)

ITEM # 1-95 ICE CUBER

Quantity: One (1)
Manufacturer: Scotsman
Model: C0530MA-1

1. One (1) Model C0530MA-1 Prodigy Plus® Ice Maker, cube style, air-cooled, self-contained condenser, production capacity up to 525 lb/24 hours at 70°/50° (380 lb AHRI certified at 90°/70°), stainless steel finish, medium cube size, 115v/60/1-ph, 15.2 amps, cULus, NSF, CE
2. One (1) 3 year parts & labor warranties
3. One (1) 5 year parts & labor warranties on Evaporator
4. One (1) 5 year parts on compressor & condenser

ITEM # 1-96 ICE BIN FOR ICE MACHINES

Quantity: One (1)
Manufacturer: Scotsman
Model: B948S

1. One (1) Model B948S Ice Bin, top-hinged front-opening door, 893 lb application capacity, for top-mounted ice maker, polyethylene liner, metallic finish exterior, includes 6" legs, NSF
2. One (1) 3 year parts & labor warranties
3. One (1) Model KBT22B Bin Top, for use with all 30" modular cubers, flakers or nugget makers on B948S, BH900 bin
4. One (1) Model KLP7 Legs with Flanged Feet, 6", for B series bins or HD dispensers

ITEM # 1-97 FLOOR TROUGH

Quantity: One (1)
Manufacturer: Custom
Model: STAINLESS STEEL

1. One (1) Model STAINLESS STEEL Approximately 4'-6" l x 1'-0" d. Provide 14 gauge type 304 stainless steel floor trough with coved corners and integrally pitched toward waste outlet with a stainless steel beehive strainer. Provide IMC Teddy ASFT-ADA stainless steel accessible grating. Fabricate and install per complete drawings, schedules, elevations, and details.

ITEM # 1-98 WATER FILTRATION SYSTEM

Quantity: One (1)
Manufacturer: Scotsman
Model: SSM2-P

1. One (1) Model SSM2-P Water Filter Assembly, twin system, designed for ice makers & beverage equipment, cubers over 650 lb, & up to 1200 lb, flakers & nuggets over 1200 lb, includes AquaArmor by AgION for antimicrobial protection, NSF, cULus
2. One (1) Model SC10-A Prefilter, 10" coarse
3. One (1) Model SSMRC1 Replacement Cartridge, for SSM (package of 1)

ITEM # 1-99 SPARE NO.

ITEM # 1-100 WORK TABLE W/ PREP SINK

Quantity: One (1)
Manufacturer: Custom
Model: STAINLESS STEEL

1. One (1) Model STAINLESS STEEL Approximately 8'-9" l x 2'-6" w. Provide stainless steel work table with 1-5/8" legs with adjustable bullet feet, lower and/or mid shelves, 6" high back and end splash (where required). Top shall be 14 ga stainless steel, and legs shall be 16 ga. Fabricate and install per complete drawings, schedules, elevations, and details.
2. One (1) CSS Model PREP SINK Provide 16 ga stainless steel sink tub measuring approximately 18" w x 24" d x 12" h. Welded in place with polished seams.
3. One (1) Fisher Model 29033 DrainKing Waste Valve, flat strainer, overflow body, chrome finish

ITEM # 1-101 SPLASH MOUNTED PREP SINK FAUCET

Quantity: One (1)
Manufacturer: T&S Brass
Model: B-0231-CR

1. One (1) Model B-0231-CR Faucet, 12" swing nozzle, 8" wall mount base, 1/2" NPT female Inlets, ceramas cartridges

ITEM # 1-102 WALL SHELF (KNIFE BRACKETS)

Quantity: One (1)
Manufacturer: Custom
Model: STAINLESS STEEL

1. One (1) Model STAINLESS STEEL Approximately 7'-0" l x 1'-0" w. Provide stainless steel wall shelf with knife brackets. Wall shelf shall be: 16 ga stainless steel with #4 finish, bracket shall be 14 ga stainless steel. Fabricate and install per complete drawings, schedules, elevations, and details.

ITEM # 1-103 EMPLOYEE LOCKERS <NIC>

Quantity: Eight (8)
Manufacturer: NIFSEC

1. Eight (8) Employee Lockers - NIFSEC

ITEM # 1-104 REMOTE REFRIGERATION RACK AND SYSTEM

Quantity: One (1)
Manufacturer: OmniTemp Refrigeration
Model: ZS1-2

1. One (1) Model ZS2-4 Model No. ZS2-4 Eco-Cool as manufacturer by Refrigeration Design Technologies (RDT)
 Quantity: 1
 Electrical: 208-230v/3ph
 Connected to Item's: 1-01, 1-07, 1-34, 1-86, 2-03, 3-06
 The RDT UL-Listed horizontal discharge, air-cooled rack system designed for outdoor installation. The unit shall be pre-wired for a single point electrical connection with a main fused disconnect. The refrigeration unit shall be housed in a weather-protected compact structural galvanized steel frame. The unit shall include individual dedicated air-cooled condensers. Condensers shall be aluminum fin/copper tube designed to operate at 15 degrees TD. Condenser fan motors shall be mounted within the enclosure. The exterior housing shall feature stainless steel with one-piece stainless-steel louvers. Entire galvanized metal frame shall be pre-assembled, welded and cleaned. Anchoring tabs shall be welding to the rack base, total of four, one at each corner on the front and rear of the rack. Internal pitch pocket provided.

 All compressor units shall be scroll type and factory assembled to operate with R-448a refrigerant.
 - 5.0 HP (primary) medium temperature digital scroll compressor.
 - 5.0 HP (back-up) medium temperature scroll compressor with manual change over for 100% redundancy.
 - 5.0.0 HP low temperature scroll compressor for walk-in freezer.

Compressors and refrigeration piping will be installed in such a manner as to eliminate noise with vibration eliminators in refrigeration lines, as needed.

Each system shall be equipped with a ball-bearing fan motor, an XC645CX Dixell controller (digital compressors only), oil separators, fixed head pressure control, suction filter, liquid line sight glass, liquid line drier, crankcase heaters, headmaster controls or fan cycling, liquid line inlet and outlet valves, defrost cycle and armored super hose connections (in lieu of capillary tubes).

All refrigerant lines shall be extended to one side of the package in a neat and orderly manner. All tubing shall be securely supported and anchored with non-corrosive coated clamps. All joints must be brazed, not soldered. All piping and controls shall be factory pressure-tested with nitrogen at 175 PSI.

All field piping installed as per factory standards and the sizing of the piping shall meet proper velocities as per factory standards. Insulation will be foam type 25/50 smoke and fire type. Medium temperature will use 3/4" thick wall, low temperature will use 1" thick wall and sub-cooled liquid lines will use 1/2" thick wall insulation. All insulation shall be jacketed with Aluminum (complying with division 15000,) 1-1/2" overlap and secured with wire "zip" ties. All jacket elbows to be roll formed. All field piping installed with plastic bushing wherever steel to copper tubing comes together. Include all labor, material, equipment, tools, refrigerant, oil, and other required accessories for the complete installation of the systems as shown and specified. Interconnection of all accessories accomplished for ease of servicing.

After installation and before charging, evacuate all piping systems to a 500-micron evacuation. After evacuation, charge system with nitrogen and maintain pressure of 150% working pressure for 6 hours. Cap off, install pressure gauge and hold for 24 hours minimum. Re-evacuate, hold for 6 hours, charge and make electronic detector test all joints.

Final wiring of connections, conduit and/or pull boxes, provided under applicable electrical and plumbing contracts. See R-1 drawing for wiring schematic for field wiring.

ITEM # 1-105 REMOTE CONDENSER UNIT

Quantity: One (1)
Manufacturer: Scotsman
Model: ERC111-1

1. One (1) Model ERC111-1 Condenser Unit, Remote Refrigeration, designed for outdoor installation, temperature range from -20°F to 120°F, galvanized finish, 115v/60/1-ph, 2.7 amps, use with C0522xR & C0530xR, cULus
2. One (1) 3 year parts & labor warranties
3. One (1) 5 year parts on condenser

ITEM # 2-01 HAND SINK

Quantity: One (1)
Manufacturer: Eagle Group
Model: HSAP-14-ADA-FW

1. One (1) Model HSAP-14-ADA-FW Hand Sink, wall mount, 14" wide x 16" front-to-back x 5" deep bowl, 16/304 stainless steel construction, splash mount gooseneck faucet with wrist handles & mixer valve, marine edge on front & sides, 1/2" NPS water inlet, chrome-plated P-trap, wrist handles, soap dispenser, basket drain, skirt assembly & paper towel dispenser, PHYSICALLY CHALLENGED, NSF

ITEM # 2-02 HAND SINK FAUCET, SPLASH MOUNT

Quantity: One (1)
Manufacturer: T&S Brass
Model: B-1146-04

1. One (1) Model B-1146-04 Faucet Workboard, splash mounted, 4" centers, swivel gooseneck, 4" wrist action handles
2. One (1) 4" wrist action handle, standard
3. One (1) Model B-0199-01F-15 Aerator, non-splash, flow control, 1.40 gpm, 55/64"-27 UNS female threads

ITEM # 2-03 2 DOOR ROLL-IN REFRIGERATOR

Quantity: Two (2)
Manufacturer: Victory Refrigeration
Model: RIS-2D-S1

1. Two (2) Model RIS-2D-S1 UltraSpec Series Refrigerator Featuring Secure-Temp 1.0™ Technology, Roll-in, two-section, 67.2 cu. ft. capacity, stainless exterior & interior, standard depth cabinet, full height 20 gauge stainless steel doors, TOUCH POINT™ electronic temperature control/indicator, LED lighting, expansion valve technology, Santoprene door gaskets with 2 year warranty, stainless steel breakers, stainless steel ramp, 1/3 HP, UL, cUL, UL EPH Classified, MADE IN USA
2. Two (2) 3 years parts & labor warranty (excludes maintenance items)
3. Two (2) Remote refrigeration system by others (part # -R)
4. Two (2) 115v/60/1-ph, 10.7 amps, cord with NEMA 5-15P
5. Two (2) Door hinging: left door hinged on left, right door hinged on right standard

ITEM # 2-04 DOLLY CART

Quantity: Four (4)
Manufacturer: G.A. Systems Inc.
Model: LY8

1. Four (4) Model LY8 Basket Dolly/Transport Base, 27"W x 27"D x 8"H, holds 2 rows of Speedee-Serv speedline stacking baskets (not included), aluminum base, 5" swivel casters
2. Eighty (80) Model B13202 Wire Basket, 20-11/16"W x 13-1/4"D x 2-5/16"H, rectangular, zinc wire construction
3. Fourty (40) Model B13204 Wire Basket, 20-11/16"W x 13-1/4"D x 4-9/16"H, rectangular, zinc wire construction

ITEM # 2-05 HEATED CABINET

Quantity: Four (4)
Manufacturer: Cres Cor
Model: H-137-SUA-12D

1. Four (4) Model H-137-SUA-12D Cabinet, Mobile Heated, insulated, top-mount heater assembly, recessed push/pull handles, magnetic latch, (12) sets chrome plated wire universal angle slides for 12" x 20" thru 18" x 26" pans on 4-1/2" centers, adjustable 1-1/2" centers, reversible dutch doors, (4) heavy duty 5" swivel casters (2) braked, anti-microbial latches, stainless steel construction, NSF, cCSAus, ENERGY STAR®
2. Four (4) Standard Warranty: 1 year labor with 3 year parts warranty
3. Four (4) 120v/60/1-ph, 1500 watts, 12.0 amp, 10 ft power cord, NEMA 5-15P, standard
4. Four (4) Right-hand door swing, standard
5. Four (4) Model 1056-002 Corner Bumpers, add 2" to OA dimensions, non-marking, gray

ITEM # 2-06 REFRIGERATED CABINET

Quantity: Three (3)
Manufacturer: G.A. Systems Inc.
Model: C4

1. Three (3) Model C4 Refrigerated Serving Cabinet, 50-3/16"W x 30-3/8"D x 34"H, bottom-mounted self-contained refrigeration (Refrigerated Snap In), (2) aluminum sliding lids with locking bar, holds (6) 4" deep or (12) 2" deep baskets, removable louvered front access panel, hot gas condensate evaporator, includes (2) locking pins, stainless steel construction, 3" swivel casters with brakes, R134a, ADA Compliant, UL, UL EPH CLASSIFIED
2. Three (3) Model DSD50 G.A. Systems Display Double Over Shelf is mounted to the top of G.A. Systems cabinets with 3/8" bolts. Fabricated of 18 gauge #4 stainless steel and 1" square stainless steel tubing.
3. Fifty-Four (54) Model B13202 Wire Basket, 20-11/16"W x 13-1/4"D x 2-5/16"H, rectangular, zinc wire construction
4. Twenty-Seven (27) Model B13204 Wire Basket, 20-11/16"W x 13-1/4"D x 4-9/16"H, rectangular, zinc wire construction

ITEM # 2-07 SERVING COUNTER, HOT FOOD, ELECTRIC

Quantity: Two (2)
Manufacturer: G.A. Systems Inc.
Model: H4

1. Two (2) Model H4 Heated Serving Cabinet, 50-3/16"W x 30-3/8"D x 34"H, (2) sliding lids with locking bar, holds (9) 4" deep or (18) 2" deep baskets, stainless steel construction, includes: (2) locking pins, 3" plate casters with brakes, UL, UL EPH CLASSIFIED
2. Thirty-Six (36) Model B13202 Wire Basket, 20-11/16"W x 13-1/4"D x 2-5/16"H, rectangular, zinc wire construction
3. Eighteen (18) Model B13204 Wire Basket, 20-11/16"W x 13-1/4"D x 4-9/16"H, rectangular, zinc wire construction

ITEM # 2-08 SPARE NO.

ITEM # 2-09 SPARE NO.

ITEM # 2-10 SPARE NO.

ITEM # 2-11 WINDOW SERVE COUNTERTOP

Quantity: One (1)
Manufacturer: Custom
Model: STAINLESS STEEL

1. One (1) Model STAINLESS STEEL Approximately 30'-0" l x 2'-7" w. Provide stainless steel work countertop. Top shall be 14 ga stainless steel. Fabricate and install per complete drawings, schedules, elevations, and details.

ITEM # 2-12 CASH REGISTER <NIC>

Quantity: Four (4)
Manufacturer: NIFSEC

1. Four (4) Cash Register - NIFSEC

ITEM # 2-13 BUMPER RAILS

Quantity: One (1)
Manufacturer: Custom
Model: STAINLESS STEEL

1. One (1) Model STAINLESS STEEL (LOT) Provide 14 ga. stainless steel bumper rails guards mounted at 34" above the finished floor. Stainless steel shall have a #4 finish. Fabricate and install per complete drawings, schedules, elevations, and details.

ITEM # 3-01 HAND SINK

Quantity: One (1)
Manufacturer: Eagle Group
Model: HSAP-14-ADA-FW

1. One (1) Model HSAP-14-ADA-FW Hand Sink, wall mount, 14" wide x 16" front-to-back x 5" deep bowl, 16/304 stainless steel construction, splash mount gooseneck faucet with wrist handles & mixer valve, marine edge on front & sides, 1/2" NPS water inlet, chrome-plated P-trap, wrist handles, soap dispenser, basket drain, skirt assembly & paper towel dispenser, PHYSICALLY CHALLENGED, NSF
2. Two (2) Model -RS Right side splashes for handsink

ITEM # 3-02 HAND SINK FAUCET, SPLASH MOUNT

Quantity: One (1)
Manufacturer: T&S Brass
Model: B-1146-04

1. One (1) Model B-1146-04 Faucet Workboard, splash mounted, 4" centers, swivel gooseneck, 4" wrist action handles
2. One (1) 4" wrist action handle, standard, nc
3. One (1) Model B-0199-01F-15 Aerator, non-splash, flow control, 1.40 gpm, 55/64"-27 UNS female threads

ITEM # 3-03 WORK COUNTER

Quantity: One (1)
Manufacturer: Custom
Model: STAINLESS STEEL

1. One (1) Model STAINLESS STEEL Approximately 4'-3" l x 2'-6" w. Provide stainless steel work counter with undershelf and/or mid shelf, galvanized metal base, and 6" high back and end splash (where required). Top shall be 14 ga stainless steel, body to be 16 ga. Fabricate and install per complete drawings, schedules, elevations, and details.

ITEM # 3-04 WORK COUNTER

Quantity: One (1)
Manufacturer: Custom
Model: STAINLESS STEEL

1. One (1) Model STAINLESS STEEL Approximately 12'-8" l x 2'-6" w. Provide stainless steel work counter with undershelf and/or mid shelf, galvanized metal base, and 6" high back and end splash (where required). Top shall be 14 ga stainless steel, body to be 16 ga. Fabricate and install per complete drawings, schedules, elevations, and details.

ITEM # 3-05 WORK COUNTER

Quantity: One (1)
Manufacturer: Custom
Model: STAINLESS STEEL

1. One (1) Model STAINLESS STEEL Approximately 4'-7" l x 2'-6" w. Provide stainless steel work counter with undershelf and/or mid shelf, galvanized metal base, and 6" high back and end splash (where required). Top shall be 14 ga stainless steel, body to be 16 ga. Fabricate and install per complete drawings, schedules, elevations, and details.

ITEM # 3-06 2 DOOR ROLL-IN REFRIGERATOR

Quantity: One (1)
Manufacturer: Victory Refrigeration
Model: RIS-2D-S1

1. One (1) Model RIS-2D-S1 UltraSpec Series Refrigerator Featuring Secure-Temp 1.0™ Technology, Roll-in, two-section, 67.2 cu. ft. capacity, stainless exterior & interior, standard depth cabinet, full height 20 gauge stainless steel doors, TOUCH POINT™ electronic temperature control/indicator, LED lighting, expansion valve technology, Santoprene door gaskets with 2 year warranty, stainless steel breakers, stainless steel ramp, 1/3 HP, UL, cUL, UL EPH Classified, MADE IN USA
2. One (1) 3 years parts & labor warranty (excludes maintenance items)
3. One (1) Remote refrigeration system by others (part # -R)
4. One (1) 115v/60/1-ph, 10.7 amps, cord with NEMA 5-15P
5. One (1) Door hinging: left door hinged on left, right door hinged on right standard

ITEM # 3-07 DOLLY CART

Quantity: Three (3)
Manufacturer: G.A. Systems Inc.
Model: LY8

1. Three (3) Model LY8 Basket Dolly/Transport Base, 27"W x 27"D x 8"H, holds 2 rows of Speedee-Serv speedline stacking baskets (not included), aluminum base, 5" swivel casters
2. Sixty (60) Model B13202 Wire Basket, 20-11/16"W x 13-1/4"D x 2-5/16"H, rectangular, zinc wire construction
3. Thirty (30) Model B13204 Wire Basket, 20-11/16"W x 13-1/4"D x 4-9/16"H, rectangular, zinc wire construction

ITEM # 3-08 FILLER PANELS AND TRIM

Quantity: Eight (8)
Manufacturer: Custom
Model: STAINLESS STEEL

1. Eight (8) Model STAINLESS STEEL Provide 14 ga. stainless steel filler panel with #4 finish. Provide all necessary closure, louvers and trim strips for a complete installation. Fabricate and install per complete drawings, schedules, elevations, and details.

ITEM # 3-09 SPARE NO.

ITEM # 3-10 SPARE NO.

ITEM # 3-11 1 DOOR ROLL-IN HEATED CABINET

Quantity: One (1)
Manufacturer: Victory Refrigeration
Model: HIS-1D-1

1. One (1) Model HIS-1D-1 UltraSpec Series Heated Cabinet Featuring Secure-Temp 1.0™ Technology, Roll-in, one-section, 33.6 cu. ft. capacity, stainless exterior & interior, standard depth cabinet, full height door, TOUCH POINT™ electronic temperature control/indicator, stainless steel ramp, UL, UL EPH Classified, MADE IN USA
2. One (1) 3 years parts & labor warranty (excludes maintenance items)
3. One (1) 208-240v/60/1-ph, 6.3 amps, includes cord & plug
4. One (1) Door hinging: standard on right

ITEM # 3-12 WORK COUNTER

Quantity: One (1)
Manufacturer: Custom
Model: STAINLESS STEEL

1. One (1) Model STAINLESS STEEL Approximately 10'-3" l x 2'-6" w. Provide stainless steel work counter with undershelf and/or mid shelf, galvanized metal base, and 6" high back and end splash (where required). Top shall be 14 ga stainless steel, body to be 16 ga. Fabricate and install per complete drawings, schedules, elevations, and details.

ITEM # 3-13 HAND SINK

Quantity: Two (2)
Manufacturer: Eagle Group
Model: HSAP-14-ADA-FW

1. Two (2) Model HSAP-14-ADA-FW Hand Sink, wall mount, 14" wide x 16" front-to-back x 5" deep bowl, 16/304 stainless steel construction, splash mount gooseneck faucet with wrist handles & mixer valve, marine edge on front & sides, 1/2" NPS water inlet, chrome-plated P-trap, wrist handles, soap dispenser, basket drain, skirt assembly & paper towel dispenser, PHYSICALLY CHALLENGED, NSF
2. Two (2) Model -LS Left side splashes for handsink

ITEM # 3-14 HAND SINK FAUCET, SPLASH MOUNT

Quantity: Two (2)
Manufacturer: T&S Brass
Model: B-1146-04

1. Two (2) Model B-1146-04 Faucet Workboard, splash mounted, 4" centers, swivel gooseneck, 4" wrist action handles
2. Two (2) 4" wrist action handle, standard
3. Two (2) Model B-0199-01F-15 Aerator, non-splash, flow control, 1.40 gpm, 55/64"-27 UNS female threads

ITEM # 3-15 REFRIGERATED CABINET (SELF-CONTAINED)

Quantity: Six (6)
Manufacturer: G.A. Systems Inc.
Model: C5

1. Six (6) Model C5 Refrigerated Serving Cabinet, 63-3/16"W x 30-3/8"D x 34"H, bottom-mounted self-contained refrigeration (Refrigerated Snap In), (2) aluminum sliding lids with locking bar, holds (6) 4" deep or (12) 2" deep baskets, removable louvered front access panel, hot gas condensate evaporator, includes (2) locking pins, stainless steel construction, 3" swivel casters with brakes, R134a, ADA Compliant, UL, UL EPH CLASSIFIED
2. Six (6) Model MD6226 G.A. Systems Merchandising Display Rack Double Sided is an accessory which can be added to the top of G.A. Systems Speedline Cabinets (with the exception of freezer cabinets and cashier stands.) Fabricated of 1-1/2" square stainless steel tubing joined together with 1" square and 1" round stainless steel tubing forming two slanted shelves and is designed to display wire baskets.
3. One Hundred Forty-Four (144) Model B13202 Wire Basket, 20-11/16"W x 13-1/4"D x 2-5/16"H, rectangular, zinc wire construction
4. Seventy-Two (72) Model B13204 Wire Basket, 20-11/16"W x 13-1/4"D x 4-9/16"H, rectangular, zinc wire construction

ITEM # 3-16 HEATED CABINET

Quantity: Six (6)
Manufacturer: G.A. Systems Inc.
Model: H5

1. Six (6) Model H5 Heated Serving Cabinet, 63-3/16"W x 30-3/8"D x 34"H, (2) sliding lids with locking bar, holds (12) 4" deep or (24) 2" deep baskets, stainless steel construction, includes: (2) locking pins, 3" plate casters with brakes, UL, UL EPH CLASSIFIED
2. One Hundred Forty-Four (144) Model B13202 Wire Basket, 20-11/16"W x 13-1/4"D x 2-5/16"H, rectangular, zinc wire construction
3. Seventy-Two (72) Model B13204 Wire Basket, 20-11/16"W x 13-1/4"D x 4-9/16"H, rectangular, zinc wire construction

ITEM # 3-17 UTILITY CHASE

Quantity: Six (6)
Manufacturer: Custom
Model: STAINLESS STEEL

1. Six (6) Model STAINLESS STEEL Provide 14 ga. stainless steel utility chase with #4 finish. Fabricate and install per complete drawings, schedules, elevations, and details.

ITEM # 3-18 SERVICE COUNTER

Quantity: One (1)
Manufacturer: Custom
Model: STAINLESS STEEL

1. One (1) Model STAINLESS STEEL Approximately 72'-8" l x 2'-6" w. Provide stainless steel work counter with undershelf and/or mid shelf, galvanized metal base, and 6" high back and end splash (where required). Top shall be 14 ga stainless steel, body to be 16 ga. Fabricate and install per complete drawings, schedules, elevations, and details.

ITEM # 3-19 CASH REGISTER <NIC>

Quantity: Eleven (11)
Manufacturer: NIFSEC

1. Eleven (11) Cash Register - NIFSEC

ITEM # 3-20 SERVING COUNTER, COLD FOOD

Quantity: Two (2)
Manufacturer: Multiteria
Model: CLS96

1. Two (2) Model CLS96 Essence Series Cold Food Station, 96"W, Tight Link interlocking, (6) pan drop-in self-contained cold pan with 3" recess NSF 7, 3/4" drain, stainless steel tubular frame & counter top, 6" stainless steel legs with adjustable feet, 115v/60/1-ph, 12.0 amps, NEMA 5-15P, 1/2 hp
2. Two (2) WARNING: This product can expose you to wood dust and chemicals including chromium, which are known to the State of California to cause cancer. For more information go to www.P65Warnings.ca.gov.
3. Two (2) 34" high, standard
4. Two (2) Self-service
5. Two (2) Countertop, Stainless steel, standard
6. Two (2) Laminate panels, specify, standard
7. Two (2) NSF7 drop-in self-contained cold pan, 3" pan recess
8. Two (2) Removable undershelf, standard
9. Two (2) Duplex outlet, flush, standard

END OF SECTION

SECTION 11 52 00

AUDIOVISUAL SYSTEMS

PART 1 - GENERAL

1.1 GENERAL CONDITIONS

- A. The Invitation for Bids, Instruction to Bidders, and General Conditions of the Contract including any Supplementary Conditions apply to all Work under this section.
- B. The Contractor acknowledges and warrants that he has closely examined all the Contract Documents, that they are suitable and sufficient to enable the Contractor to complete the Work in the time allotted for the Contract Sum as accepted by the Owner and Consultant, and that they include all Work, whether or not shown or described, which reasonably may be inferred to be required or useful for the completion of the Work in full compliance with all applicable codes, laws, ordinances, rules, and regulations.
- C. Execution of the Contract by the Contractor is a representation and warranty that the Contractor has carefully examined the Contract Documents, and represents and warrants that the Contractor is thoroughly familiar with the nature and location of the Work, the Site, the specific conditions under which the Work is to be performed, and all matters which may in any way affect the Work or its performance. The Contractor further represents that as a result of such examinations and investigations, the Contractor has thoroughly reviewed and understands the Contract Documents and their intent and purpose, and is familiar with all applicable codes, ordinances, laws, regulations and rules as they apply to the Work, and that the Contractor will abide by same.
- D. Claims for additional time or additional compensation as a result of the Contractor's failure to follow the foregoing procedure and to familiarize itself with all local conditions and the Contract Documents will not be permitted.
- E. Related Work Specified Elsewhere:
 - 1. All RFP requirements shall apply to this Section.
 - 2. Power, signal conduits and back-boxes provided and installed under Division 26; except loudspeaker back-boxes and specialty back-boxes provided under this work for installation under Division 26.

1.2 SUMMARY OF WORK

- A. SCOPE:
 - 1. Supply and install sound and video systems including all apparatus and equipment, wiring, termination, labor, and services required to provide systems as specified and shown on drawings.
 - 2. Supply and install any incidental equipment needed in order to meet the functional requirements stated herein and on drawings. This shall include all support and restraint for the fixed loudspeakers and projection equipment.
 - 3. Set up and adjustment of specified hardware and software.
 - 4. Furnish all test equipment and the services of the project engineer and the project manager to assist the Owner's representative in the acceptance testing.
 - 5. Make any adjustments to any part of the system, including the re-aiming of loudspeakers, which may be found necessary during the acceptance testing.
 - 6. Provide training in the operation of the systems to the person or persons selected by the Owner. Refer to in Part 3 paragraph below entitled "Training".

- B. Coordination:
 - 1. Schedule installation operations in sequence required in order to obtain best completion results.
 - 2. Coordinate installation of different components to assure maximum accessibility for required maintenance, service, and repair.
 - 3. All specialty sub-Contracting including installation of all telecommunications lines and equipment as shown on the Contract Documents to be coordinated by the Contractor.

1.3 EQUIPMENT AND MATERIALS

- A. The AV Contractor shall verify all functionally required characteristics of interrelated equipment specified under this section are compatible. The AV Contractor shall coordinate work having interdependent responsibilities for installing, connecting to, and placing in service such equipment.
- B. By making requests for substitutions, the Contractor:
 - 1. Represents that he has personally investigated the proposed substitute product and determined that it is equal to or superior in all respects to that specified.
 - 2. Represents that he will provide the same warranty for the substitution that the Contractor would for that specified.
 - 3. Certifies that the cost data presented is complete and includes all related costs under this Contract, and waives all claims for additional costs related to the substitution which may later become apparent.
 - 4. Will coordinate the installation of the accepted substitute, making such changes as may be required for the Work to be complete in all respects, including, but not limited to, in full compliance with all applicable codes, laws, ordinances, rules, and regulations and completion in the time allotted for the Contract Sum as accepted by the Owner and Consultant.

1.4 SUBMITTALS

- A. All submittals shall be in accordance with the general provisions of the RFP, including General and Supplementary conditions.
 - 1. Audio-Visual Consultant will not review partial submittals.
 - 2. Audio-Visual Consultant will review up to two (2) submittals of any one submittal topic.
 - 3. The cost Audio-Visual Consultants time for additional submittal reviews due to non-conformance with the requirements listed herein will be borne completely by the Audio-Visual Contractor.
 - a. Substitutions of equal equipment beyond the alternatives listed will be permitted only in accordance with Division 1. If an alternative listed is discontinued prior to installation, the Contractor shall submit a substitution request to provide the manufacturer's replacement model. The Audio-Visual Consultant shall be the final judge of the acceptability of substitutions
 - 4. Credentials of its project engineer for review and approval. This person shall:
 - a. Either be a university graduate engineer in electrical or electronic engineering of physics and have at least five years' experience with similar electronic and optical specialty systems, or have other experience and educational background appropriate for the Work as approved by the Architect, the Consultant, and the Owner
 - b. Observe at all times a good working relation with the Architect's and Owner's representatives, and cooperate with engineers and technicians assigned by the Owner, who are charged with the operation and maintenance of the system.
 - c. Provide all technical liaisons between the Audio-Visual Contractor, the Architect, the Owner and the Consultant(s). This shall include participation in meetings and conferences. He will be required to be present at the project site for final inspection, approve the operating and maintenance manuals, and provide the specified instruction to designated members of the Owner's staff.

- d. Be responsible for supervision of all technical work that is part of the contract. This supervision includes the following:
 - 1) Preparation of all construction Drawings from information within the specifications and the Drawings, including approval and signing of all shop Drawings.
 - 2) Supervision of shop fabrication and field installation work to assure conformance with the contract Drawings, the specifications, and the approved shop Drawings to assure workmanship of the highest quality. He shall oversee the testing of all assemblies and sub-assemblies prior to delivery to the project site.
- e. Take a leading role in the specified testing of the completed installation to assure himself for the Audio-Visual Contractor that all specifications are met. Work with and assist the Consultant in his final testing for approval and acceptance of the system for the Owner.
5. Proof of the firm's current membership in (or at least two (2) supporting staff memberships in) two (2) or more of the following professional Audio Visual organizations for two (2) or more years:
 - a. NSCA: National Systems Contracting Association
 - b. ICIA: International Communications Industries Association
 - c. AES: Audio Engineering Society
 - d. USITT: United States Institute for Theatre Technology
6. Credentials of supporting staff who have received current factory certifications from any/all equipment manufacturers whose franchise agreements require it and who meet the following qualifications:
 - a. The supervisor of the work of this section shall have at least five (5) years direct professional experience with devices, equipment, and system installation of the type and scope specified herein.
 - b. All personnel engaged in the installation of this Section shall have at least three (3) years direct experience with devices, equipment, and system installations of the type and scope specified herein.
 - c. In addition, submit proof of at least two (2) current staff member certifications in two (2) or more of the following:
 - 1) NICET-II (Certification by National Systems Contractor's Association)
 - 2) NICET-III (Certification by National Systems Contractor's Association)
 - 3) C-EST (Certification by National Systems Contractor's Association)
 - 4) R-ESI (Certification by National Systems Contractor's Association)
 - 5) CTS-D (Certification by International Communications Industries Association)
 - 6) CTS-I (Certification by International Communications Industries Association)
7. Credentials of DSP System Programmer:
 - a. The Contractor shall employ a QSC Q-Sys Level II factory certified control system programmer to provide the DSP system programming for this project. Submit proof of certification.
8. Credentials of Control System Programmer:
 - a. The Contractor shall employ (or engage the services of) an Extron factory certified ECP (Extron Control Professional) level control system programmer to provide the control system programming for this project. Submit proof of certification.
- B. Post Award Submittals: submit within 30 days of award.
 1. Submit four (4) copies and one (1) reproducible (CD-ROM [drawings as .dwg; documents as .pdf; software as per manufacturer's directions]) of the following:
 - a. A statement of subcontractors, franchises, distributorship, dealerships, arrangements, and agreements with manufacturers of equipment to be used for this work.

- b. Complete bill of quantities, including all material, components, devices, and equipment required for this work. The bill of quantities shall be tabulated respective of each and every system as specified, in the order of the specification section 2 below, and shall contain the following information for each item listed:
 - 1) Quantity
 - 2) Description
 - 3) Manufacturer's name and model number
 - 4) Manufacturer's specification sheet
 2. Schedule: Within fourteen (14) calendar days of the receipt of the notice to proceed the Audio-Visual Contractor shall prepare and submit for approval, in accordance with the General Conditions, a schedule which shall include, but is not limited to, the following:
 - a. Submission of shop drawings, samples and layouts for all items described herein.
 - b. Start and Completion date(s) for field installation work.
 - 1) Installation date(s) of all wires and cables in conduits and required cable trays.
 - 2) Date when fully-operational equipment racks will be fully tested and ready for Audio-Visual Consultant's observation.
 - 3) Delivery date(s) of all systems and subsystems to the project site.
 - c. Start and Completion date(s) for shop fabrication work.
 - d. Date of submission of samples for approval by the Architect of all finishes/materials which will be visible to the public.
 - e. Programming of all remote control and Digital Signal Processing driven devices.
 - f. Completion dates(s) for the following tests:
 - 1) Performance tests on all individual A/V components as they are received from the manufacturer in the Audio-Visual Contractor's shop.
 - 2) Performance tests on completed assemblies and subassemblies assemblies, including all racks in the Audio-Visual Contractor's shop.
 - 3) Performance tests on the completed systems as a whole prior to shipment to the project site.
 - 4) General performance testing of systems at the project site.
 - g. Completion dates for the following Shop and Field Observations.
 - 1) Shop fabricated assembly and subassembly observation.
 - 2) Substantial Completion Observation at the project site.
 - 3) Final acceptance observation at the project site.
 - h. Submission date for operating, maintenance manuals, as-built drawings, documentation, and closeout materials.
 - i. In the event the Audio-Visual Contractor wishes to deviate from the schedule once it is established and approved, he may do so only receiving written approval from the General Contractor.
- C. Field and Shop Drawing Submittal:
 1. Submit four (4) half-size copies and one (1) CD-ROM copy of the following:
 - a. Corrected items from previous submittals. All resubmitted drawings shall be identified with clouded changes. Label each cloud with delta number and date of resubmittal.
 - b. Control panel Layouts: Developed drawings of all control system panel layouts.
 - c. Functional Diagram: single-line block diagram showing interconnection of all components, receptacles, terminal blocks, controls, transformers, and loudspeakers in addition to the active elements. Include terminal and cable numbers, all system and component labels. Show detailed system component information including but not limited to manufacturer's name, model number, any specialized part number option and all input and output connection information, for each piece of equipment. No drawing codes shall be permitted. Mount one (1) full-scale original or photograph (not blueprint) copy behind acrylic in the control booth for each system.

- d. Floor plans, at scale of Contract Documents, showing the locations throughout the project of all receptacles, conduits, wireways, trays, pullboxes, junction boxes, equipment racks equipment and other devices with appropriate designations and fill.
- e. Riser diagrams, showing all elevations, room numbers, conduit sizes, types and fills, box sizes and types, devices, equipment, and rack designations.
- f. Equipment rack elevation drawings scaled (1-1/2" = 1'-0" or larger):
 - 1) Front Elevations: include equipment designation, manufacturer's name, model number, rack location and rack designation.
 - 2) Rear Elevations: include AC power wireways and route of wiring harnesses.
 - 3) Sections: include depth of all equipment components.
- g. Patch bay elevations, showing all patch bay appearances and designations.
- h. Samples for approval by the Architect of all finishes/materials that will be visible to the public including at least receptacles and controls with associated trim plate and each type of loudspeaker baffle and/or grille.
- i. Cable schedules and run sheets, associates with each equipment rack and/or any isolated piece of equipment or device, including cable designation, type, manufacturer and manufacturer's type number, wire color, device and terminal designation and device location, keyed to both the system block diagram and equipment rack elevation drawings.
- j. Contractor fabricated items, detailed drawings showing all components, devices and equipment, including dimensions, component values, terminal designations, types, locations, manufacturer's name and model number.
- k. Loudspeaker cluster and monitor loudspeaker methods of assembly and attachment to supporting construction, confirming dimensions, details of hardware components, devices, including manufacturer's make and model number. Refer to structural attachment details in the construction documents.
- l. All drawings shall be clear and legible. The minimum text size for all drawings shall be 1/8" high. Permissible scales shall be: 1/8"=1', 1/4"=1', 3/8"=1', 1/2"=1', 1"=1', 1-1/2"=1', 3"=1', 6"=1', and full scale
- m. A bound volume or volumes of comprehensive specifications for all material, devices, components, and equipment selected for use in this section, whether modified or not, provided as required under "Post Award Submittals" above.

D. Digital Signal Processor (DSP) System Submittal for Owner Review:

- 1. Prior to programming the Digital Signal Processing (DSP) system, the Contractor shall submit shop drawings per the project standards showing all screen layouts and control descriptions of all system functions to the Owner for review and comment prior to actual programming of the system. Shop drawings shall include screen layouts of the DSP software "Control Pages" for all "configuration presets" and "parameter presets". Submit all information in native file format and hard copy form to the Consultant for review and approval. The contractor shall incorporate all Consultant and Owner comments into the programming of the system.
- 2. Prior to delivery of the systems to the job site, the Contractor shall demonstrate fully functioning systems in the Contractor's facilities that include the DSP system programming. This demonstration shall coincide with the Owner's Representatives observation of Completed Sub Assemblies (Refer to Part 3 paragraph entitled "System Performance Tests"). The Owner will review and comment upon the remote-control programming, and the Contractor shall incorporate all Owner comments into the programming of the systems.
- 3. After the installation of the AV systems has been deemed substantially complete, but prior to final acceptance of the system, the Owner shall have a review period of thirty (30) days to observe the operation of the DSP system. At the end of this review period, the Owner may request programming changes relating to the look and feel of the operation pages or the functionality of commands. The Contractor shall make these changes prior to acceptance of the systems.

E. Control System Submittal for Owner Review:

1. Prior to programming the remote-control system, the Contractor shall submit shop drawings per the project standards showing all control screen layouts, graphical user interfaces (GUI) and control descriptions of all remote-control system functions to the Owner for review and comment prior to actual programming of the system. Submit in native file format and hard copy form. Shop drawings shall include control screen layouts of the touch panel pages for each venue, web page layouts (as required in Part 2 below). Submit electronic versions for Owner review. The Contractor shall incorporate all Owner comments into the programming of the systems.
2. Prior to delivery of the systems to the job site, the Contractor shall demonstrate fully functioning systems in the Contractor's facilities that include the remote-control programming. This demonstration shall coincide with the Owner's Representatives observation of Completed Sub Assemblies (Refer to Part 3 paragraph entitled "System Performance Tests"). The Owner will review and comment on the remote-control programming submittal, and the Contractor shall incorporate all Owner comments into the programming of the systems.
3. After the installation of the AV systems has been deemed substantially complete, but prior to final acceptance of the system, the Owner shall have a review period of thirty days to observe the operation of the remote-control system. At the end of this review period, the Owner may request programming changes relating to the look and feel of the remote-control panels or the functionality of commands. The Contractor shall make these changes prior to acceptance of the systems.

F. Shop Test Statement Submittals:

1. Submit four hard copies and one electronic of the following prior to shipping fabricated equipment racks to the Project site:
 - a. A bound volume, or volumes, of results of performance tests and adjustment data, including all test procedures specified in Part 3 paragraph entitled "System Performance Tests". Example Shop Test Statement submittal templates are available from the Consultant upon request.
 - b. Submit a written request for equipment rack observation certifying that equipment racks are completely assembled, tested and ready for inspection.
 - c. Detailed interior and exterior photos of assembly supporting claim for readiness for inspection.

G. Final Submittals: Submit the following Record Drawings developed from the final "as built" systems:

1. Four (4) half-size (15"x21") copies and one (1) reproducible of each of the block diagrams, plans, risers, patch bay drawings, rack elevations, cable schedules and detail drawings. All reproducible drawings shall be submitted on CD-ROM.
 - a. One (1) complete set of Functional diagrams dry mounted to matte board and set under clear acrylic cover.
 - b. One (1) additional set of rack elevation drawings, each drawing mounted in the associated equipment rack with a protective plastic cover
2. No more than thirty (30) days after Acceptance Testing, submit three (3) copies of each of the following manuals prior to, and as a requirement of, Owner Acceptance of the work of this section:
 - a. Equipment operating instructions: complete, comprehensive instructions for the operations of all contractor-fabricated devices and equipment items provided as part of the work of this section.
 - b. Manufacturer's installation, operating and service information including schematic diagrams for each item of equipment furnished. Order the equipment manuals in the order of the specifications. Provide tabs between each equipment manual. Provide a detailed index at the front of each manual indicating specification reference number, manufacturer's trade name, model number and part description. Provide three (3) copies to the Owner after they have been reviewed and approved by the Audio-Visual Consultant.

- c. Printed material within contractor-fabricated equipment and systems operating manuals shall be bond paper copies, offset or letterpress printed. Drawings, charts, and graphs shall be bond paper offset printed. The systems contractor-fabricated equipment instruction manuals shall be composed using a single, consistent visual format and writing style; text shall be derived from component equipment manufacturer's instruction manuals and may include reproductions of artwork and other materials.
- 3. Submit four (4) copies of each of the following schedules, lists, and data prior to, and as a requirement of, Owner Acceptance of the work of this section:
 - a. All source code for any contractor provided or programmed equipment on CD-ROM.
 - b. Final bill of quantities; complete bill of quantities all material as delivered, including a separate schedule of portable equipment.
 - c. Equipment schedule; complete, final schedules of equipment and devices provided in each room, by room number and name.
 - d. Performance, test, and adjustment data; comprehensive documentation of all performance verification and correction procedures and measurements, including raw and equalized house curves and equalizer settings.
 - e. Maintenance and spare parts schedules; a comprehensive tabulation of equipment, devices, miscellaneous parts, and maintenance items, including manufacturer's name, address, model number, systems use and miscellaneous information.
- 4. No more than thirty (30) days after Acceptance Testing, provide one (1) copy of the following:
 - a. Certificates: all licenses, certificates of operation and/or compliance as required.
- 5. The system will not be accepted until these documents are reviewed and approved by the Owner's Representative.

1.5 QUALITY ASSURANCE

- A. Unless otherwise stated, all electrical, electronic, and optical equipment shall be a product of firms regularly engaged in the manufacture of electrical, electronic or optical equipment. The equipment shall be the latest model or type offered which meets the applicable specifications at the time of the submittal. Discontinued items replaced by newer models or versions are prohibited and should not be submitted for review. It shall be the Contractor's responsibility to provide the Audio-Visual Consultant with information regarding discontinued products listed as alternatives in the specification. If an alternative listed is discontinued prior to installation, the Contractor shall submit a substitution request to provide the manufacturer's replacement model.
- B. Quality of workmanship and fabrication of all equipment and components, which are custom fabricated shall be comparable to professional equipment produced by specialized manufacturers of the trade involved and shall be verified by observation. Only firms having 5 years experience in all aspects of the fabrication and installation of similar systems shall be allowed to perform the work.
- C. All materials and products shall be new and of professional quality. Unless specifically stated in the drawings or specifications, no existing or pre-owned materials shall be installed.

- D. The work specified herein, and in each of the allied sections, shall be accomplished by a single Audio-Visual Contractor experienced in the design, fabrication, installation, checkout, and warranty contract management of systems such as those described in each section. This Audio-Visual Contractor shall have complete responsibility for the systems described herein and shall be the single contract point for the Architect, the Consultant, and/or the Owner with respect to all work specified herein.
 - 1. Substitution requests will not be permitted prior to award of contract. Substitution requests may be submitted with a proposer's shop drawing package. Such requests shall include the name of the material or equipment for which it is to be substituted and a complete description of the proposed substitution and a detailed itemized comparison of physical and performance characteristics of the proposed substitution product with specified product, including drawings, performance, and test data (in identical units of measure), and other information necessary for an evaluation. A statement setting forth changes in other materials, equipment, or other portions of the Work including changes in the work of other contracts that incorporation of the proposed substitution would require shall be included. The burden of proof of the merit of the proposed substitution is upon the proposer. The Consultant's decision of approval or disapproval of a proposed substitution shall be final.
- E. Contractor Qualifications:
 - 1. See pre-award submittal criteria in this specification section for further information regarding Contractor Qualifications.

1.6 WARRANTY AND SERVICE

- A. The AV Contractor shall warrant the installation free of faulty workmanship.
- B. All components, including solid-state devices, warranted free of defects for a period of one (1) year from date of final acceptance. This minimum warranty provision shall not diminish the terms of individual equipment manufacturers' warranties.
- C. Paint and exterior finishes, fuses and lamps are excluded from above warranty statement except when damage or failure results from defective materials or workmanship covered by warranty
- D. Provide maintenance service for a period of two (2) years after acceptance of installation. Service to consist of at least two (2) semiannual visits to the site for checking and adjustment of equipment.
- E. Response: Provide four (4) hour telephone warranty service, with 24-hour on-site technical response time. Provide a technician on call from 7 a.m. to 10 p.m. seven (7) days a week.

PART 2 - PRODUCTS

2.1 GENERAL

- A. OWNER FURNISHED; CONTRACTOR INSTALLED EQUIPMENT (OFCI)
 - 1. The owner intends to furnish the following pieces of equipment. The contractor shall provide all necessary cable, connectors, miscellaneous hardware, engineering and installation labor, and depot level support for all owner furnished, contractor installed equipment for the duration of the project warranty as described above.
 - 2. AV Contractor shall develop a schedule indicating delivery dates necessary for the receipt of all Owner Furnished equipment to ensure an on-time completion of the Work of this section. This schedule shall be coordinated with the Owner, GC and Consultant.

B. MASTER QUOTES

1. Master quotes have been generated for the following items:
 - a. N/A

C. ADDITIVE ALTERNATES

1. Provide additive alternate unit pricing for the following items where indicated on drawings (include necessary cable, connectors, miscellaneous hardware, and engineering and installation labor for a complete and fully operational system.):
 - a. N/A

- D. Safety Laboratory Listings: All equipment powered from the mains shall be labeled as listed by a testing laboratory acceptable to the local code authority. Underwriters Laboratories, Edison Testing Laboratories, or the City of Los Angeles testing lab usually meet this requirement.

2.2 AUDIO AMPLIFIERS AND SIGNAL PROCESSORS

A. (AMP1) AMPLIFIER, 4CH (500W/70V)

1. Features
 - a. 4x analog inputs
 - b. 4xAES inputs
 - c. 2 dual redundant Dante inputs
 - d. Lake™DSP Processing
2. Acceptable
 - a. Lab Gruppen D Series 20:4L
 - b. Consultant approved equal.

B. (AMP2) AMPLIFIER, 4CH (2300W)

1. Features
 - a. 4x analog inputs
 - b. 4xAES inputs
 - c. 8 dual redundant Dante inputs
 - d. Lake™DSP Processing
2. Acceptable
 - a. Lab Gruppen D Series 200:4L
 - b. Consultant approved equal.

C. (AMP3) AMPLIFIER, 1CH (240W/70V)

1. Acceptable
 - a. Lab Gruppen Lucia Series 240/1-70
 - b. Consultant Approved Equal

D. (DSP1) DIGITAL SIGNAL PROCESSOR TYPE-1

1. Features
 - a. Eight card slot core frame
 - b. Configure as Core unit

- 2. Acceptable
 - a. QSC Q-SYS Core 510i
 - 1) Furnish High Performance mic/line modules as indicated
 - 2) Furnish Dante I/O card as indicated
 - 3) Furnish additional I/O cards as required
 - b. Consultant approved equal
- E. (DSP2) DIGITAL SIGNAL PROCESSOR TYPE-2
 - 1. Features
 - a. Eight card slot core frame
 - b. Configure as IO Mode unit
 - 2. Acceptable
 - a. QSC Q-SYS Core 510i
 - 1) Furnish High Performance mic/line modules as indicated
 - 2) Furnish additional I/O cards as required
 - b. Consultant approved equal
- F. (DSP3) DIGITAL SIGNAL PROCESSOR TYPE-3
 - 1. Features
 - a. Four card slot expansion frame
 - 2. Acceptable
 - a. QSC Q-SYS I/O Frame
 - 1) Furnish High Performance mic/line modules as indicated
 - 2) Furnish additional I/O cards as required
 - b. Consultant approved equal
- G. (DSP4) DIGITAL SIGNAL PROCESSOR TYPE-4
 - 1. Features
 - a. 24 I/O DSP unit
 - b. 8 in, 8 out, 8 flexible connections
 - 2. Acceptable
 - a. QSC Q-SYS Core 110f
 - b. Consultant approved equal
- H. (MIX1) MIXING CONSOLE, DIGITAL, 20 FADER
 - 1. Features
 - a. 20 fader digital control surface
 - b. Furnish nosecone, road case and doghouse by Olympic Case Co.
 - c. Furnish all necessary cables and hardware
 - d. Furnish redundant power supply module
 - e. LED Little lites (furnish one for each jack + one spare)

- f. Furnish Adjustable height console table w/casters
 - 1) 36" deep by 60" wide w/ 12" manual height adjust.
 - 2) 1000 pound load capacity, minimum.
 - 3) Heavy-duty, non-marring, locking, part-time, casters.
 - 4) Cross brace legs at rear of table assembly.
 - 5) Top made from min. 3/4" Trespa®
 - 6) Acceptable manufacturer RDM Industries A-107P-WC Series (Submit for approval)
 - 2. Acceptable
 - a. Allen-Heath DLive C2500
 - b. Consultant approved equal
- I. (MIX2) MIXING CONSOLE, DIGITAL, 12 FADER, COMPACT
 - 1. Features
 - a. 12 fader digital control surface
 - b. Furnish all necessary cables and hardware
 - c. Furnish mixer top case with integral equipment rack by Olympic Case Co.
 - 1) min 8 ru
 - 2) Furnish 2ru locking drawer
 - 3) Heavy-duty, non-marring, locking casters
 - 2. Acceptable
 - a. Allen-Heath DLive C1500
 - b. Consultant approved equal
- J. (MIXIO1) MIXING CONSOLE ENGINE, 64 INPUT
 - 1. Features
 - a. 64 inputs x 32 outputs
 - b. Furnish M-Dante input module and adapter
 - c. Program control system to control mix engine via API to provide reduced functionality mode for simple operation using touchpanels.
 - Acceptable
 - a. Allen-Heath Mixrack CDM64
 - b. Consultant approved equal
- K. (MIXIO2) MIXING CONSOLE ENGINE, 32 INPUT
 - 1. Features
 - a. 32 inputs x 16 outputs
 - b. Furnish M-Dante input module and adapter
 - c. Program control system to control mix engine via API to provide reduced functionality mode for simple operation through the use of touchpanels.
 - Acceptable
 - d. Allen-Heath Mixrack CDM32
 - e. Consultant approved equal

2.3 AUDIO TRANSDUCERS

- A. (S1) LOUDSPEAKER, FULL RANGE, WALL, 12"
 - 1. Features
 - a. Multi-tap 70v transformer
 - b. Furnish mfg wall bracket
 - 2. Acceptable
 - a. JBL AC266
 - b. Consultant Approved Equal
- B. (S2) LOUDSPEAKER, SURFACE MOUNT, DUAL 8"
 - 1. Features
 - a. Furnish mfg U-bracket for wall attachment
 - 2. Acceptable
 - a. Renkus Heinz CX62
 - b. Consultant Approved Equal
- C. (S3) LOUDSPEAKER, CEILING, RECESSED, 6.5"
 - 1. Features
 - a. Multi-tap 70v transformer
 - b. Furnish mfg backbox and grille
 - c. coordinate custom grille color with architect
 - 2. Acceptable
 - a. JBL 227CT
 - b. Consultant Approved Equal
- D. (S4) LOUDSPEAKER, CEILING RECESSED, 6.5"
 - 1. Features
 - a. Multi-tap 70v transformer
 - 2. Acceptable
 - a. Community C6
 - b. Consultant Approved Equal
- E. (S5) LOUDSPEAKER, SURFACE MOUNT, 6.5"
 - 1. Features
 - a. Multi-tap 70v transformer
 - b. Furnish mfg tile bridge kit
 - c. coordinate custom grille color with architect
 - 2. Acceptable
 - a. Community CS6
 - b. Consultant Approved Equal

- F. (S6) LOUDSPEAKER, SUSPENDED MOUNT, 12"
 - 1. Features
 - a. Multi-tap 70v transformer
 - b. Suspend above lighting grid
 - c. coordinate custom color with architect
 - 2. Acceptable
 - a. JBL Control 321CT
 - 1) MTC-300BB12 Backbox
 - 2) MTC-300SG12 Square Grille
 - b. Consultant Approved Equal
- G. (FR1) LOUDSPEAKER, FULL RANGE, LINE-ARRAY, 120x05
 - 1. Acceptable
 - a. Community IV6-1122/05 plus the following hardware.
 - 1) Furnish all necessary mounting hardware from Polar Focus and Community
- H. (FR2) LOUDSPEAKER, FULL RANGE, LINE-ARRAY, 120x15
 - 1. Acceptable
 - a. Community IV6-1122/15 plus the following hardware.
 - 1) Furnish all necessary mounting hardware from Polar Focus and Community
- I. (FR3) LOUDSPEAKER, FULL RANGE, LINE-ARRAY, 90x60
 - 1. Acceptable
 - a. Danley SM96 plus the following hardware.
 - 1) Furnish all necessary mounting hardware from Polar Focus and Danley U-Bracket
- J. (SUB) LOUDSPEAKER, LOW FREQUENCY, 1x18"
 - 1. Acceptable
 - a. Community IV6-118S plus the following hardware.
 - 1) Furnish all necessary mounting hardware from Polar Focus and Community
- K. (FF) LOUDSPEAKER, FRONT FILL
 - 1. Features
 - a. furnish all necessary mounting hardware and accessories
 - b. Coordinate custom color with architect
 - 2. Acceptable
 - a. Electro-Voice EVU-1062/95
 - 1) Furnish optional Neutrik NL4 SpeakOn® connector plate.
 - 2) Furnish 50' ruggedized, SJO rubber jacketed 10AWG loudspeaker cable, NL4 to NL4 for each unit. Equal to ProCo LSCNN-50.
- L. (PH) LOUDSPEAKER, WIDE-RANGE, PAGING HORN
 - 1. Acceptable
 - a. TOA CS-64
 - 1) Furnish all necessary mounting hardware
 - b. Consultant Approved Equal

M. (HAS) FM HEARING ASSISTANCE SYSTEM:

1. Features:
 - a. Front panel audio input level
 - b. Multiple available channels (17).
 - c. Balanced line input.
 - d. Adjustable RF power Output.
 - e. Multi-function LED Battery Level indication on receiver.
 - f. LCD Display of system status on receiver and transmitter.
2. Electrical Characteristics
 - a. 72-76 MHz frequency band, ensure frequency compatibility with local RF environment and other equipment.
 - b. Signal to noise ratio 60dB (wide band channels).
 - c. Output power (full) 100mW.
3. Acceptable Products:
 - a. Transmitter (HAS): Listen Technologies LT-800-072. (furnish quantity indicated on drawings)
 - b. Universal Antenna Kit: Listen Technologies LA-122 (furnish 1 per transmitter)
 - c. Rack Mount Kit: Listen Technologies LA-326 (furnish 1 per transmitter)
 - d. Receiver, programmable: Listen Technologies LR-5200-072 (furnish receivers for 4% of seats) with LA-430 neck loop and LA-401 ear speaker.
 - e. Stereo Headphones: LA-402 (furnish 1 per receiver)
 - f. High Capacity Li-ion Rechargeable Batteries: Listen Technologies LA-365. (furnish 1 per receiver)
 - g. Receiver storage/charging case(s), 12-unit: LA-380 (furnish qty sufficient simultaneously charge all transmitters)
 - h. ADA Compliance Kit: LA-304

N. (MIC1) MICROPHONE, PAGING HANHELD, NOISE CANCELLING

1. Features/ Requirements
 - a. Coiled cord
 - b. Push-to-Talk
 - c. Furnish chassis mounting clip, attach to B&LP panel
 - d. Furnish replacement coiled cord
2. Acceptable
 - a. Shure 577B
 - b. Consultant Approved Equal
3. Quantity
 - a. Furnish 2 units

O. (MIC2) MICROPHONE, PROGRAM

1. Features/ requirements
 - a. Unobtrusive hanging microphone for use in feeding program to backstage and front of house when board feed is not in use

- b. Suspend below catwalk, connect to panel using Universal input as a preliminary setting-route through console to backstage and lobby feed.
 - 2. Acceptable
 - a. Audio-Technica ES933ML/MIC and all required suspension hardware and accessories
- P. (MIC3) ARCHIVAL RECORDING STEREO PAIR MICROPHONES
 - 1. Features/ requirements
 - a. Hanging or stand mount XY configuration stereo microphones for use in archival recording
 - b. Provide stereo XY mount (sim. to Beyerdynamic MAV802) and all required suspension accessories.
 - c. Protective case for mics when not in use
 - d. Suspend from catwalk, connect to input panel, route to archival recorder, via patchbay.
 - 2. Acceptable
 - a. AKG C451B Stereo Pair
 - b. Consultant Approved Equal
- Q. (DAR) COMPACT DISC/FLASH MEDIA PLAYER/RECORDER
 - 1. Acceptable
 - a. Tascam SS-CDR200
 - 1) Furnish RC-SS22 optional wired remote control
 - b. Consultant Approved Equal
- R. (CD) COMPACT DISC/FLASH MEDIA/BLEETOOTH PLAYER
 - 1. Features
 - a. Tempo control (CD and USB)
 - b. RS-232C control
 - c. USB-2 Flash Media interface
 - d. Bluetooth interface
 - e. Wireless IR remote
 - 2. Acceptable
 - a. Denon DN-500CB
 - b. Consultant Approved Equal
- S. (WLS1) MICROPHONE, WIRELESS, DIGITAL, QUAD CHANNEL COMBO SYSTEM
 - 1. Features/ Requirements
 - a. Coordinate frequency selection w/ local rf traffic; submit for approval.
 - b. Dante digital audio interface
 - c. Integrate and configure control within the mixing consoles user interface
 - d. Encrypted transmission
 - 2. Acceptable
 - a. Shure ULX-D Series each system consisting of:
 - 1) ULXD4Q Quad-channel receiver w/rack kit (qty. 1)
 - 2) ULXD2/B58 handheld transmitter (qty. 4)
 - 3) ULXD1/ bodypack transmitter (qty. 4)
 - 4) Countryman B3W4FF05BSL lavalier microphone (qty.4)

- 5) Countryman E6IOW6T2SL ear set microphone (qty.4)
- 6) SBC210 Dual portable charging station (qty. sufficient to charge all TX simultaneously)
- 7) SB900 Li-Ion rechargeable battery pack (qty. 1 per TX)
- 8) UA830/UA8/UA820 Half-Wave Antenna (qty. 2)

b. Consultant approved equal.

T. (WLS2) MICROPHONE, WIRELESS, DIGITAL, DUAL CHANNEL COMBO SYSTEM

1. Features/ Requirements

- a. Coordinate frequency selection w/ local rf traffic; submit for approval.
- b. Encrypted transmission

2. Acceptable

- a. Shure QLXD Series each consisting of:
 - 1) QLXD4 receiver w/rack kit (qty. 1)
 - 2) QLXD2/SM58 handheld transmitter (qty. 1)
 - 3) QLXD1/ bodypack transmitter (qty. 1)
 - 4) WL185 lavalier microphone (qty. 1)
 - 5) SBC210 Dual portable charging station mount in rack drawer (qty. 1)
 - 6) SB900 Li-Ion rechargeable battery pack (qty. 2)
 - 7) (ANTCMB) UA221 Passive Antenna Combiner (qty. 2)
- b. Consultant approved equal.

U. PERFORMANCE MICROPHONE PACKAGE

1. Furnish a live performance microphone package including the following:

- a. Shure SM58 (qty. 8)
- b. Shure Beta 58A (qty. 2)
- c. Shure Sm57 (qty. 8)
- d. Shure Beta 57A (qty. 2)
- e. Shure Beta 87A (qty. 2)
- f. Gator Case Microphone storage cases (qty.

2.4 PRODUCTION COMMUNICATIONS

A. (PC Main) MAIN STATION:

1. Features:

- a. Four-channel main station
- b. 10 zone switchboard channel assignment
- c. Direct program audio input
- d. Announce audio output
- e. Furnish optional 6in gooseneck microphone
- f. Short circuit protection and reset circuitry
- g. System Capacity (without Remote Station): up to 60 beltpacks or 20 speaker stations

2. Acceptable:

- a. Clear-Com SB-704
 - 1) Furnish optional 9" gooseneck mic (GM-9).

- B. (PC REMOTE) Remote Station:
1. Features:
 - a. four channel full-duplex operation
 - b. Remote power
 - c. Furnish Gooseneck mic
 2. Acceptable:
 - a. Clear-Com RM-704
 - 1) Furnish optional 9" gooseneck mic (GM-9).
 3. Quantity:
 - a. Furnish one unit at on stage-stage manager position (PC REMOTE)
- C. Belt Packs:
1. Features:
 - a. Single channel
 - b. Recallable function setup
 - c. Visual and audible call signal
 - d. 2.5mm auxiliary headset connector
 - e. Provide mounting clip under counter at sound and lighting control positions
 - f. Furnish 15' XLR cable w/ each beltpack
 2. Acceptable:
 - a. Clear-Com RS-701
 3. Quantity: Furnish 12
- D. Headsets:
1. Features:
 - a. Single and dual muff headset compatible with hardwired and wireless communication system
 - b. Extremely durable
 - c. Broadcast audio quality response
 - d. Balanced microphone output attached switches off when boom is raised
 2. Acceptable:
 - a. Clear-Com CC-300 Single Muff Headset
 3. Quantity: Furnish 12
- E. Accessories:
1. Furnish the following:

a. Call Flasher (FL-7)	Qty: 1
b. HandSet (HS-6)	Qty: 2
c. Splitter (SP-3)	Qty: 4
d. KB702 GM+ 9" gooseneck mic (GM-9) mounted in V-BOX	Qty: 2

2.5 VIDEO

- A. (VP1) VIDEO PROJECTOR - TYPE 1
 - 1. Features
 - a. 1-chip DLP, solid-state laser phosphor, 11000 ANSI
 - b. furnish ceiling mount
 - c. furnish motorized zoom lens, field verify size prior to ordering
 - d. furnish 2 spare filters per unit
 - 2. Acceptable
 - a. Christie D13HD-HS
- B. (VP2) VIDEO PROJECTOR - TYPE 3
 - 1. Features
 - a. 1-chip DLP, solid-state laser phosphor, 7500 ANSI
 - b. furnish locking mount
 - c. furnish motorized zoom lens, field verify size prior to ordering
 - d. furnish 2 spare filters per unit
 - 2. Acceptable
 - a. Christie DWU850-GS
- C. (BLU) DIGITAL VIDEO DISC PLAYER
 - 1. Features
 - a. RS-232
 - b. Blu-Ray capable
 - 2. Acceptable
 - a. Denon DN-500BD
- D. (DVR) Digital Video Flash Media Recorder
 - 1. Acceptable
 - a. Matrox Monarch HDX
 - 1) Furnish rack mount kit
 - 2) Furnish 64GB Lexar P20 USB media cards (qty: 4)
- E. (CAM1) CAMERA, DIGITAL VIDEO, PTZ
 - 1. Features
 - a. simultaneous HD-SDI and H.264 streaming outputs
 - b. furnish remote control unit
 - c. furnish all necessary mounting hardware and accessories
 - 2. Acceptable
 - a. Panasonic AW-HE130K+AW-RP50N/E
- F. (CAM2) CAMERA, DIGITAL VIDEO, PTZ
 - 1. Features
 - a. simultaneous HDBaseT streaming outputs
 - b. furnish remote control interface unit (CAM3EX)

- c. furnish all necessary mounting hardware and accessories
 - 2. Acceptable
 - a. Vaddio RoboSHOT 12 HDBT
 - G. (DMPS) DIGITAL MEDIA PRESENTATION SYSTEM
 - 1. Acceptable
 - a. Crestron DMPS-4K-300-C
 - 1) Furnish all necessary hardware and accessories.
 - b. Consultant approved equal
 - H. (DMED1) DIGITAL MEDIA ENCODER/DECODER-TYPE 1
 - 1. Acceptable
 - a. Crestron NVX DM 350
 - b. Consultant approved equal.
 - I. (DMED2) DIGITAL MEDIA ENCODER/DECODER-TYPE 2
 - 1. Features
 - a. Dante/AES67 Audio Send or Receive
 - 2. Acceptable
 - a. Crestron NVX DM 352
 - b. Consultant approved equal.
 - J. (FPD1) FLAT PANEL DISPLAY-TYPE 1
 - 1. Acceptable
 - a. Samsung DM55E 55" flat-panel display
 - 1) Chief RLF2 low-profile fixed mount
 - 2) FSR PBW-270 recessed backbox
 - 3) IP control module as required for control system interface
 - K. (FPD2) FLAT PANEL DISPLAY-TYPE 2
 - 1. Acceptable
 - a. Samsung LS22E310HSL 22" flat-panel display
 - 1) Chief FTRV fixed mount (as required)
 - 2) Chief TS118SU articulating mount (as required)
 - 3) IP control module as required for control system interface
 - L. (DOC) DOCUMENT CAMERA
 - 1. Acceptable
 - a. Epson DC-21
- 2.6 REMOTE CONTROL SYSTEM
- A. General: The Control Systems consist of three (3) parts: Remote Control and Monitoring, and DSP Control and Monitoring.
 - 1. The contractor shall provide programming for the remote control systems as described below and shown on the Category AV drawings. The Contractor shall submit shop drawings of all control screen layouts and control descriptions to the Architect for review and comment prior to actual final programming and installation.

2. Provide bi-directional feedback on all screens for all devices.
3. Labels and Text: Avoid abbreviations and acronyms. Device selection and control buttons will be labeled with clear text descriptions. Transport control buttons will use graphical icons. Lettering is 1/8" minimum sans serif font, maintaining background to text contrast. Use contrasting color to highlight function or feedback status.
4. Use positive logic. Avoid conditions that may cause command synchronization conflicts. Provide power sensors or other devices to ensure that positive logic conditions are maintained. Use RS-232 or RS-422 devices that provide feedback of equipment status to the control system.
5. Feedback shall be indicated in a logical manner on the touch screen at all times. The status of each controllable device shall be polled to reflect the most accurate state of the overall system condition at all times.
6. Link functions to require the fewest number of use actions to control the audiovisual equipment.
7. Each media selection clears the previous audio and visual selection (i.e. "CD SELECT" clears the audio as well as video selection of "DVD SELECT").
8. Default conditions shall be established for the system at power-up including device, warm-up routine, power conditions, switcher status and other default conditions.
9. Buttons (hard and soft) shall incorporate pilot lights or inverted illumination capabilities.
10. The programming shall be "foolproof" to the extent that each operation or sequence of operations does not cause the control system to become inoperable to interfere with further procession, correct operations or execution of commands.
11. Provide the following modules for control as required:
 - a. Relays.
 - b. Serial and Infrared (IR).
 - c. RS 232 and RS 422 with adjustable baud rate.
 - d. Logic Input Control.
12. Provide the following control system accessories as required:
 - a. Terminal blocks, wiring hardware
 - b. Power Supplies, submit for approval.
 - c. Supply Com ports, IR ports and/or modules as necessary.
 - d. Provide additional accessories, including sync and power sensors, as required to provide a fully operational system.
 - e. Provide minimum 30-minute UPS backup for the RC units.

B. Remote Control Submittals and Owner Review:

1. Prior to programming the remote control system, the Contractor shall submit shop drawings per the project standards showing all control screen layouts and control descriptions of all remote control system functions to the Owner's Representative and AV Consultant for review and comment prior to actual programming of the system. Shop drawings shall include control screen layouts of the touch panel pages for each panel, remote layouts (accessible by authorized PC computer on the AV network), DSP software "Control pages" for all preset configurations. Submit electronic versions of the software and to the Consultant for review and approval. The Contractor shall incorporate all Owner comments into the programming of the systems.
2. Prior to delivery of the systems to the job site, the Contractor shall demonstrate fully functioning systems in the Contractor's facilities that include the remote control programming. This demonstration shall coincide with the Owner's Representatives observation of Completed Sub Assemblies (Refer to Section 3.2). The Owner will review and comment upon the remote control programming, and the Contractor shall incorporate all Owner comments into the programming of the systems.

3. After the installation of the AV systems has been deemed substantially complete, but prior to final acceptance of the system, the Owner shall have a review period of forty-five days to observe the operation of the remote control system. At the end of this review period, the Owner may request programming changes relating to the look and feel of the remote control panels or the functionality of commands. The Contractor shall make these changes prior to final acceptance of the systems.
- C. Control System Help Menu:
1. Provide a detailed context sensitive help section to aid the operation and use of the media system. The help section shall provide a "novice" user with enough information to use every aspect of the programmed, controllable devices.
 2. Provide a help button on every "page".
 3. The help button on each "page" shall open the section of the help menu specific to that "page". Every button on that "page" shall be detailed in such section of the help menu.
- D. Touch Screen Layout Description:
1. Programming: System Screens shall be ordered, mapped, and the buttons defined as deemed necessary by the Consultant. The goal of the remote control system programming is to provide a simple, user-friendly interface to the audio-visual system. With this in mind, each button on the remote control panels may initiate control of multiple devices to streamline operation of the system.
 2. Template: Layout shall be clear, uncluttered, professional, and up to date.
 3. Title Screen: Contractor shall obtain bitmap file of the Owner's logo for this screen. Touching the screen in any location will bring user to the Main Menu screen. This is the default start up screen for power up and sleep mode.
- E. Remote Control Submittals and Owner Review:
1. Prior to programming the remote control system, the Contractor shall submit shop drawings per the project standards showing all control screen layouts and control descriptions of all remote control system functions to the Consultant and Owner for review and comment prior to actual programming of the system. The Contractor shall incorporate all Consultant and Owner comments into the programming of the systems.
 2. Prior to delivery of the systems to the job site, the Contractor shall demonstrate fully functioning systems in the Contractor's facilities that include the remote-control programming. This demonstration shall coincide with the Owner's Representatives observation of Completed Sub Assemblies (Refer to Paragraph 3.2). The Consultant and Owner will review and comment upon the remote-control programming and the Contractor shall incorporate all Consultant and Owner comments into the programming of the systems.
 3. After the installation of the AV systems has been deemed substantially complete, but prior to final acceptance of the system, the Owner shall have a review period of 90 days to observe the operation of the remote-control system. At the end of this review period, the Owner may request programming changes relating to the look and feel of the remote control panels and/or the functionality of commands. The Contractor shall make these changes, at no cost to the Owner, prior to final acceptance of the systems.
- F. (RC1) REMOTE CONTROL SYSTEM - TYPE 1
1. Acceptable:
 - a. Crestron PRO3
 - b. expansion modules as required
 2. Consultant Approved Equal
- G. (TP1) TOUCH PANEL, 15", TABLETOP MOUNT
1. Acceptable
 - a. Crestron TS-1542-C-B-S
 - 1) Furnish all required accessories
 - 2) Furnish portable Pelican style storage case or foam-lined drawer in Mix rack

H. (TP2) TOUCH PANEL, 10", RACK MOUNT

1. Acceptable
 - a. Crestron TSW-1060-B-S
 - 1) Furnish all required accessories
 - 2) Furnish custom rack mount kit

2.7 A/V DATA NETWORK DISTRIBUTION SYSTEM

A. (DSWITCH1) 48 PORT MANAGED SWITCH

1. Features
 - a. QSC Q-Sys qualified
 - b. 48-10/100/1000 ports
 - c. Furnish 2-10G uplink ports and SFP uplink modules as required.
 - d. Furnish optional redundant Power Supply
2. Acceptable
 - a. Cisco WS-C3560X-48T-L

B. (DSWITCH2) 8 PORT MANAGED LAN SWITCH

1. Features
 - a. QSC Q-Sys qualified
 - b. PoE(+) enabled
2. Acceptable
 - a. Packedge SX-8P
 - b. Consultant approved equal

C. (DSWITCH3) 10 PORT MANAGED LAN SWITCH

1. Features
 - a. 10 port Gb switch
 - b. PoE(+) enabled
2. Acceptable
 - a. Cisco SG300-10P
 - b. Consultant approved equal

D. (D-#) Data Patch Panel

1. Features:
 - a. Rack Mountable, 2RU
 - b. Category 6 Rated
 - c. 48 Port Configuration
 - d. Furnish (1) 24" patch cord per jack pair
 - e. Furnish wall mounted patchcord cable hangers for all patchcords
2. Acceptable
 - a. Leviton eXtreme 6+ QuickPort Patch Panel with one factory certified patch cable per two ports (AVC shall furnish patchbays in sufficient quantity to fulfill the functional intent of the drawings.)

E. (AVPC) Control & Monitoring Computer:

1. Features:
 - a. Small form factor chassis (SFF) (13.3"w x 3.95"h x 15"d) with 240watt power supply and manufacturers optional dust filter kit.
 - b. ATX motherboard with minimum 3.9 GHz Intel i5-6600 Quad Core, 8GB DDR4 2133MHz RAM,
 - c. NVIDIA Quadro K240 2GB video card w/ dual output (DP + DVI)
 - d. CD-R/RW/DVD+/-RW drive
 - e. Dual 2.5 inch, 250GB (min.), Solid-State SSD Hybrid drive (configured in Raid 1 Mirrored Array)
 - f. SD flash card reader
 - g. Dual 10/100/1000 Base Ethernet NIC card.
 - h. Rack mounted, clamshell, Flat panel LCD-TFT video monitor [MON].
 - i. Rack mounted 104 key PS2 keyboard + mouse [KBD]
 - j. Windows 10 Professional operating system
 - k. Provide Middle Atlantic custom CPU rack kit.
 - l. Provide minimum 30-minute UPS backup for the CPU.
2. Acceptable:
 - a. HP Z240 SFF custom configured and ancillary components
 - b. Consultant approved equal
3. (MON) Monitor, 17" Rack Mount:
 - a. Features:
 - 1) Clamshell LCD monitor drawer
 - 2) Rack mountable, 1RU
 - 3) Resolution: 1920x1200 WUXGA TFT LCD
 - 4) Inputs: VGA + Optional HDMI w/Audio
 - 5) OSD On-screen Display function
 - b. Acceptable: Acnodes RP2117+HDMI Option
4. (KBD) Keyboard/Touchpad, Rack Mount:
 - a. Features:
 - 1) Keyboard / Touchpad
 - 2) Rack mountable, 1RU
 - b. Acceptable: Acnodes RK1000T

2.8 RACKS, WIRE, CONNECTORS AND MISCELLANEOUS HARDWARE

A. (ER#): Full Height Stationary Equipment Racks

1. Features:
 - a. 44, 1-3/4" rack space elevation.
 - b. Accepts EIA standard 19 panel width, 32" deep.
 - c. 1/2", 3/4", 1", 1-1/2", electrical knockouts, top and bottom rear.
 - d. Ventilated top and bottom elevation panel.
 - e. Furnish full height ground Buss Bar

- f. Furnish drawers and pull-out shelves as indicated on drawings
 - g. Furnish thermostatically controller 8" top-fan unit and filtered air intake.
 - h. Furnish (min.1/2") high-density rubber insulation pad under entire rack assembly.
 - 2. Acceptable: Middle Atlantic BGR-series
 - 3. Quantity:
 - a. Equipment rack(s): As shown on drawings.
 - b. Side panel: 1 pair, each side by side assembly.
 - c. Top panel: 1 each equipment rack.
 - d. Rear door: 1 each equipment rack.
 - e. Mid rails: 1 pair each equipment rack.
 - f. Cable Chase (4"): 1 each equipment rack + 1
- B. Rack Panels:
- 1. Blank Panels:
 - a. Features:
 - 1) 1/8" anodized brushed aluminum finish.
 - 2) 19" standard EIA width.
 - b. Acceptable: Lowell, Middle Atlantic
 - c. Quantity: As shown on drawings.
 - 2. Vent Panels:
 - a. Features:
 - 1) 16 Ga. perforated steel with black power coat finish.
 - 2) 60% minimum open area.
 - 3) 19" standard EIA width.
 - b. Acceptable: Lowell, Middle Atlantic
 - c. Quantity: As shown on drawings.
- C. Rack Kit(s):
- 1. Features:
 - a. 1/6" anodized brushed aluminum finish.
 - b. Custom manufactured for each piece of equipment.
 - c. 19" standard EIA width.
 - 2. Acceptable: Middle Atlantic or manufactures optional rack kit.
 - 3. Quantity: 1 for each non-standard 19" EIA piece of equipment.
- D. (BAL/UBAL) Line Input Transformer +4dB output to -10dB input:
- 1. Features:
 - a. Unbalances "Pro" to "Consumer IHF" Outputs.
 - b. Transformer isolation.
 - c. Passive device.
 - 2. Electrical Characteristics:
 - a. Bandwidth: -3dB at 0.25 Hz and 100 kHz.
 - b. Input impedance: 13 kohm.
 - c. Common Mode Rejection: greater than 60dB.

- d. Insertion loss: 14dB
- 3. Acceptable: Jensen ISO-MAX PC-2XR
- 4. Quantity: 1 per unbalanced stereo input pair.
- E. (ISO-A) 1:1 Line Transformer:
 - 1. Features:
 - a. 1:1 turn ratio.
 - b. Transformer isolation.
 - c. Passive device.
 - 2. Electrical Characteristics:
 - a. Bandwidth: -3dB at 0.25 Hz and 100 kHz.
 - b. Distortion: > 0.001% THD
 - c. Common Mode Rejection: greater than 60dB.
 - d. Insertion loss: less than 1.5 dB
 - e. Hum Rejection: greater than 60 dB.
 - 3. Acceptable: Jensen ISO-MAX DM2-2XX
 - 4. Quantity: Use as required.
- F. Line Level Amplifier Interface:
 - 1. Features:
 - a. Balances unbalanced "Consumer" line level signals.
 - b. Unbalances balanced "Pro" line level signals.
 - c. Servo Balanced inputs and outputs.
 - d. 600-ohm termination switch.
 - 2. Electrical Characteristics:
 - a. Frequency response: -0dB +0.5 dB from 5 Hz to 100 kHz.
 - b. Distortion: 0.005 THD
 - c. Common Mode Rejection: greater than 45dB.
 - d. Insertion loss:
 - 1) - 14dB +-6dB ("Pro" to "Consumer")
 - 2) + 14dB, +- 6dB ("Consumer" to "Pro")
 - 3. Acceptable: Aphex Model 124
 - 4. Quantity: 1 per "consumer" -10 dB unbalanced stereo pair.
- G. (VC/VC2) Manual Volume Control for Ceiling Loudspeakers:
 - 1. Features:
 - a. High quality auto transformer series for use in 70-Volt system
 - b. 10 step attenuation
 - c. Durable stainless steel plate with skirted black knob
 - d. Size appropriately for connected load
 - e. VC2 shall consist of a volume control with a source selector switch mounted on a two gang plate
 - 2. Acceptable: Lowell LVC Series or equal by Atlas|IED.

- H. Rack Power Conditioner:
1. Features:
 - a. Power line filters for spike and RFI control.
 - b. 20 amp power conditioning capacity.
 2. Acceptable:
 - a. SurgeX SX1120-RT
 3. Quantity: Provide 1 per equipment rack provided.
- I. (A-#) AUDIO PATCH PANEL:
1. Features:
 - a. 48x2 mini-TT jacks
 - b. Programmable configuration
 - c. Furnish (1) 24" patch cord per jack pair
 - d. Furnish wall mounted patch cable hangers for all patch cords
 2. Acceptable:
 - a. Bittree B96DC-FNSST/E3-M2OU12B series (AVC shall furnish patchbays in sufficient quantity to fulfill the functional intent of the drawings.)
- J. (V-#) VIDEO PATCH PANEL:
1. Features:
 - a. 32x2 mini-WeCo jacks
 - b. Full Normal, Non-terminating jacks
 - c. Fully populate all jack locations
 - d. Furnish (1) 24" patch cord per jack pair
 - e. Furnish wall mounted patch cable hangers for all patch cords
 2. Acceptable:
 - a. Bittree B64T-2MWNHD series (AVC shall furnish patchbays in sufficient quantity to fulfill the functional intent of the drawings.)
- K. (DM-#) DIGITAL MEDIA PATCH BAY, SHIELDED
1. Features
 - a. 24-port Category 6 rated STP patch field
 - b. Fully populate all jack locations
 - c. Furnish (1) 36" Factory Certified, Shielded (min 350MHz) patch cord per jack pair
 - d. Furnish wall mounted patch cable hangers for all patch cords
 2. Acceptable
 - a. Bittree DSKP124-C6FTS (AVC shall furnish patchbays in sufficient quantity to fulfill the functional intent of the drawings.)
- L. (F-#) Fiber Optic Patch panel
1. Features
 - a. Separate panels for single-mode and multi-mode patching.
 - b. Accepts (3) 12-fiber LC mounting modules
 - c. Rack mountable, 1 RU
 - d. Populate all module slots with connector panels.

- e. Furnish splice trays as required to accommodate all field cables.
 - f. Furnish slide mount kit for ease of access.
 - g. Furnish all necessary accessories.
 - 2. Acceptable: Leviton Opt-X Ultra Fiber Optic Patch Panel (5R1UH-S03) + (3)-Mounting plates (5F100-2QL) and Splice Trays (T5PLS-12F) (AVC shall furnish patchbays in sufficient quantity to fulfill the functional intent of the drawings.)
- M. Fiber Field Termination Box:
- 1. Features:
 - a. All fiber optic cables shall connect to a Field Terminal Box within each AV backbox prior to landing on panel receptacles.
 - b. Mount Field Terminal Box inside AV panel.
 - c. Furnish and install factory certified patch cables from FTB to panel receptacles.
 - 2. Acceptable: Multilink FWM-1X-SP-BK+MLCD-12-MM-P-BLK adapter plate
- N. Audio Terminal Blocks:
- 1. Features:
 - a. All mic, line level and DC control cables interconnecting with an equipment rack shall connect to an audio terminal block, prior to exiting the rack or landing on a piece of equipment.
 - b. Rated for stranded 20 GA - 24 GA wire.
 - 2. Acceptable: WAGO Style modular DIN rail terminal blocks (must be used in conjunction with cable end ferrules and mfg. recommended tooling).
- O. High-Level Audio Terminal Blocks:
- 1. All loudspeaker lines leaving an equipment rack shall be connected via phenolic barrier-type, double-row, closed back, screw terminal blocks from Marathon Kulka®.
 - 2. Alternately, modular style DIN rail terminal blocks of proper size and in conjunction with ferrules may be substituted for the barrier blocks.
- P. Installed Wiring: (NOTE: Non-plenum versions listed, furnish plenum equivalents as required by Code.)
- 1. Loudspeaker lines in conduit: standard electrical wire, stranded copper, color-coded, THHN/THWN type.
 - a. CONDUIT HAS BEEN SIZED FOR THHN
 - b. Low Z: AWG #10 unless otherwise noted
 - c. High Z: AWG #14 unless otherwise noted
 - 2. Loudspeaker lines not in conduit:
 - a. Low Z: AWG #10 equal to Belden 6T00UP or WestPenn HA210 or consultant approved equal.
 - b. High Z: AWG #14 equal to WestPenn 226 or Liberty 14-2C or consultant approved equal.
 - 3. Mic and Line, twisted, shielded pair #22: equal to Belden 8761 or WestPenn (x)454 or consultant approved equal.
 - 4. Production communication: (2) individual, twisted shielded pair #20, drain wire #20 cables equal to Belden 8762 or WestPenn 77292 or consultant approved equal.
 - 5. Video 75 ohm COAX, field/inter-rack runs greater than 150' feet, conduit sized for .300" OD cables:
 - a. RG-6/U Type in conduit: Belden 1694A, WestPenn 6350, Canare L-5CFB or Liberty 18-CMR-SD or consultant approved equal.

6. Video 75 ohm COAX, field/inter-rack runs greater than 25 feet / less than 150', conduit sized for .250" OD cables:
 - a. RG-59/U Type in conduit: Belden 1505A, WestPenn 819, Canare L-4CFB or Liberty 20-CMR-VIDEO or consultant approved equal.
7. Video 75 ohm COAX, inter/intra-rack runs less than 25 feet
 - a. RG-59/U Type: Belden 1865A, WestPenn HD825, Canare L-3CFB or Liberty 23-MINI-SD or consultant approved equal.
8. DC Control Lines:
 - a. low current loads (<2A) (mute, relays, VCA, LED): AWG #20.
 - b. medium current loads (>2A) (actuators, illuminators): AWG #18.
9. RF: 50 ohm (Remote antennae).
 - a. (runs <25') Acceptable: Belden 8240 or Liberty RG58-CMR or approved equal.
 - b. (runs >25') Acceptable: Belden 8214 or Liberty RG8-CMR or approved equal.
10. RF: 75 ohm.
 - a. RG-6/U Acceptable: Comm/Scope 5730 or approved equal.
 - b. RG-11/U Acceptable: Comm/Scope 5916 or approved equal.
11. Digital Remote Control Lines:
 - a. Acceptable: Carol C4065A, West Penn 271 or Liberty 22-8C or approved equal.
12. Unshielded, Twisted Pair:
 - a. Category 5e
 - 1) Acceptable: Berk-Tek LANmark-350 or approved equal.
 - b. Category 6
 - 1) Acceptable: Berk-Tek LANmark-1000 or approved equal.
 - c. Category 6A
 - 1) Acceptable: Berk-Tek LANmark-10G or approved equal.
13. Digital Media Cable
 - a. HDMI – Only pre-made factory terminated and V1.4 certified cable assemblies shall be permitted. HDMI runs longer than 30' shall not be permitted.
 - 1) (runs <15') Category 2-HighSpeed w/Ethernet: Acceptable: Blue Jeans Cable Belden Series-FE or Liberty E2-HDSEM-M series.
 - 2) (runs >15'<30') Category 2-HighSpeed w/Ethernet: Acceptable: Blue Jeans Cable Belden Series-1
 - b. Copper (DM over one-wire cable requirements)
 - 1) Installed: Category 6 Shielded Twisted Pair (F/UTP) by CommScope, Belden, or equal. Submit to consultant for approval.
 - 2) Patchcords: Category 6 Shielded Twisted Pair by CommScope, Belden, or equal. Submit to consultant for approval.
 - c. Fiber
 - 1) OM3, 50µm multimode fiber by CommScope, Belden, or equal. Submit to consultant for approval.

Q. Portable Cables:

1. Reusable Portable Cable Tie
 - a. Acceptable: Rip-Tie CableWrap no known equal.
 - b. Quantity: 1 per portable cable provided.
2. Loudspeaker extension and patch cables: AWG #12/4, SJO-type rubber jacket: Belden 8472 or equal. Fully terminate all NL4 connectors
 - a. Wire per detail

- b. Quantity:
 - 1) 8 - 5' cables
 - 2) 8 - 25' cables
 - 3) 8 - 50' cables
 - 4) 4 – 100' cables
 - c. Acceptable:
 - 1) Submit for Approval
 3. Mic extension cables: Ready-made, premium quality, with XLR connectors in 10', 25', 50' and 100' lengths, with rubber jackets by ProCo Lifelines Series or Consultant Approved Equal.
 - a. Quantity:
 - 1) 10- 12' cables
 - 2) 10- 25' cables
 - 3) 10- 50' cables
 - 4) 10– 100' cables
 - b. Acceptable:
 - 1) Submit for Approval
 4. Digital Video extension cables: Stranded RG6/U type with 3-piece BNC connectors in 12', 25', 50' and 100' lengths.
 - a. Quantity:
 - 1) 4- 12' cables
 - 2) 4- 25' cables
 - 3) 4- 50' cables
 - 4) 4– 100' cables
 - b. Acceptable:
 - 1) Submit for Approval
 5. HDMI extension cables: Blue Jeans Cable Belden Series-1 (or Consultant approved equal) in 12' & 25' lengths.
 - a. Quantity:
 - 1) 4- 12' cables
 - 2) 4- 25' cables
 6. Digital Media Extension Cables: Ruggedized, Tactical Style Cable STP Ethercon to Shielded RJ-45 in 12', 25', 50' and 100' lengths.
 - a. Quantity:
 - 1) 4- 12' cables
 - 2) 4- 25' cables
 - 3) 4- 50' cables
 - 4) 2– 100' cables
 - b. Acceptable:
 - 1) Submit for Approval
 7. Guitar Cables ¼" Tip-Sleeve
 - a. Acceptable: ProCo Evolution Series
 - b. Quantity: Furnish (4) EVLGCN-20 Cables
 8. Balanced ¼" Tip-Ring-Sleeve, Quad
 - a. Acceptable: ProCo Ameriquad Series
 - b. Quantity: Furnish (4) AQBP-20, (4) AQBP-10 Cables

9. Balanced 1/4" Tip-Ring-Sleeve to XLR
 - a. Acceptable: ProCo Excellines Series
 - b. Quantity: Furnish (4) BPBQXM-20, (4) BPBQXF-20 Cables
 10. Cable tester
 - a. Acceptable: Ebtech Swizz Army 6in1 Cable tester
 - b. Quantity: Furnish 1 unit with lithium batteries
- R. Microphone Stands Package
1. Furnish the following Microphone stands:
 - a. K&M 260/1, Black (qty. 8)
 - b. K&M 210/8, Black (qty. 8)
 - c. K&M 25960, Black (qty. 4)
 - d. K&M 232, Black (qty. 4)
- S. Adapters:
1. Furnish the following Adapters:
 - a. Acceptable: ProCo Kwik Fixer Series
 - 1) PRX – XLR Polarity Reverser (qty. 2)
 - 2) LMX – Line/Mic Attenuator (qty. 2)
 - 3) 9144PC – Hi-Z to Lo-Z (qty. 2)
 - 4) MAX10 – 10dB Pad (qty. 2)
 - 5) MAX20 – 20dB Pad (qty. 2)
 - 6) MAX30 – 30dB Pad (qty. 2)
 - 7) GLX – Ground Lift Adapter (qty. 2)
 - 8) ITX – Iso Xfmr XLR-XLR (qty. 2)
 - 9) ITXBQ – Iso Xfmr XLR-TRS (qty. 2)
 - 10) ITXQ – Iso Xfmr XLR-TS (qty. 2)
 - 11) Furnish portable storage case
- T. Headphones:
1. Furnish the following Monitor Headphones
 - a. Acceptable: Sony MDR-7506 (qty. 2)
- U. Connectors and Receptacles:
1. Only metal connector shells and bodies are permitted.
 2. Mic and Line:
 - a. Solder only. No IDC, 1-piece compression or screw terminal versions permitted.
 - b. Input: 3-pin female XLR-type and 1/4" TRS jacks where shown on drawings. Insulate 1/4" jacks from plate, do not ground pin 1 on XLRs.
 - c. Output: 3-pin male XLR-type and 1/4" TRS as above.
 - d. RCA: Only solder style, metal connector shells and bodies are permitted., no "molded assemblies" shall be permitted
 3. Loudspeaker:
 - a. Only Neutrik Speakon® devices are acceptable.
 - b. Wire all terminals unless otherwise noted.
 - c. Panel: Neutrik NL4MP or NL2MP as required.

- d. Cords: NL4FC.
 - e. Cable couplers: Neutrik NL4MM.
 - f. Wooden box mounting: Neutrik NL4MPR.
 - g. All NL4 devices shall be cabled for two channel operation unless otherwise noted.
- 4. Video: 75 ohm Coax
 - a. Only 3-piece BNC devices are acceptable.
 - b. No IDC, compression or screw terminal versions permitted.
 - c. Extron BNC's shall not be permitted
 - d. Panel-mount recessed BNC: Neutrik D-Series
 - e. Cable:
 - 1) Canare BCP-C3B for Vx-3C series cables.
 - 2) Canare BCP-C4B for use with RG-59 cables.
 - 3) Canare BCP-C77A for use with LV-77S cables.
 - f. Cable couplers: BNC male/male barrel
 - g. HDMI: Cables shall be Cat-2 certified for 10.2 Gb/s and shall carry the HDMI logo.
- 5. Control: submit cut sheets.
- 6. Production Communications: 3-pin and 6-pin male XLR-type as shown on drawings
- 7. Digital Media (RJ45 style):
 - a. Only punch down style (female jack) connectors shall be acceptable.
 - b. No feed-thru's will be allowed.
 - c. Any male (plug) terminations shall be factory performed and certified.
- V. (FPD) FLAT PANEL DISPLAY BACKBOX
 - 1. Acceptable
 - a. FSR PWB-270 with all required plates, panels, and accessories
- W. (V) VIDEO PANEL BACKBOX
 - 1. Acceptable
 - a. FSR PWB-270 with all required plates panels and accessories
- X. Receptacle Panels, aluminum:
 - 1. Field-verify panel sizes required for backboxes.
 - a. Oversize flush panels sufficient to trim wall openings but not less than ½"
 - b. Size surface mount panels exactly to backbox yielding no sharp corners and chamfering edges
 - 2. Aluminum panels with labels engraved and back-filled in black
 - 3. Anodized, horizontal brushed finish
 - 4. Submit engraved sample for approval by architects.
- Y. DC Power Supplies:
 - 1. 12, 24 volt, capacity as required with 100% extra, UL (or other) listed: Condor linear, submit cut sheets.
 - 2. Provide and install in shielded metal chassis with fused LED status indicators.

- Z. UPS Uninterruptible Power Supply (Control and Amp Room)
1. Acceptable: SurgeX SU-2000-Li
 - a. Rack mounted, furnish one unit per each rack populated with the following devices:
 - 1) AVPC's
 - 2) RC's
 - 3) DSP's
 - 4) Data Switches
 - 5) Digital Media
 - b. Furnish expansion batteries as required to power AVPC's, RC's, DSP's and Data Switches for 30 minutes minimum.

PART 3 - EXECUTION

3.1 INSTALLATION

A. General:

1. The following installation requirements shall govern the design, fabrication and installation of the system(s) specified herein. In case of a discrepancy between these overall system standards and the individual equipment item specifications, the latter shall govern:
 - a. The equipment specified shall be installed according to standards of good human engineering practice and the conditions specified herein.
 - b. Workmanship on the installed systems shall be of professional quality, best commercial practice and accomplished by persons experienced in the techniques and standards of the particular industries involved.
 - c. The specifications describe required performance. The specifications with the contract drawings indicate a general design; it is the intention of the specifications that the Audio-Visual Contractor will supply from his background of experience and knowledge the necessary supporting details; for example, the implementation of specific components into functioning sub-systems.
 - d. In general, the drawings show dimensions, positions, and kind of construction. The specifications describe materials, qualities and methods. Any work called for on the drawings and not mentioned in the specifications, or vice versa, shall be performed as though fully set forth in both. In case of differences between the drawings and the specifications, the decision of the Owner's Representative shall govern. Work not particularly detailed, marked or specified, shall be construed to be the same as similar parts or areas that are detailed, marked, or specified.
2. Equipment markings shall present only needed information and be readable from the operator's normal work position. These markings shall be designed to minimize ambiguous interpretation.
3. Control panels shall be designed to reduce chances of human error and controls shall be natural and consonant with normal operator expectations.
4. All control consoles and their panel mountings shall be provided with the necessary controls, indicators and switches, etc., as outlined in the pertinent sections of this specification. The grouping of these facilities shall be in accordance with the associated drawings and shall, in all cases, be arranged to present an orderly, functional appearance. The layout of controls shall be such that priority of accessibility shall be given to those facilities which frequently require attention.
5. The total design of the system shall simplify the operator's task and insure maximum performance and reliability while minimizing possibilities for human error and providing a comfortable environment for the operator during operation.
6. At the operational level (i.e., patch panels, Audio-Visual equipment receptacle boxes, etc.) all receptacles shall be clearly marked by function and number. When there are multiples of the same function for example, a given microphone line may appear at several locations, the same label shall be shown at each location.

B. The Conduit System:

1. The category AV drawings indicate the number, type and location of the receptacle, wire and cable requirements and Equipment Room layouts, which are the responsibility of the Audio-Visual Contractor. The conduit diagrams indicate schematically the functions served by the conduit system. Also, the conduit diagrams may indicate the locations at which functions are served at several locations in the facility. See the general installation notes for additional information and requirements as shown on the category AV drawings.
2. The Electrical Contractor shall provide the conduit system shown on the category AV drawings. If the conduit installation is concurrent with the present contract, the Audio-Visual Contractor shall inspect the work at appropriate times during construction and report any discrepancies to the Architect and General Contractor in writing. The Audio-Visual Contractor shall coordinate the exact location of intermediate collector boxes behind the equipment rack(s) with the electrical contractor.
3. The Electrical Contractor shall verify continuity of all conduit as described in the category AV drawings with a yellow pull string.
4. The Audio-Visual Contractor shall be responsible for supplying any additional conduit that may be required to complete the system installation in accordance with the drawings.
5. It shall be the responsibility of the Audio-Visual Contractor to obtain the exact location of any pull boxes, "LBs" or other intermediate locations from the Electrical Contractor.
6. The Audio-Visual Contractor shall also verify that conduits are adequate for the wiring and functions specified. If the Audio-Visual System Contractor substitutes the specified wiring the Audio-Video Contractors shall bear the sole responsibility for reengineering the conduit system.
7. The Audio-Visual Contractor shall field verify all back box installation conditions on site and shall size connection panels as described below. Notify the Audio-Visual Consultant of any discrepancies between AV drawings and installation conditions.
 - a. Surface Mounted Back Boxes: Connection panels shall be sized to match the outer edges of the installed back box and shall have smooth edges.
 - b. Recessed Mounted Back Boxes: Connection panels shall be sized to overlap the outer edges of the installed back box by 1" in both horizontal and vertical directions and shall be installed tightly against the wall surface finish.
8. Each conduit shall contain wires or cable of the same signal level or the same type of circuitry only. Each separate service level designation shown on the AV conduit riser shall be run in their respective, separate conduits and all conduit landings in backboxes or equipment racks shall be grouped by service level.
9. Ground power conduits to the power system ground. Do not connect power system conduits to the racks or to the audio system ground.

C. Equipment Room(s) Arrangement:

1. The general layout for these rooms is indicated in the drawings. The Audio-Visual Contractor shall prepare and submit a detailed layout for approval by the Owner's Representative. This drawing shall include, but not be limited to, the equipment racks, the operator's console and monitoring station, the lighting system and the fire suppression/extinguishing system.
2. Maintain accessibility to the rear of the equipment racks. In the event that the equipment room is not large enough to maintain minimum rear access clearance as mandated by National Electric Code, local code requirements and herein, the equipment racks shall be mounted on 3" casters or use an extension system. If casters are used the Audio-Visual Contractor shall engineer a locking mechanism and submit it for approval by the Owner's Representative. See specification section 3.01D5 for minimum clearance information.

D. Equipment Rack Assemblies:

1. General:

- a. Equipment rack(s) shall be completely assembled, tested and programmed in the Audio-Visual Contractor's shop. No rack assembly shall be performed at the project site. After the equipment racks are tested the Audio-Visual Contractor shall notify the Owner's Representative in writing that the equipment rack assemblies are ready for observation and approval. Allow adequate time for any modifications necessary to satisfy the contract drawings and specifications.
- b. Use rear and mid rails for intermediate terminations. Maintain accessibility to the rear of the equipment.
- c. Mid rails must be used to support equipment weighing more than 50 pounds.

2. Wiring Harnesses:

- a. Equipment rack wiring shall be "Harness" style. "Point to Point" rack wiring is not acceptable. The individual wiring harnesses shall be located at the front of the equipment rack and individual pairs of cable shall be broken out around the side of the equipment to the rear where the connectors are located.
- b. Electrical service levels shall not be mixed in an individual harness. It is the intent that there will be a separate harness for each electrical service level.
- c. Great care shall be exercised to keep low level signal harnesses separated from the AC power lines and high level signal harnesses.
- d. When 3 or more equipment racks are used, interconnection between equipment racks shall be performed with multi channel cable and multi-pin connector assemblies. It is the intent that each rack shall be a complete stand-alone assembly allowing the system to be completely tested in the Audio-Visual Contractor's shop.

3. Equipment Labels:

- a. Rack-mounted equipment shall be labeled on front and back, as to function using engraved black/white laminated plastic blocks. For example: LEFT HI-FREQ AMPLIFIER or CENTER EQUALIZER
- b. Use permanent professional quality labels such as "Lamacoid" or approved equal. Stick-on strip labels such as those from Dyno, Brother or Kroy are not acceptable.
- c. The labels shall directly relate to the device names indicated on the as-built drawings.

4. Internal A/C Receptacles:

- a. Maintain grounding as shown on contract drawings and described in the herein.
- b. In general, locate all internal AC receptacles on the left side of the rack and all harnesses on the right side of the rack. In the event that there are 2 equipment racks side by side locate the A/C receptacles in the middle of the equipment racks and the wiring harnesses to the outer sides.
- c. Furnish each equipment rack with a full height AC plug strip with receptacles sufficient for powering all equipment contained with plus 20% for future expansion.
- d. The use of Waber strip style plug strips, commercial or consumer grade is strictly prohibited.
- e. All "wall-wart" style power supplies shall be firmly secured to the plug strip using 3M Dual-Lock™ recloseable fastener strips or single Ty-wraps, joined or linked ty-wraps are not permitted.
- f. Provide 1- 40 Watt lamp and pull-chain in top rear of the rack, for each equipment rack.

5. Installation:

- a. No equipment racks may be installed on site prior to prior to the following:
 - 1) The Consultant has performed the A/V Equipment Rack Observation in the A/V Contractor's Shop.

- 2) Any and all punch list items described as 'minimum to enable rack delivery to site' have been addressed, proof has been submitted to Consultant, and Consultant has approved rack delivery to site.
 - 3) Notice has been filed with the General Contractor, the Architect, and the Consultant that a 'dust-free' environment has been achieved in the project in all areas where audiovisual system equipment is to be installed. Dust-free shall be defined as follows: all floor, wall, ceiling construction, millwork, finishes (including paint), carpet, hardware, electrical, and HVAC is absolutely complete (and tested and fully operational in the case of electrical and HVAC systems) before A/V equipment racks may be delivered to the site.
- b. The equipment rack(s) shall be installed in the Equipment Room(s) in the configuration shown in the drawings. The plan shall allow for an absolute minimum of 36 inches, preferably 42 inches, of clear space measured from the front of the rack(s) and from the rear of the equipment rack(s) to any installed equipment or walls.
 - c. All stationary equipment rack(s) shall be secured to the building structure to meet seismic and code requirements.
 - d. Interconnecting multi-channel cabling shall be led laterally from equipment rack to the vertical rack member, opposite from the AC power and then run vertically, remaining as exposed and accessible as possible. Wherever corners in multi-channel cabling occur strain relief spiral covering shall be used. All cable clamps shall be non-conducting or have soft insulating covers.
 - e. Great care shall be exercised to keep low level signal lines separated from the AC power lines and high-level signal lines.
 - f. All audio field lines entering the Equipment Racks must be connected with an intermediate terminal block. Video field lines may be connected directly to the switcher or patch bays. In the event that a patch bay with an E3 or E90 connectors is used, the patch bay may serve as the terminal block. This will also facilitate the testing of the systems in the Audio-Visual Contractor's shop.
 - g. All connections of lines at terminal blocks, as well as at signal receptacles, shall be mechanically secured and then soldered. No unsoldered connections shall be permitted. Where lines approach the racks and terminal blocks they shall also be mechanically anchored at the rack, and provided with sufficient slack length to avoid strain, abrasion or wear.

E. Wiring and Cabling:

1. General:

- a. Extreme care must be taken to physically segregate and separate all high level lines from lower level lines.
- b. Control cables and power distribution wiring shall not be installed adjacent to signal cables. Power distribution cabling shall be on the opposite side from signal wiring in equipment enclosures and shall be uniformly located throughout an installation.
- c. A wall location near the racks shall be chosen and suitable suspension "fingers" provided so that all patch cords of a given type can be grouped and suspended.
- d. All wire and cable utilized in systems interconnection shall be of the flame-retardant type (FR-1 flame test).
- e. All cabling or system interconnection which passes through or into acoustically isolated areas, such as sound locks and studios, shall be suitably sealed after cable has been installed.

2. Wire Labels:

- a. During installation both ends of all wires or cables shall be clearly labeled with approved wire labels.
- b. The wire labels shall be numbered consecutively with respect to the patch bay with a leading service level designation. If there are no patch bays utilized in the system the wire labels shall be numbered consecutively with a leading service level designation.

- c. The wire labels shall not be more than 8 inches or less than 4 inches from the connector or termination at each end of the cable.
 - d. Wire labels shall utilize plastic shrink-wrap, protecting the text and ensuring they remain affixed to the wiring. Approved: Thomas and Betts or approved equal, submit sample to the Owner's Representative.
- 3. Documentation:
 - a. Maintain a careful running log of route and terminations for each cable.
 - b. A detailed wiring diagram shall be furnished with wire numbers shown as part of the as-built documentation. All spare cable shall be shown on the as-built documentation.
- 4. Cable Management:
 - a. Cabling and wiring within the Equipment Room(s), that are semi-permanent (i.e., those leading from rack to rack, rack to conduit terminus or rack to equipment locations) shall be carried not within conduit, but rather within ducts, troughs or cable trays mounted along walls or below the ceiling.
 - b. Appropriate hooks along the wall or on the ceiling will aid in running occasional or frequently changed extension cables to use position.
 - c. Cables shall be grouped and bundled by type and routed from source to termination in a uniform manner throughout all equipment housings. Care shall be taken not to break the insulation or deform the cable by harness supports. Cables shall not change relative position in a cable group throughout a cable route.
 - d. Cable support bars shall be installed to support cables in areas of dense harness breakouts such as behind patch panels, distribution amplifiers and other multiple input/output devices.
 - e. Edge protection material ("cat track") or grommets shall be installed on the edges of holes, lips of ducts or any other point where cables or harnesses cross metallic edges.
- 5. Terminations:
 - a. The Audio-Visual Contractor shall employ the latest termination practices and materials.
 - b. Signal and control cable ends shall be neatly formed, and shrinkable tubing shall be applied where necessary to secure the insulation against fraying or raveling.
 - c. Field terminations shall be made with terminal blocks.
 - d. Internal rack terminations and field terminations shall be made with terminal blocks.
 - e. Punch block terminations are not acceptable and shall not be allowed.
 - f. Coaxial connectors shall be crimp-on and then soldered. Audio and control wires shall be terminated with crimp-on lugs, and then soldered.
 - g. All bare wire shall be tinned prior to termination unless the connector manufacturer recommends otherwise.
 - h. Unused line level shields shall be individually insulated using shrinkable tubing and attached to the cable using an additional piece of shrinkable tubing.
 - i. Premade, molded cable assemblies, the sorts of which are typically supplied with consumer grade electronics are not permitted for use on this project. Only custom made and commercial grade, factory certified assemblies shall be accepted. The Consultant shall be the final judge on the acceptability of any given cable assembly.
 - j. All panel mount connectors shall be secured with Kep® style lock nuts having integral external tooth lock washers and treated with LocTite® 242-Blue thread locking compound.

F. System Grounding:

- 1. The "spider" concept, as indicated in the grounding diagram, is designed to avoid ground loops and inductive coupling.
- 2. The systems shall be hum free, stable and free of oscillation with the earth ground temporarily disconnected.

3. The earth ground shall be made at only one point in the system as indicated and shall be in accordance with National Electric Code 2002 paragraphs 250.146(D), 406.2(D) and 480.20 Exception.
4. The grounding method shall insure that the system is free of the following problems under any mode of operation:
 - a. RF oscillation, pickup and interference.
 - b. Distortion.
 - c. Crosstalk.
 - d. Signal Leakage.
 - e. Very high frequency feedback.
 - f. Audio Hum.
5. Major wiring ducts or trays in the Equipment Room(s) shall be grounded to the conduit system.
6. The equipment racks shall be isolated from, and not electrically bonded to, the building conduit system. This means that the conduit system shall not be electrically connected to the equipment racks and that the equipment racks shall be installed so that they are electrically isolated from the building structural steel. The racks shall be electrically bonded at only one point to the isolated grounding system as shown on the category AV drawings.

G. Seismic Restraints:

1. All hanging or free-standing equipment and cabinets furnished including but not limited to racks, loudspeakers, projection screens, and TV monitors shall be secured to substantial building structures. The equipment described shall resist seismic acceleration in any direction up to a limit of the greater of 1.0 G or the limit prescribed by the local governing codes.
2. Refer to the contract drawings for approved seismic restraints details.
3. Maintain electrical isolation between the equipment racks and building steel.

H. Audio System Processing Adjustments:

1. The AV Contractor shall program the DSP system to include filters adjusted such that the loudspeaker zone(s) effected by same are measured to exhibit uniform (flat) frequency response (less than +/- 3 dB) at the listening location for the frequencies the transducer is designed/intended to address. Measurements utilized for determining filter adjustments shall be made on axis with respect to a single transducer (representative of the zone) in its intended field of coverage. Loudspeaker cross-over filters shall be provided first for all actively crossed transducers per loudspeaker manufacturer's instructions. Additional filters will still be required to achieve uniform frequency response measured at the various listening locations. For loudspeaker zones of small transducers, utilize high-pass filters first and foremost and then utilize parametric EQ filters to flatten the measured response. For loudspeaker zones of large transducers, where other transducers in the system will address higher frequencies, utilize low-pass filters first and foremost and then utilize parametric EQ filters to flatten the measured response.
2. The AV Contractor shall program the DSP system to include delay settings adjusted so that the direct sound from the main loudspeaker clusters and the delay zone transducers in question arrives simultaneously at the listening plane served by the delay zone transducers. The Audio-Visual Consultant may add additional delay to address 'imaging / Haas effect preferences' as appropriate.
3. The Audio-Visual Consultant may add additional filters and delay (as required) to address 'tuning preferences', but such 'tuning preferences' shall not be considered as part of the base line requirements for determining substantial completion of the audio system. Flat frequency response and time alignment of the direct sound from the loudspeakers will be considered a base line requirement for determining substantial completion of the audio system.

I. Loudspeaker Installation:

1. Operational Requirements: The design of the loudspeaker system is governed by the functional requirements of the system and the design criteria established as a result of the functional requirements. The functional requirements for the project are based upon the programmed uses of the auditorium. The design criteria is provided below to establish the minimum performance characteristics of the main loudspeaker system.
2. Sound Output: The loudspeaker system shall provide a calculated long term RMS direct sound pressure levels of not less than 102 dB SPL on the listening plane of seating area. This figure is the calculated output of the center cluster alone or the left and right clusters together with no contribution from the reverberant response of the room. This level will be maintained +/- 3dB throughout the seating area.
3. Peak to Average Ratio: The loudspeaker system shall maintain an available peak to average sound pressure output of not less than 6 dB, i.e., the system will be capable of peak output levels of not less than 108 dB (+/-3dB) throughout the seating area.
4. Loudspeaker Coverage: The output of the loudspeaker system will not vary more than +/- 3dB throughout the entire seating area. This criterion applies for either the center cluster operating alone or both the left and right clusters operating together. The Contractor shall build in $\pm 5^\circ$ of adjustability in all axis for each rigged loudspeaker. During commissioning, the Consultant may request that the Contractor adjust the aiming of cabinets to optimize coverage. The Contractor shall undertake these changes w/o additional costs to the Project.
5. Frequency Response: overall system response 40 Hz to 18,000 Hz.
6. System Components: The individual components of the loudspeaker clusters shall be engineered to function together as an arrayed system. Individual components shall be standard off the shelf models from a single manufacturer. All high frequency horns shall be built in to cabinets: exposed horns are not acceptable. The overall response of the system will maximize consistency throughout the specified frequency response for all seats. Within the nominal coverage pattern of the loudspeaker, the frequency response shall exhibit a high degree of uniformity throughout the rated horizontal and vertical angles of coverage. Additionally, the phase interaction between the individual components comprising the clusters shall be minimized by limiting the overlapping areas of coverage between components within a single cluster.
7. Loudspeaker Cluster Footprint: The overall footprint of the individual loudspeaker clusters shall limit the size of the clusters so that they have sufficient clearance as shown on the drawings.
8. Submit loudspeaker mounting (rigging) drawings to the Architect for review after they have been approved and signed by a certified structural engineer engaged in regular practice in the Project's State.
9. All loudspeaker backcans must be secured to the building structure by qualified personnel in accordance with safe installations practices. Use suspension materials, connection fixturing and methods that are appropriate for the building structure and installation conditions. Employ a minimum 5:1 safety factor for each suspension point or greater as may be required by local code.

J. Video Projector Installation:

1. The video projector shall be converged, registered and color balanced. Obtain from the owner all scan rates and resolutions that are to be used and properly converge the projector for all possible inputs. In addition, the Audio-Visual Contractor shall optimize the projector for the following standard scan rates and resolutions:
 - a. NTSC
 - b. HDTV, 720i, 720p, 1080i, 1080p
 - c. 640x480, 60Hz.
 - d. 800 x 600, 60Hz and 72Hz.
 - e. 1024 x 768, 60Hz, 70Hz, 72Hz and 75Hz.
 - f. 1152 x 870, 75Hz.
 - g. 1280 x 1024, 60Hz, 70Hz, 72Hz and 75Hz.

- h. 1400 x 1050, 60Hz, 70Hz, 72Hz and 75Hz.
- i. 1600 x 1200, 60Hz, 70Hz, 72Hz and 75Hz.

K. Satellite Receiving Equipment Installation (as appropriate):

- 1. Installers must hold current Level 2 certification through the (SBCA) Satellite Broadcasting & Communications Association.
- 2. Follow all local & national codes governing dish installation and grounding.

3.2 SYSTEM PERFORMANCE TESTS:

A. General:

- 1. The Audio-Visual Contractor shall pre-assemble and test all systems and sub-systems in his own facility before completed assemblies are delivery to the project site.
- 2. Tests shall include but are not limited to those listed below in order to verify that the system meets all design requirements.
- 3. The Audio-Visual Contractor shall perform the initial system testing and adjustment prior to scheduling the final system acceptance tests.
- 4. The Consultant shall provide forms in electronic form for the documentation of all test results. All tests shall be fully documented and a neat copy presented for review by the Owner's Representative and inclusion in the system manual.

B. Performance Tests on Individual Components:

- 1. Perform in Audio-Visual Contractor's facility.
- 2. Verify that the manufacturer's specifications are met.
- 3. Measure and record the impedance on each driver, and verify the acoustical output and freedom from rattles and distortion of all loudspeakers.

C. Performance Tests on Completed Component Sub-assemblies:

- 1. Perform in Audio-Visual Contractor's facilities.
- 2. Before delivery of the equipment to the project site, the specialty Audio-Visual Contractor shall demonstrate to Owner's Representatives at the Audio-Visual Contractor's facilities that all sub-assemblies are operating as specified.
- 3. Verify the achievement of the specifications for each electronic component in situ, i.e., as assembled in its console, rack or other enclosure, powered by the system power supply and with all other components also activated, i.e., powered and interconnected. The magnitude and character of the threshold noise shall be observed for appearance of hum in excess of that present with individual activation, or the appearance of high frequency oscillation.
- 4. Projection equipment shall be tested to verify that the manufacturer's specifications are met after it has been incorporated into a complete subassembly.
- 5. Video equipment shall be tested to verify that its operation meets the manufacturer's specifications and EIA RS-170A after assembly into complete subsystems.

D. Performance Tests on the Complete System:

- 1. Verify that all wiring is correctly and completely installed. Verify that there are no short circuits between conductors within any cable, or from cable to cable. Verify the integrity of each conductor, i.e., that the conductor is not open circuited. In addition, the correct polarity of each connector, including those in patch panels, shall be verified and the color-coding scheme shall be recorded and included in the documentation provided to the Owner's Representative.

2. Verify that the entire system performance is in accordance with the design requirements. Specific attention is directed to the following for each system:
 - a. Projection Equipment.
 - b. Video Transports.
 - c. Video Matrix Switchers.
 - d. Remote Control Components.
 - e. Video Distribution Amplifiers.
 - f. Audio Amplifiers.
 3. The threshold noise output of the system, measured at the output of the power amplifier, must equal the input when its gain control is full on, and of the line or booster amplifier input when all channel controls are off. No hum shall be audible in the system within the noise signal, or with the inputs terminated in microphone impedance and all controls full on. No high frequency oscillation shall be observed at the system output. No audible radio signal shall be detectable in the system at any control setting. Depending upon the proximity of a local radio station, or upon the cable configuration of the system, RF oscillation or leakage may be a problem and the Audio-Visual Contractor shall be prepared to install a RF low pass filter appropriately in the system as a final remedy.
 4. Cross talk between channels shall be measured with signal equivalent to 1.0 Volts output into one channel with its gain off and the gain of each other channel varied over their full range. Maximum signal leakage at the system output must be equivalent to -70 dB re 1.0 Volt at the pre-amp output at 1 kHz, increasing to -52 dB at 8 kHz.
 5. The general performance of each loudspeaker unit in situ shall be verified by applying pink noise signal at 10.0 Volt level and verifying the specified output SPL at a distance of 1 foot. Normal undistorted sound quality shall be verified by headphone listening at the output of the calibrated system. Each loudspeaker shall also be fed with an oscillator signal at 10.0 Volt level within its intended frequency range, verifying absence or abnormal distortion of rattles due to installation.
 6. The audio system shall be adjusted as specified above in paragraph entitled "Audio System Processing Adjustments" where minimum requirements for establishing readiness for the substantial completion observation of an audio system are specified.
 7. The complete video system shall be tested in the following manner: All video outputs of the system shall conform to EIA RS-170A when typical inputs to the system are fed with a "known good signal" from a video signal generator.
- E. All optical projection system performance shall be in accordance with the following:
1. Projected images shall properly fill their respective screens to full size without "cropping" or overshoot.
 2. Projection lenses shall provide distortion free images without color fringing or aberration.
 3. Screen brightness and screen brightness ratio shall reasonably approach the theoretical value based on the projector's specified light output value with the necessary light loss corrections.
- F. Test procedures for the optical projection systems shall conform with the following basic guidelines:
1. All equipment items shall be 100% tested for correct functional operation.
- G. Test procedures for video systems shall conform to the following basic guidelines:
1. All equipment and video signal chains shall operate according to manufacturer's specifications and/or to the EIA RS-170A standard.
 2. All video monitors shall be setup and adjusted following the manufacturer's guidelines including the following (with or without blue gun only):
 - a. Black level (using the brightness control).
 - b. White level (using the contrast control).
 - c. Correct Hue.

3. All video cameras shall be setup and adjusted for the following:
 - a. Black balance.
 - b. White balance.
 - c. Range of zoom and iris function.
- H. All these tests, and any others that the Audio-Visual Contractor may wish for his own satisfaction, shall have been performed and successfully achieved before observation requested. The Owner's Representative may request repetition and demonstration during observation of certain of these tests or other critical tests if problems become apparent. If specifications are not met, further observations will be at the Audio-Visual Contractor's expense.

3.3 DEMONSTRATION AND ACCEPTANCE TESTING

A. Substantial Completion Observation:

1. The Audio-Visual Contractor shall file a written notice with the General Contractor when all of the aids to use described in paragraph above entitled "Submittals", above, have been submitted for approval, all tests described in paragraph above entitled "System Performance Tests", are complete and the test reports have been submitted for review and approval and the systems and sub-systems are ready for the Substantial Completion Observation.
2. The Consultant shall provide a checklist in electronic form for the AVC to fill out, certifying that they have completed all requisite tests and checks and have performed remedial corrections. These forms must be completed and submitted for review along with the written notice of readiness indicated above.
3. The Audio-Visual Contractor shall be prepared to demonstrate the overall system performance including but not limited to functionality, control system programming, operation, optics performance and DSP software control (where applicable). The Audio-Visual Contractor shall be prepared to demonstrate proper gain structure and that base line EQ (uniform frequency response) settings and delay filters (time alignment) have been set. In addition the Substantial Completion Observation of the systems may include repetition or demonstration of any or all of the tests described in paragraph above entitled "System Performance Tests" above or other critical tests if problems become apparent and the specifications are not met. After the Substantial Completion Observation, written notice noting whether the systems meet the criteria set forth in the General Conditions for Substantial Completion, along with a list of items for the Audio-Visual Contractor to correct shall be provided to the Audio-Visual Contractor.
4. In the event that the systems are found not to be Substantially Complete, all of the costs including fees, travel and living expenses in connection with subsequent observations or corrective work shall be borne solely by the Audio-Visual Contractor. This includes new problems that arise during the course of the subsequent observations.

B. Acceptance Observation:

1. After the systems have been certified as Substantially Complete, and the Audio-Visual Contractor has filed written notice with the General Contractor that the corrections ordered, have been completed, a Final Acceptance Observation shall be scheduled.
2. During the Final Acceptance Observation of the systems repetition or demonstration of any of the tests described in paragraph above entitled "System Performance Tests", above, or other critical tests if problems become apparent and the specifications are not met, may be requested.
3. Assist in performing final system adjustments and acceptance tests. Provide all labor, materials and tools necessary for these tests and adjustments. Provide all necessary test equipment to complete the tests.
4. Budget 24 working hours for the performance of these tests and adjustments. If final acceptance is delayed beyond this period because the installation is not in proper working order or is incomplete, the Audio-Visual Contractor shall pay for all additional time and expenses for any resultant extension or re-scheduling of the acceptance testing period.

5. Any measurements of frequency response, distortion, noise or other characteristics and any adjustments deemed necessary may be performed on any item or group of items, including re-orientation of loudspeakers, to insure optimum performance of the system.
6. In the event that the corrections have not been completed to the satisfaction of the Owner's Representative, or new problems arise at the time of the Acceptance Observation, all costs including consulting fees, travel and living expenses in connection with subsequent observations or corrective work shall be borne solely by the Audio-Visual System Contractor.

C. Acceptance:

1. After observations and tests indicate that the entire Audio-Visual system and sub systems as specified herein and indicated on the drawings are in total compliance with the drawings and specifications, a letter indicating said compliance shall be issued.
2. Acceptance of the system shall be accomplished as described in the General Conditions.
3. Final acceptance of the installation will be granted when it is clear to the Owner's Representative and the Architect that the following conditions have been met:
 - a. All fixed equipment has been furnished and installed according to the drawings and specifications.
 - b. All portable equipment has been turned over to the Owner.
 - c. All equipment and installation have been tested and shown to perform as specified.
 - d. All instruction manuals, software source code and as-built documentation have been completed and delivered to the Owner's Representative.
 - e. All wall-mounted diagrams are installed to the satisfaction of the Owner's representative.
4. The Warrantee period will begin only when all of the above listed items have been performed to the satisfaction of the Architect, Owner and Owner's Representative.

3.4 TRAINING

- A. Submit all training materials to the owner's representative for approval prior to scheduling training sessions.
- B. Provide 24 hours of hands on training practical operation of the system to the Owner's Representative. Address in the training, the general configuration of the system, basic functionality, correct operation procedures, routine maintenance and upkeep.
- C. Provide 4 hours of follow-up training within 3 months of the initial training to review aspects of the original training and provide instruction on specific troubleshooting issues the Owner's Representative raises during the training.
- D. Video tape all training sessions and provide 3 copies to the Owner on DVD-R format.

END OF SECTION

SECTION 11 52 13

PROJECTION SCREENS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY OF WORK

- A. Section includes:
- B. Related Sections include the following:
 - 1. Division 26 Section - Electrical.
 - 2. The Invitation for Bids, Instruction to Bidders and General Conditions of the contract including all Supplementary Conditions apply to all work under this section.

1.3 SCOPE

- A. Supply and install projection screen systems including all apparatus and equipment, wiring, termination, labor, and services required to provide systems as specified and shown on drawings.
- B. Supply and install any incidental equipment needed in order to meet the functional requirements stated herein and on drawings. This shall include all support and restraint for the projection screen equipment.

1.4 SCHEDULE

- A. Within thirty (14) calendar days of the receipt of the notice to proceed the Contractor shall prepare and submit for approval, in accordance with the General Conditions, a schedule which shall include, but is not limited to, the following:
 - 1. Submission of shop drawings, including proposed mounting details; samples and layouts for all items described herein.
 - 2. Start and Completion date(s) for field installation work.
 - a. Installation date(s) of all wires and cables in conduits and required cable trays.
 - b. Delivery date(s) of all systems and subsystems to the project site.
 - 3. Start and Completion date(s) for shop fabrication work.
 - 4. Completion dates for the Field Observations.
 - 5. Submission date for operating, maintenance manuals, as-built drawings, documentation and closeout materials.

1.5 SUBMITTALS

- A. All submittals shall be in accordance with the General requirements.
- B. Provide shop drawings in detailing all relevant information and mounting details.
- C. Attachment methods not covered under the general project structural mounting details shall be approved and stamped by a structural engineer currently licensed to practice in the project jurisdiction.
- D. Substitutions of equal equipment beyond the alternatives listed will be permitted only in accordance with Division 1. If a requested substitution requires a change in any of the contract drawings, a revised drawing must be submitted as part of the substitution request. The Owner, in consultation with the Audiovisual Consultant, shall be the final judge of the acceptability of substitutions.

1.6 QUALITY ASSURANCE

- A. Unless otherwise stated, all electrical, electronic and optical equipment shall be products of firms regularly engaged in the manufacture of electrical, electronic or optical equipment. The equipment shall be the latest model or type offered which meets the applicable specifications at the time of the submittal. Discontinued items replaced by newer models or versions are prohibited and should not be submitted for review.
- B. Quality of workmanship and fabrication of all equipment and components which are custom fabricated shall be comparable to professional equipment produced by specialized manufacturers of the trade involved and shall be verified by observation. Only firms having 5 years experience in all aspects of the fabrication and installation of similar systems shall be allowed to perform the work.
- C. All materials and products shall be new and of professional quality. No used materials shall be installed.
- D. The work specified herein, and in each of the allied sections, shall be accomplished by a single Contractor experienced in the design, fabrication, installation, checkout and warranty contract management of systems such as those described in each section. This Contractor shall have complete responsibility for the systems described herein and shall be the single contract point for the Architect, the Consultant and/or the Owner with respect to all work specified herein.
- E. The bidder shall, prior to the bid, in accordance with the Instruction to Bidders, submit at least the following information to verify that the bidder has the necessary experience and qualifications to perform the specified work:
 - 1. A detailed brochure describing its capabilities in terms of facilities, personnel experience background, examples of similar installations (at least two projects within the past two years), distribution arrangements with manufacturers and financial capability (including satisfaction of the project bonding requirements).
 - 2. Information identifying any and all local agents and/or subcontractors assisting in the work.
 - 3. Identify all sources of labor for all fabrication and installation throughout the duration of the project.
 - 4. Evidence of all necessary licenses and approvals to perform the specified work.
 - 5. Information on how and by whom it will fulfill the requirements of the warranty period. The Contractor shall maintain a service office with full time service personnel located within 25 miles of the project site.
 - 6. Equipment to be furnished, per Part 2, below.
 - 7. This submittal must justify in the judgment of the Consultant, the Architect, and the Owner that the Contractor has the capability to manage and install a project of this size and scope and that he is capable of the necessary business and technical arrangements for this installation and the pursuant warranty service.

1.7 DELIVERY, HANDLING & PROTECTION

- A. Do not deliver projection screens until building is enclosed and ready for screen installation.
- B. Protect screens from dust, dirt and damage during delivery, handling and installation. Additionally, after installation, protect screens from dust, dirt and damage as necessary during the completion of any Work surrounding the screen location.

1.8 WARRANTY AND SERVICE

- A. Installation warranted free of faulty workmanship.
- B. All components, including solid-state devices, warranted free of defects for a period of one year from date of final acceptance. This minimum warranty provision shall not diminish the terms of individual equipment manufacturers' warranties.
- C. Paint and exterior finishes, fuses and lamps excluded from above warranties except when damage or failure results from defective materials or workmanship covered by warranty.
- D. Provide maintenance service for a period of one year after acceptance of installation. Service to consist of at least two semiannual visits to the site for checking and adjustment of equipment.
- E. Response: Provide four (4) hour telephone warranty service, with 48-hour on-site technical response time. Provide a technician on call from 7 a.m. to 9 p.m. seven days a week for the duration of the warranty period.

PART 2 - PRODUCTS

2.1 PROJECTION SCREENS

- A. Electrically Operated, Recessed, Front-Projection Screen, Main Theater
 - 1. **Nominal 294" Diagonal; 16:9 format, Recessed, Electrically Operated, Tab-tensioned, Roll-up Front Projection Screen.**
 - 2. Acceptable Manufacturers/Models:
 - a. Stewart Filmscreen Luxus Grande or approved equal.
 - 3. Case: Aluminum and Sintra, finished with manufacturer's standard prime coat and top coat paint color coordinated with Architect.
 - 4. Motorized Roller Unit: Size and capacity recommended by screen manufacturer. Use instant reversing, gear drive motor with permanently lubricated ball bearings, automatic thermal overload protection, and limit switches to automatically stop screen in "up" and "down" positions. Stop action shall be positive to prevent coasting.
 - 5. Control: Provide networked intelligent motor control option.
 - 6. Control Cable: Provide, install, and terminate per manufacturer's recommendations control cable from switch to screen motor.
 - 7. Screen Fabric: Manufacturer's standard, opaque, seamless, flame and mildew resistant, as follows:
 - a. UltraMatte 130 Screen Material (1.3 Gain)
 - 8. Mount top of screen fabric on roller with roller lock or other pull-down limit, and bottom of fabric formed into pocket enclosing tubular steel batten.
 - 9. Screen Size: **Image size shall be 144" high by 256" wide (16:9 aspect ratio). Provide a minimum of 5" of black screen masking on the sides of the image area and 2" at the bottom. Provide 48" of black screen masking above the top extents of the image area.**

10. Contractor shall field verify mounting condition prior to ordering. Inform the Architect and Consultant immediately of any discrepancies.
 - a. Mounting Height: **21'-6" AFF**
 - b. Quantity: Furnish **1** complete units.
- B. Electrically Operated, Front-Projection Screen, Band Room
 1. Features:
 - a. **Nominal 200" Diagonal**; 16:9 format, Recessed, Electrically Operated, Tab-tensioned, Roll-up Front Projection Screen.
 - b. Furnish screen unit completely housed in an extruded aluminum case. Mount top of screen fabric to metal roller, with roller supported on brackets with self-aligning bearings. Suspend case from deck via threaded rod.
 - c. Case: Extruded aluminum, finished with manufacturer's standard white.
 - d. Motorized Roller Unit: Size and capacity recommended by screen manufacturer. Use instant reversing, gear drive motor with permanently lubricated ball bearings, automatic thermal overload protection, and limit switches to automatically stop screen in "up" and "down" positions. Stop action shall be positive to prevent coasting.
 - e. Control: Provide a 3-button low voltage remote control switch ("up", "stop" and "down") in a box with cover plate for flush wall mounting. Refer to Category AV drawings for location. Equip screen with associated (LVC) low voltage relay interface option.
 - f. Control Cable: Belden 9156. Provide, install, and terminate per manufacturer's recommendations control cable from switch to screen motor.
 - g. Screen Fabric: Manufacturer's standard, opaque, seamless, flame and mildew resistant, as follows:
 - 1) Grayhawk Screen Material (.9 Gain)
 - h. Furnish custom mounting solution to allow the screen to be easily demounted from its primary location and remounted in its secondary location. Provide fixed bracket keyhole receiving pins in both locations. Refer to contract documents for locations.
 - i. Screen Size: **Image size shall be 98" high by 174.25" wide** (16:9 aspect ratio). Provide a minimum of 5" of black screen masking on the sides of the image area and 2" at the bottom. **Provide 12" of black screen masking above the top extents of the image area.**
 - j. Contractor shall field verify mounting condition prior to ordering. Inform the Architect and Consultant immediately of any discrepancies.
 - k. Mounting Height: **15'-7" AFF**
 2. Acceptable Manufacturers/Models:
 - a. Stewart Filmscreen Luxus Medio.
- C. Electrically Operated, Front-Projection Screen, Choir Room
 1. Features:
 - a. **Nominal 147" Diagonal**; 16:9 format, Recessed, Electrically Operated, Tab-tensioned, Roll-up Front Projection Screen.
 - b. Furnish screen unit completely housed in an extruded aluminum case. Mount top of screen fabric to metal roller, with roller supported on brackets with self-aligning bearings. Suspend case from deck via threaded rod.
 - c. Case: Extruded aluminum, finished with manufacturer's standard white.

- d. Motorized Roller Unit: Size and capacity recommended by screen manufacturer. Use instant reversing, gear drive motor with permanently lubricated ball bearings, automatic thermal overload protection, and limit switches to automatically stop screen in "up" and "down" positions. Stop action shall be positive to prevent coasting.
 - e. Control: Provide a 3-button low voltage remote control switch ("up", "stop" and "down") in a box with cover plate for flush wall mounting. Refer to Category AV drawings for location. Equip screen with associated (LVC) low voltage relay interface option.
 - f. Control Cable: Belden 9156. Provide, install, and terminate per manufacturer's recommendations control cable from switch to screen motor.
 - g. Screen Fabric: Manufacturer's standard, opaque, seamless, flame and mildew resistant, as follows:
 - 1) Grayhawk Screen Material (.9 Gain)
 - h. Furnish custom mounting solution to allow the screen to be easily demounted from its primary location and remounted in its secondary location. Provide fixed bracket keyhole receiving pins in both locations. Refer to contract documents for locations.
 - i. Screen Size: **Image size shall be 72" high by 128" wide** (16:9 aspect ratio). Provide a minimum of 5" of black screen masking on the sides of the image area and 2" at the bottom. **Provide 36" of black screen masking above the top extents of the image area.**
 - j. Contractor shall field verify mounting condition prior to ordering. Inform the Architect and Consultant immediately of any discrepancies.
 - k. Mounting Height: **13'-8" AFF**
2. Acceptable Manufacturers/Models:
- a. Stewart Filmscreen Luxus.
- D. Electrically Operated, Front-Projection Screen, Drama Room
1. Features:
- a. **Nominal 147" Diagonal**; 16:9 format, Recessed, Electrically Operated, Tab-tensioned, Roll-up Front Projection Screen.
 - b. Furnish screen unit completely housed in an extruded aluminum case. Mount top of screen fabric to metal roller, with roller supported on brackets with self-aligning bearings. Suspend case from deck via threaded rod.
 - c. Case: Extruded aluminum, finished with manufacturer's standard white.
 - d. Motorized Roller Unit: Size and capacity recommended by screen manufacturer. Use instant reversing, gear drive motor with permanently lubricated ball bearings, automatic thermal overload protection, and limit switches to automatically stop screen in "up" and "down" positions. Stop action shall be positive to prevent coasting.
 - e. Control: Provide a 3-button low voltage remote control switch ("up", "stop" and "down") in a box with cover plate for flush wall mounting. Refer to Category AV drawings for location. Equip screen with associated (LVC) low voltage relay interface option.
 - f. Control Cable: Belden 9156. Provide, install, and terminate per manufacturer's recommendations control cable from switch to screen motor.
 - g. Screen Fabric: Manufacturer's standard, opaque, seamless, flame and mildew resistant, as follows:
 - 1) Grayhawk Screen Material (.9 Gain)
 - h. Furnish custom mounting solution to allow the screen to be easily demounted from its primary location and remounted in its secondary location. Provide fixed bracket keyhole receiving pins in both locations. Refer to contract documents for locations.

- i. Screen Size: **Image size shall be 72" high by 128" wide** (16:9 aspect ratio). Provide a minimum of 5" of black screen masking on the sides of the image area and 2" at the bottom. **Provide 36" of black screen masking above the top extents of the image area.**
- j. Contractor shall field verify mounting condition prior to ordering. Inform the Architect and Consultant immediately of any discrepancies.
- k. Mounting Height: **15'-6" AFF**
- 2. Acceptable Manufacturers/Models:
 - a. Stewart Filmscreen Luxus.

PART 3 - EXECUTION

3.1 INSTALLATION

- 1. Install projection screen units and accessories at locations shown, in accordance with manufacturer's instructions. Install level, plumb, secure and at proper height.
- 2. Cooperate with other trades for securing projection screen units to finished surfaces.

3.2 COORDINATION WITH ELECTRICAL DRAWINGS

- 1. Refer to Electrical drawings for service voltage, power feed. Refer to Category AV drawings for control and interlock wiring for equipment specified under this section. Assume full responsibility for the following items of work:
 - a. Review Electrical drawings and specifications to verify that electrical services provided for the front projection screens are adequate and compatible.
 - b. If additional electrical services are required over and above what is indicated on Electrical drawings and specified in Division 26, such as more control interlock conductors, larger feeder, separate 120V, control power source, include in this section the furnishing and installation of such services.
- 2. Prior to proceeding with installation of any additional electrical work, submit detailed drawings indicating exact scope of additional electrical work for review.

3.3 WORKMANSHIP

- 1. The finished installation shall be free from damage, flaws, blemishes or other defects detrimental to appearance; have doors and acoustical overlay at doors in alignment with adjacent acoustical ceiling and be uniform in plane.
- 2. Provide protection screen as required to ensure satisfactory operation and appearance at completion of project.

END OF SECTION

SECTION 11 60 01

BROADCAST, THEATER AND STAGE EQUIPMENT

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Acoustic room components including the following:
 - 1. Sound-absorbing and sound-diffusing panels.

1.2 REFERENCES

- A. American Society of Civil Engineers (ASCE):
 - 1. ASCE 7 - Minimum Design Loads for Buildings and Other Structures.
- B. ASTM International (ASTM):
 - 1. ASTM C423 - Standard Test Method for Sound Absorption and Sound Absorption Coefficients by the Reverberation Room Method.
 - 2. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials.
 - 3. ASTM E 413 - Classification for Rating Sound Transmission.
 - 4. ASTM E795 - Practices for Mounting Test Specimens during Sound Absorption Tests.
- C. Underwriter's Laboratory (UL):
 - 1. UL 723 - Test For Surface Burning Characteristics of Building Materials.

1.3 SUBMITTALS

- A. Product Data: Manufacturer's data sheets on each product to be used, including:
 - 1. Maintenance instructions and recommendations.
- B. Shop Drawings:
 - 1. Submit component and project specific installation drawings, cut sheets, and schedules showing all information necessary to fully explain the design features, appearance, function, fabrication, installation, and use of system components in all phases of operation. Submit for approval before beginning any fabrication, installation, or erection.
 - 2. Include fabrication and installation details. Distinguish between factory and field work.
 - 3. Include plans, elevations, sections, attachments and work by other trades.
 - 4. Include wiring diagrams when applicable.
 - 5. Indicate seismic bracing and fastening requirements as applicable.
- C. Verification Samples:
 - 1. Exposed Finishes and Finish Materials: Not less than 4 by 4 inches (102 by 102 mm), for each type, color, pattern, surface and material selected.

1.4 QUALITY ASSURANCE

- A. Source Limitations: Obtain all products from a single manufacturer through one source providing a comprehensive material and installation package:
- B. Manufacturer Qualifications: Minimum 5 years' experience in design and manufacturing of similar products on projects of similar size, scope and complexity, and with the production capacity to meet the construction and installation schedule.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Deliver materials in manufacturer's original unopened containers with manufacturer's labels attached. Do not deliver material until spaces to receive them are clean, dry, and ready for their installation. Ship to jobsite only after roughing-in, painting and other finishing work has been completed, installation areas are ready to accept work.
- B. Handle and install materials to avoid damage.

1.6 PROJECT CONDITIONS

- A. Environmental Limitations: Do not deliver or install materials until spaces are enclosed and weather tight, wet work in spaces is complete and dry, HVAC system is operating and maintaining ambient temperature at occupancy levels during the remainder of the construction period.
- B. Field Measurements: Verify field measurements as indicated on Shop Drawings. Where measurements are not possible, provide control dimensions and templates.
 - 1. Coordinate installation and location of blocking and supports as requested.
 - 2. Verify openings, clearances, storage requirements and other dimensions relevant to the installation and final application.
 - 3. Where applicable, coordinate locations of electrical junction boxes.
- C. Field Measurements: Verify field measurements as indicated on Shop Drawings. Where measurements are not possible, provide control dimensions and templates.
 - 1. Coordinate locations of electrical junction boxes.
- D. Ensure that products of this section are supplied to affected trades in time to prevent interruption of construction progress.

1.7 WARRANTY

- A. Special Warranty for Acoustic Room Components: Manufacturer's written warranty indicating manufacturer's intent to repair or replace panels that fail in materials or workmanship. Failures are defined to include, but are not limited to, the following:
 - 1. Fracturing or breaking of unit components which results from normal wear and tear and normal use other than vandalism.
 - 2. Warping of components not resulting from leaks, flooding, or other uncontrolled moisture or humidity.
 - 3. Failure of unit to perform acoustically in accordance with manufacturer's published data.
 - 4. Sound-Absorbing and Sound-Diffusing Panels Warranty Period: 5 years.
 - 5. Tunable Wall Panels Warranty Period: 5 years.

PART 2 PRODUCTS

2.1 MANUFACTURERS

- A. Wenger Corporation, www.wengercorp.com
- B. Kinetics Noise Control, Inc., www.kineticsnoise.com
- C. Substitutions: Under provisions of Section 01 25 13.

2.2 SOUND-ABSORBING AND SOUND-DIFFUSING PANELS

- A. Basis of Design: Provide a system of acoustical panels, as manufactured by Wenger Corporation, that absorb or diffuse sound in a configuration designed to reduce excess sound energy levels and improve sound distribution throughout the space.
- B. Performance Requirements: Provide sound absorbing and sound-diffusing panels meeting requirements with the following characteristics:
 - 1. Wall Panel Mounting Types for Acoustical Performance Characteristics according to ASTM E 795, with measurements determined according to ASTM C 423:
 - a. No air space.

- C. Convex Ceiling Diffuser Panels: Acoustically-configured, polycylindrical convex molded thermoplastic panel, 48 inch wide by 48 inch long by 8 inch deep by .125 inch (3 mm) thickness.
 - 1. Basis of Design Product: Wenger Convex Ceiling Diffuser Panels.
 - 2. Finish: Manufacturer's standard textured white.
 - 3. Ceiling Panel Mounting Method:
 - a. Lay-in ceiling grid clip. All lay-in ceiling panels include safety cable attachment to permanent ceiling grid in all four corners of ceiling panel.
 - 4. Acoustical Performance, Sound Absorption Coefficients, One-third Octave Band Center Frequency, Hz, for 48 by 48 inch by 8 inch units, Mounting Type A.
 - a. 125Hz = 0.20.
 - b. 250Hz = 0.11.
 - c. 500Hz = 0.17.
 - d. 1000Hz = 0.04.
 - e. 2000Hz = 0.09.
 - f. 4000Hz = 0.21.
- D. Fabric Facing Material: 100 percent woven plain weave polyester 2-ply, with the following characteristics:
 - 1. Light Fastness: AATCC 16, Option 3: 40 hours.
 - 2. Fastness to Crocking: AATCC 8: #4 Wet and Dry.
 - 3. Flammability: ASTM E 84, Class A or 1.
 - 4. Basis of design product: Guilford of Maine, FR-701.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Examine installation areas and mounting surfaces with Installer present, for compliance with manufacturer's installation tolerances including required clearances, floor level, location of blocking and anchoring reinforcements, and other existing conditions that may affect installation or performance.
- B. Prepare written report, endorsed by Installer, listing conditions detrimental to performance of the Work. If preparation is the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.
- C. Proceed with installation only after correction of unsatisfactory conditions.

3.2 PREPARATION

- A. Clean surfaces thoroughly prior to installation. Prepare surfaces using the methods recommended by the manufacturer for achieving the best result for the substrate under the project conditions.

3.3 INSTALLATION - GENERAL

- A. Install manufactured units in accordance with manufacturer's recommendations, approved submittals, and in proper relationship with adjacent construction.
- B. Clean exposed surfaces. Comply with manufacturer's written instructions for cleaning and touchup of minor finish damage.

3.4 INSTALLATION OF ACOUSTIC ROOM COMPONENTS

- A. Install housings utilizing manufacturer's supplied brackets and fasteners recommended for application. Adjust upper and lower limits individually after installation.

3.5 FIELD QUALITY CONTROL

- A. Inspect installed work to verify compliance with requirements.
 - 1. Verify that HVAC work and electrical work complies with manufacturer's submittals and written installation requirements.
 - 2. Perform installation and startup checks as recommended by manufacturer.
 - 3. Prepare inspection reports and submit to Architect.

3.6 CLEANING AND PROTECTION

- A. Repair or replace defective work as directed by Architect upon inspection.
- B. Clean surfaces. Touch up marred finishes, or replace damaged components that cannot be restored to factory-finished appearance. Use only materials and procedures recommended or furnished by manufacturer.
- C. Protect installed products from damage, abuse, dust, dirt, stain, or paint until completion of project. Do not permit use during construction.

END OF SECTION

SECTION 11 61 00

THEATRICAL RIGGING

PART 1 -GENERAL

1.1 SUMMARY

- A. This specification section includes the engineering, fabrication, furnishing, delivery and installation of new stage rigging equipment and drapery as specified in the 'Products' specifications and as indicated on the related rigging and drapery drawing documents for the auditorium stage.
- B. Contract Documents and General Requirements apply to the work of this Section.
- C. The General Contractor must submit the name of its selected Theatrical Rigging Contractor at the time of bid.
- D. All bidders shall fully inform themselves of the conditions under which the work is to be performed. No additional compensation shall be allowed for any labor or item the bidder could have been fully informed of prior to the bid date.
- E. While the components, quantities, and arrangements described herein and shown on the drawings indicate specific details for the realization of the stage systems, bidders may propose alternate details and components which will fulfill the functional parameters of the envisioned system. In such event, bidders shall submit a complete set of specifications and drawings, not less detailed than these and following the same general outline, together with a detailed statement indicating paragraph by paragraph wherein the equipment to be offered deviates from specifications included in this bid request. Where alternate proposals are offered they shall be submitted with the amount to be added or deducted from the base bid which is required from all bidders.

1.2 SCOPE OF WORK

- A. Work shall include the installation of all new materials and equipment necessary for the proper operation of all rigging and drapery equipment. Contractor shall furnish qualified personnel to test and adjust the equipment after installation until specified performance is attained.
- B. Preparation and submission of complete engineered shop drawings for approval by the Architect and Theatre Systems Consultant.
- C. Verification of conditions and dimensions at the job site.
- D. The adjustment and testing of the completed installation by the contractor's personnel, subject to Architect and Theatre Systems Consultant's approval.
- E. Submission of required record documents.
- F. Coordination with other affected work, trades, and inspections.
- G. Installation work includes, but is not limited to the following:
 - 1. New stage batten pipes and related wire rope hardware.
 - 2. New drapery curtains.
 - 3. New motorized winches and winch control equipment.
 - 4. New drapery curtain traveler tracks and related hardware.
 - 5. New re-mountable pipes and mounting hardware for stage catwalk lighting positions.
 - 6. New re-mountable pipes and mounting hardware for auditorium box boom lighting positions.

7. Supporting brackets, clips, drilled anchors, miscellaneous iron supports, and supplemental steel where required for installation of the work of this Section and not furnished under other Sections.
8. Safety and operational instruction signs for all rigging equipment which is installed.
9. All scaffolding, hoisting equipment, tools, etc. necessary to perform the work.

1.3 RESPONSIBILITY

- A. Thoroughly review the current Architectural, Structural, Mechanical, Electrical, and other Project related drawings prior to submitting the bid proposal.
- B. Organize and program the Work of the Section to harmonize with the work which will be performed by other contractors during the Project so that work will proceed as expeditiously as possible.
- C. Fabrication, installation, and coordination of systems and associated components specified in this Section are the contractor's responsibility. Facility structural design and engineering shall be the responsibility of the project SEOR.
- D. Comply with all applicable code requirements and the requirements of federal, state, and local authorities having jurisdiction over the design, fabrication, installation, and operation of the systems and associated components specified in this section.
- E. Take full responsibility for the proper placing and fitting of equipment and materials furnished under this Section into the structure.
- F. Design components and install equipment to fit into the structure as built.
- G. Specifications only establish criteria and do not attempt to dictate specific installation details and methods which may be necessary for the successful contractor's design; drawings related to the Work of the Section may therefore be diagrammatic.
- H. Become familiar with the building construction and finishes, access and space available for equipment, and obvious interferences requiring special attention.
- I. Carefully check and verify pertinent dimensions, sizes, loads and the appropriateness of structure supporting the proposed Work of this Section, both on the Drawings and in the field, before proceeding with any work.
- J. Provide additional structural and support members and guards as necessary for proper installation and operation of the Work of this Section.
- K. All variations from specified equipment must be approved in writing by the Architect and Theatre Systems Consultant.
- L. All rigging equipment and hardware must be of new and recent manufacture.
- M. All components utilized in the stage rigging equipment shall be specifically recommended by their manufacturer or trade organization for rigging applications. They shall be installed and used in accordance with the manufacturer's specification. All load-rated hardware must be appropriately marked and of domestic U.S. manufacture.
- N. Design and engineer equipment, devices, machinery, and systems based upon the following:
 1. Safety to personnel during operation, use, and maintenance.
 2. Adequate strength.
 3. Proper coordination of systems and elements, including impact strength, breaking strength, emergency stopping distances, acceleration and deceleration rates, and normal working stress capabilities of equipment and components.
 4. Reliability, with consideration for special or unusual requirements of the unit or installation.

- 5. Ease of maintenance.
- 6. Coordination with associated and adjacent systems provided under other Sections.
- O. Omissions: Where dimensions and loading capacities have been omitted from this specification, they are to be determined by the bidder in accordance with accepted industry standards and the guidelines in this section. In no way shall the Contractor be relieved of the primary responsibility to provide a safe, fully functional system.
- P. Insurance: In the absence of more stringent requirements, the Contractor shall maintain injury and property liability insurance coverage throughout the project's scheduled timetable, including workmen's compensation coverage for Contractor's employees. At no time throughout this project will the School District be liable for any damage, loss or personal injury claims arising out of the negligence of the Contractor.

1.4 CODES, LABELS, AND STANDARDS

- A. All rigging equipment and installation methods must conform to current CBC California Building Code rules and all local codes and ordinances.
- B. A manufacturer's label shall be conspicuously and permanently attached to each piece of rigging equipment. Chain, rope and wire rope are exempt from this requirement.
- C. Visible and permanent system capacity information shall be displayed at a location which is easily seen by the operator.
- D. Those parts of the rigging equipment which require lubrication and maintenance shall be safely and easily accessible and serviceable. The name and type of the lubricant shall be conspicuously displayed near lubrication points. Lubrication points shall be conspicuously marked.
- E. Critical instructions for the rigging equipment shall be visibly mounted within view of the operator. Such instructions shall be brief and concise.
- F. Conform to the applicable requirements of the current adopted editions of the following reference codes or standards:
 - 1. Occupational Safety and Health Act.
 - 2. Occupational Safety and Health Standards.
 - 3. California Building Code.
 - 4. Code for Welding in Building Construction.
 - 5. Life Safety Code.
 - 6. American Iron and Steel Institute (AISI).
 - 7. American National Standards Institute (ANSI).
 - 8. American Welding Society (AWS).
 - 9. United States Institute for Theatre Technology (USITT).
 - 10. Entertainment Services & Technology Association (ESTA).

1.5 QUALIFICATIONS

- A. Provide the Work of this Section under a single Contractor widely experienced in the design, manufacture, and installation of theatrical rigging equipment, hardware, and draperies of the quality and complexity specified in this Section.
- B. Contractor shall have been actively engaged in the theatrical rigging and drapery business for at least the past 5 consecutive years.

- C. Bidders must be licensed and legally qualified as a California construction contractor at the time of bidding.
- D. Maintain a competent Supervisor, acceptable to the School District and the Architect, during the entire installation. Change of Supervisor during the Project is not acceptable without prior written approval from the School and the Architect.
- E. Employ only experienced theatrical stage riggers on the Project.
- F. Employ only certified welders, if welding is required.
- G. Employ only experienced drapery sewers under the supervision of a drapery workroom Supervisor having at least 5 years experience in the production of draperies of the types specified in this Section.

1.6 SUBMITTAL DRAWINGS

- A. Shop drawings shall be a single, integrated set of drawings produced by a single company on a common title block and with consistent drafting conventions through the entire set of drawings. Dates and notations for drawing revisions shall be consistent throughout all drawings and shall be located in the same location on common title blocks.
- B. No references shall be made to "work by others" or "supply by others" for items that are part of the scope of work for this section.
- C. Shop drawing shall be submitted on minimum 24"x36" size sheets. Equipment data sheet submittals shall be on letter-size paper and when multiple items are on a single page the item being proposed shall be identified clearly by an arrow, box, or other method.
- D. Shop drawing submittals shall include the following drawings in addition to equipment data sheets:
 - 1. Cover sheet with complete index of drawings, identification of Project, Architect, General Contractor, Consultant, and complete Rigging Contractor contact information including name and phone number for Rigging Contractor's project manager.
 - 2. Stage rigging plan(s) indicating lineset placement and dimensions for all suspended rigging, operable or fixed. Minimum scale of $\frac{1}{4}" = 1'-0"$. Identify all linesets with number, function, and distance from plaster line.
 - 3. Stage rigging section indicating all linesets by type and including illustrations of curtains, lighting battens, and other elements with cross section greater than a single pipe batten. Include indications of high and low trims for all variations on operable linesets. Minimum scale of $\frac{1}{4}" = 1'-0"$. Identify all linesets with number, function, and distance from plaster line.
 - 4. Stage rigging elevations for general purpose pipe battens, lighting battens, fire curtain, operable curtains including all traveler track & pipe batten hardware, projection screen, and any other variations of manual or motorized rigging. Include batten attachment detail references for all lineset types. Minimum scale of $\frac{1}{4}" = 1'-0"$.
 - 5. Schedule(s) for stage rigging elements including batten lengths & types, arbor sizes & capacities, track types and sizes, curtain types and sizes, placement relative to a known datum reference.
 - 6. Details of all individual rigging elements including but not limited to:
 - a. Pipe battens, batten splices, all batten and arbor cable termination methods, batten marking methods.
 - b. All types of rigging blocks, counterweight arbors, counterweights, lockrail & rope lock, outrigger brackets, tee or j-bar wall details including all supports.
 - c. All fire curtain elements including curtain, smoke pocket, lattice track and counterweight arbors, supplemental steel, release equipment, and winch details.
 - d. All motorized winch details, motor and control wiring enclosures, motor and control wiring details and schematic diagrams.
 - e. Traveler tracks and related hardware, curtain fabrication instructions.

- f. Attachments of rigging elements to building structure.

1.7 PERMITS AND INSPECTIONS

- A. Furnish material and work under this Section which meets or exceeds applicable legal and code requirements.
- B. Perform tests required by the Architect, District Representative, and authorities having jurisdiction.

1.8 SAFEGUARDS AND PROTECTION

- A. Provide suitable barriers and warning signs associated with or adjacent to stage rigging and drapery installation wherever necessary for the protection or safety of workers on the Project, School's personnel, and others, both during construction and after completion of the Work of this Section. Maintain barriers and warning signs during installation of the Work of this Section.
- B. Provide guards and guides at structural edges and corners and surrounding moving equipment as necessary to prevent fouling or tearing of draperies or rigging by structure, other rigging, or personnel contacts.
- C. Protect materials and equipment from dirt and damage. Cover materials until just before the completion of the Project to prevent the adhesion of foreign matter or unintended paint.
- D. Replace damaged or defective work or material prior to final payment request.
- E. Take full responsibility for loss or injury to persons or property resulting from neglect of the above precautions.

1.9 DELIVERY AND STORAGE OF MATERIALS

- A. Contractor is responsible for scheduling and timely delivery and placement of items furnished under this Section.
- B. Deliver equipment and other material to the jobsite in crates, bundles, bags and drums.
- C. Clearly identify on each container the item name, size, and intended use.

1.10 SPARE PARTS

- A. Provide spares, spare parts and special tools for all rigging equipment if necessary for proper operation and maintenance of equipment.

1.11 OPERATIONS AND MAINTENANCE DATA

- A. Verbal Instructions: Instruct the School's designated operating personnel in the operation and maintenance of all systems.
- B. Inspections: Make a minimum of two inspections with operations personnel, within the guarantee period, at no expense to the School, to ensure all systems to be in satisfactory operating condition. Submit written report signed by operating personnel witnessing inspection to the School indicating inspection results with copies to the Architect and Theatre Systems Consultant.

1.12 COMPLETION

- A. Before operating any equipment for demonstration or test, comply with manufacturer's preparation instructions.
- B. After checkout and adjustment, the rigging systems shall be operated for approval of the School, Architect, and Theatre Systems Consultant.

- C. The contractor shall provide a minimum of four (4) hours of operations and maintenance instruction for the School's staff. This is to be coordinated with the School's schedule.
- D. If due to installation-caused matters the Architect or Theatre Systems Consultant is required to perform any follow-up checkout or inspection visits after the approved completion of the project, the Contractor shall compensate the Architect or Consultant at their standard hourly rates for all time expended.

1.13 GUARANTEE

- A. Guarantee all material, rigging equipment and work for a period of two years from written acceptance of the work, against defects of any kind.
- B. Parts Warranty: Obtain guarantees and/or warranties for factory assembled equipment and include with 'Operations and Maintenance Data.'
- C. Replacement: In the event of failure of any work, equipment, or device during the life of the guarantee, at no cost to School, repair or replace the defective work and remove, replace or restore any parts of the structure or building which may be damaged as the direct result of the defective work or in the course of making the replacement of defective work or materials. Any work, equipment or device replaced due to failure shall be guaranteed for a period of 2 years from date of replacement.
- D. The Contractor shall provide field service maintenance, at no cost to the School, within 24 hours of notification of system malfunction. This service response shall be in effect for a period of 24 months after School's acceptance of the system.

1.14 INSURANCE

- A. Provide full insurance against loss or damage during equipment shipment, storage, installation, and testing.

PART 2 -PRODUCTS

2.1 GENERAL

- A. Provide only materials which are new and of first quality.
- B. Use only load-rated hardware of domestic U.S. manufacture.
- C. Receive from the Architect approval of design, materials, and components prior to fabrication.
- D. Substitute Materials: In no case shall materials of lesser design or workmanship be deemed acceptable. Any Contractor proposing to use a substitute material or item of equipment must guarantee the suitability of the recommended substitution and provide appropriate manufacturer's literature, catalog information, cut sheets and product data sheets sufficient to permit the architect or engineer to make a meaningful and informed decision to accept the substitution. All such requests must be made at least ten days before the bid opening date. Approval of substitute equipment shall be made by addenda prior to the bid opening date.
- E. Omissions: Where dimensions and loading capacities have been omitted from this specification, they are to be determined by the bidder in accordance with accepted industry standards and the guidelines in this section. In no way shall the Contractor be relieved of the primary responsibility to provide a safe, fully functional system.
- F. All electrical equipment to be listed by Underwriters Laboratories (UL), the Electrical Testing Laboratories (ETL), or other recognized independent testing organization and bearing the organization's listing mark.
- G. Construct and install equipment so that when the equipment is operated the sound pressure levels are minimal.

2.2 PIPE BATTENS - GENERAL PURPOSE LINESETS

- A. New pipe battens shall be fabricated from full joint lengths of new 1-1/2" I.D. schedule forty black iron pipe, straightened, stripped and painted. All pipe joints shall be by means of bolted 18" internal sleeves. Threaded pipe couplings shall not be acceptable.
- B. Paint a 1-inch wide stripe white at the centerline of the pipe. Cap pipe ends using yellow hemispherical plastic or neoprene rubber bumpers.
- C. All general purpose linesets including those designated for drapery curtains and projection screens shall attach to the lift lines by means of a 1/4" plated, grade 30 proof coil trim chain wrapped one and one half turns around the top batten and attached back to the thimble at the end of the lift line with a 5/16" forged shackle. Trim chains shall be 36" long and shall be terminated at the stage end of each lift line.

2.3 HEAD BLOCKS

- A. The head blocks shall be appropriately sized to accommodate the flying linesets, 12" O.D. minimum. They shall be either a Nylatron casting or ASTM Class 30 grey iron sheave with machined grooves to match the lift line size being used. The sheave shall have tapered roller bearings, 10 gauge side plates which fully enclose the sheave, bolted side plates, six spacers between the side plates, four of which to prevent cables from escaping the sheave grooves, and equal pitch diameter on cable grooves for smooth operation. Mounting clips shall be provided for proper attachment to the existing head block. Provide tie-offs for attachment of double purchase cabling components.
- B. The housing assembly shall be designed to withstand compressive loads and to prohibit any bending or buckling of the side plates and mounting base.
- C. The mounting of the head blocks shall prevent movement of the block and loosening of the block or mounting with time under load and vibration. All bolts shall be rated for the imposed design loads and all nuts shall employ locking washers or be of a self-locking variety.
- D. In cases where head beams are not within 1-degree of being level, provide pivoting head block assemblies or method for mounting blocks to keep lift line fleet angles at 0-degrees at point where lift line touches sheave groove.

2.4 LOFT BLOCKS

- A. New loft blocks shall consist of a housing which encompasses an 8-1/2" O.D. minimum sheave with sealed precision ball bearings, a shaft which is locked against rotation in the housing, spacers which help to strengthen the housing and which prevent the cable from escaping from its groove, and provision for mounting the assembly to the supporting structure securely and accurately. All nuts shall be of a self-locking design or shall be equipped with lock washers. All nuts and bolts shall be Grade 5 minimum and sized for the imposed design loads with service factors. Mounting clips shall be properly sized for the load and mounting conditions. Clamping bolts must be properly torqued to prevent bolt loosening or block slippage.
- B. All loft blocks shall include idlers with the appropriate number of sheaves to keep lift lines between blocks from sagging.
- C. The block and associated mounting hardware shall have a minimum recommended working load of at least 500 lbs, and shall be designed for underhung usage.
- D. In cases where loft beams are not within 1-degree of being level, provide pivoting loft block assemblies or method for mounting blocks to keep lift line fleet angles at 0-degrees at point where lift line touches sheave groove.

2.5 CATWALK LIGHTING PIPES

- A. Provide and install individual segments of pipe for mounting of stage lighting fixtures outrigged from stage and auditorium lighting catwalks. Pipes to be fabricated from 1-1/2" Std. pipe. Pipes to be stripped, cleaned, and painted black prior to installation. Quantity and sizes of pipes per project drawings.

- B. Provide and install outrigger brackets and associated mounting hardware for support of horizontal lighting pipes. Outrigger brackets to be Unistrut #P2946 or equal. Provide pipe clamp for attachment of lighting pipe to outrigger brackets, Unistrut #P2558 or equal with 1/4" mounting hardware and square washers as required.
- C. Provide lengths and quantities of outrigger brackets and lighting pipes as noted in schedules on project drawings.

2.6 MOTORIZED RIGGING

- A. Furnish and install motorized winches to raise and lower the stage lighting battens.
 - 1. Winches shall mount at the catwalk level and be raised above floor level to allow access to internal hoist components.
 - 2. Winch system shall have, as a minimum, 1,400 lb. lifting capacity.
 - 3. Winch system shall provide for soft-starts and soft-stops under normal operation to prevent unnecessary impact to pipe battens and to reduce dynamic loading on the building structure. Soft starts and stops shall be accommodated via programmable solid-state ramping.
 - 4. The winch shall consist of the following major components: the gear motor and motor brake, load brake, limit switches, load sensor, slack line detector, absolute position sensors, cable drum assembly, and wire rope.
 - 5. All components shall be enclosed in a unified enclosure suitable for securing the unit to the stage wall supports when mounted vertically such that lift lines pass out the top of the unit to headblocks above.
- B. Gearmotor and brake
 - 1. The gear motor and motor brake shall be an integral unit from a single manufacturer. It shall operate on 208 Volt or 480 Volt 60 Hz, 3 phase current, voltage per contract drawings.
 - 2. The motor brake shall be integral to the gear motor and shall be capable of holding 125% of the motor full load torque.
 - 3. The motor brake shall be spring actuated to apply and hold braking force. The motor brake shall be magnetically released and held open upon actuation.

Load brake

 - 1. The rotary disk load brake shall bring the moving load to a complete stop and shall hold the load in position in the event of a mechanical failure of the motor, motor brake or gearbox.
 - 2. The load brake shall be mechanically released when the load is moving in the up direction. The load brake shall be close when the hoist has stopped. The load brake shall always be engaged when the load has stopped moving either up or down. When lowering the load the load brake shall partially disengage to allow and control descent of the batten. The load brake shall remain closed in the absence of rotational torque on the gearbox.
- D. Limit switch, load sensor, position sensor, slack line detector
 - 1. A limit switch assembly shall be mounted within the hoist enclosure for hard "normal" and "ultimate" end of travel limits. Hard end of travel limits shall be set/adjusted at the time of installation aided by an indicator light visible on the bottom panel of the hoist cover.
 - 2. A load sensor shall be built into the hoist to create a profile of the actual load on the hoist as it travels through its normal cycle. The profile may be changed by "re-training" the profiling system whenever the suspended load is changed on the batten by activating a key-switch operated training cycle on the motor controller. The load sensor shall continuously monitor the load when load sensing is turned on.
 - 3. A position sensing system shall be built into the hoist to provide accurate position information. The system shall consist of two absolute sensor types that provide accurate position information for each batten at power-up of the system. Systems that require re-homing shall not be acceptable. Incremental encoders shall not be acceptable for position readout purposes.

4. The slack line detector shall be built into the hoist. When a slack line condition in excess of 15" develops in a lift line, the slack line detector shall remove power from the hoist. The batten shall be allowed to move only in the upward direction to allow removal of the cause of the slack line fault.
- E. Wire rope drum
1. The drum shall wrap up to eight 3/16" diameter 7 x 19 galvanized aircraft (utility) wire rope lift lines up to 50' long in a compact manner on the cable drum. They shall be managed by a wire rope (cable) keeper integral to the hoist. The drum design shall prevent wire rope from tangling or crossing over itself.
- F. Local control interface
1. Provide an interface in a remote enclosure located next to the hoist. Interface shall include:
 - a. Hoist Up/Down Control.
 - b. Limit Switch override buttons (tool accessible).
 - c. Address switches.
 - d. Status LED's
 2. The local interface shall store winch historical data including:
 - a. Record of severe fault conditions with date and time stamp.
 - b. Record of E-stops, overloads, moves and power cycles.
 - c. Record of travel distance and peak loads since installation/inspection.
- G. Control system
1. The controller for all hoists shall be a singles integrated system in a single enclosure and shall include the following features:
 - a. Key operated power switch.
 - b. LCD display for feedback/operating information including error messages, positions readouts, supported load data.
 - c. Key operated motor load profile training/enable switch.
 - d. Latching motor selection buttons with rear illuminated naming tabs.
 - e. Rear illuminated hold-to-operate (dead-man) up and down operation buttons.
 - f. Dedicated E-stop button.
 - g. Outlet for wired remote.
 - h. Soft start/stop options for each hoist.
 2. Controller shall be mounted in a surface mount enclosure with a locking door.
 3. Provide a wired pendant controller with 30' of flexible cord for connection to control system and ability to operate any hoists controlled by the system.
- H. Basis of design.
1. Winch: E.T.C. EXO #P1400G
 2. Controller: E.T.C. Quicktouch #QT8
 3. Other winch systems contingent on pre-approval.

2.7 CABLE FITTINGS

- A. Cable clips when used shall conform to wire rope manufacturer's recommendations as to size, number, and method of installation. Clips shall be drop forged Crosby or approved equal. Under no circumstances may malleable cable clips be used in suspension or lifting lines.

- B. Swaged sleeve fittings shall be copper Nicopress. Swaged fittings shall be installed per the fitting manufacturer's instructions, using the appropriate tools, and checked with a 'Go - No Go' gauge.
- C. Eyes shall be formed over heavy pattern, galvanized wire rope thimbles of correct sizes.
- D. Turnbuckles shall be drop forged and galvanized. Turnbuckles shall be moused after adjustment to prevent loosening.

2.8 TRIM CHAINS

- A. Trim chains shall be 36" long, made of 1/4" plated, grade 30 Proof Coil chain. Connection between the end link and the lifting cable shall be made with a thimble and copper Nicopress sleeve. Chains shall be wrapped one and one half turns around the batten and attached back to the thimble at the end of the lift line with a 5/16" forged shackle. Adjustment is made by connecting the shackle into a link along the return side of the chain.
- B. Trim chains shall have a recommended working load of at least 750 lbs.

2.9 LIFT CABLES

- A. All lift cables shall be 7 x 19 construction, galvanized aircraft cable, sized as required, and with breaking strengths as follows:
 - 1. 1/8" diameter - 2,000 pounds
 - 2. 3/16" diameter - 4,200 pounds
 - 3. 1/4" diameter - 7,000 pounds
 - 4. 5/16" diameter - 9,800 pounds
 - 5. 3/8" diameter - 14,400 pounds
- B. Damaged or deformed cable shall not be used. All wire rope rigging shall be installed so as to prevent abrasion of the wire rope against any part of the building construction or other equipment.

2.10 BLACK BOX PIPE GRID

- A. Provide pipe grid in black box space constructed from overlapping sections of 1-1/2" schedule 40 steel pipe. Pipe joints shall be by means of bolted 18" internal sleeves, threaded couplings shall not be acceptable.
- B. Utilize cross grid connectors at all pipe intersections for assembling the pipe grid. Connector to consist of two formed 1/8" steel plates that clamp 1-1/2" schedule 40 steel pipes at right angles. The two halves of the clamps shall be connected via 3/8" grade 5 bolts and nuts. Connectors shall be JR Clancy #015-100 or approved equal.
- C. Attach the pipe grid to wall at a minimum of two sides. Support of pipe grid to structure above and size and extent of grid shall be per project drawings.

2.11 TRAVELER TRACKS FOR DRAPERY CURTAINS

- A. Traveler tracks shall be heavy-duty, manually operated, bi-parting, straight, with all necessary accessories for operation including end stop and mounting brackets for installation to stage batten pipes.
- B. Track channels shall be continuous 2-5/8" by 2-3/4" (minimum size) 14-gauge steel up to 24' long. Track shall be supplied with sufficient hanger clamps for support at a maximum of 6'-0" O.C.
- C. Carriers shall be spaced on 12" centers and shall be urethane-tired, sealed ball bearing assemblies. Supply heavy duty hook, swivel and 6" trim chain for curtain attachment. A rubber bumper shall be attached to each carrier to reduce noise.

- D. Single end pulley, double end pulley and adjustable floor block to utilize minimum 6" diameter nylatron sheaves with sealed ball bearings.
- E. Bi-parting tracks shall be provided with a stretch resistant 3/8" O.D. operating line.
- F. Provide an adjustable floor block with a minimum 6" diameter sheave and sand bag to maintain tension in operating line for each traveler track pull line. Sheave to be machined for 1/2" diameter operating line. Floor block to be H&H #643 or approved equal.
- G. Traveler track system shall be H&H Specialties #418S-complete or approved equal.

2.12 DRAPERY CURTAINS

- A. Submit two samples of all specially dyed, standard mill dyed, and natural fabrics to be used for drapery curtains under this section to the Architect and obtain his written approval thereof prior to dyeing or fabrication. Each sample of fabric shall be a minimum of 2 feet square and clearly marked to designate its intended use.
- B. Permanently flameproof all draperies using the immersion process, unless fabric is inherently flameproof. Draperies shall meet the standards of NFPA 701 and CFC section 806 as well as any others which may be required by authorities having jurisdiction. All draperies shall meet the flame propagation performance criteria of CA. code of regulations, Title 19, Division 1, & CBC 410.3.6. Provide three copies of Certificates of Flameproofing treatment to the Architect for distribution to the School and Fire Department Officials.
- C. Labeling of flameproof treated fabrics to include, but not limited to, the following information:
 - 1. Name and address of flameproofing.
 - 2. Date of flameproofing.
 - 3. Type of flameproofing compound.
 - 4. Manufacturer of flameproofing compound.
 - 5. Trade name.
 - 6. Age of compound at time of flameproofing for each drapery.
- D. The drapery curtains shall be fabricated per the following methods:
 - 1. Turn top of all fabric and unless otherwise noted, attach to 3" wide, heavy synthetic webbing with a minimum of three rows of stitching. Where fullness is specified, pleat and sew to web.
 - 2. Hem bottom of each piece scheduled for bottom chain around 6" canvas pocket having bottom 3" above bottom of hem. Insert #8 plastic-coated or galvanized jack-chain and stitch in place to prevent bunching.
 - 3. Hem the sides of all curtain and drapes 4" unless specified otherwise.
 - 4. Install brass grommets 12" on center in webbing unless otherwise specified.
 - 5. Make seams straight, without puckers or wrinkles. Clip selvages 6" on center.
 - 6. Where specified, attach lining fabric to top web and with twill tape (at each lining seam) sewed to top of bottom hem to prevent billowing.
 - 7. Finished dimension of curtain drapery pieces refer to the piece in its normal hanging position, after all chains or stiffening pipes have been added, and the piece is in its "working" condition.
 - 8. Provide a test strip of fabric for filed flame tests attached to the rear of each curtain.

9. Label all curtains by marking the centerline of each leg and border at the rear of the top webbing by stitching a vertical piece of red twill tape 8" long by 3/4" wide so that the top end of the tape is level with the top of the webbing and always on the drape. Identify each border and full stage drop with labels approximately 3" by 4" attached to rear of piece at left and right bottom ends, left and right top ends (on web). Attach one label each to bottom and top (on web) ends for legs and traveler curtains, alternate left and right to correspond to offstage edge of curtains. Label shall be white cloth with indelible markings designating the finished dimensions in feet and inches.
- E. The main (house, or act) curtain shall be fabricated from a synthetic inherently flame-retardant fabric, KM Fabrics Prestige 25 oz. or approved equal, fabricated from 54" wide bolts of fabric, standard mill-dyed color selected by the Architect. The lining shall be opaque, natural cotton denim. The velour pile direction shall be UP.
1. Provide 4' turnback of face fabric at onstage and offstage sides. Sew vertical velour strips with rolled seams, 1" wide at bottom of curtain alternating 2 feet and 3 feet long at 12" on center. Attach harness snaps, double riveted through the webbing and additional backing material if required so that the snap will not separate from the webbing under a load of 35 pounds. Bottom hem 9".
 2. A finished sample of the front curtain, hemmed 9" on the bottom and 4" top and sides, shall be submitted to the Architect for review and written approval prior to fabrication of the curtain. The sample shall be a minimum of 4 feet wide by 2 feet high.
 3. The main curtain shall have 75% fullness.
 4. Submit sample line card with available color options to Architect & Theatre Systems Consultant at time of 1st submittal to allow Architect to select curtain color.
- F. Black masking legs shall be fabricated from a synthetic inherently flame-retardant fabric, Milliken Encore 22 oz. or approved equal, fabricated from 64" wide bolts of fabric, black. The velour pile direction shall be DOWN.
1. Black cotton twill ties 3'-0" long shall be provided, one for each grommet plus 5% spares.
 2. The masking legs shall have 50% fullness.
 3. Each masking leg shall be provided with #8 plastic coated or galvanized jack chains and stitched into place to prevent bunching.
- G. Black masking borders shall be fabricated from a synthetic inherently flame-retardant fabric, Milliken Encore 22 oz. or approved equal, fabricated from 64" wide bolts of fabric, black. The velour pile direction shall be DOWN.
1. Black cotton twill ties 3'-0" long shall be provided, one for each grommet plus 5% spares.
 2. The masking borders shall have 0% fullness.
 3. The bottom shall include a 4" pipe pocket that shall hold a 1/2" I.D. pipe batten 2" above the bottom of the curtain.
 4. Each border shall be provided with a 1/2" schedule 40 pipe, threaded and with couplers for the bottom pipe pocket, length as necessary to run full length width of curtain.
- H. The midstage and upstage black traveler curtains and the backing drape curtain shall be constructed the same as the main front curtain with the following exceptions:
1. Fabric shall be synthetic inherently flame-retardant, Milliken Encore 22 oz. or approved equal, fabricated from 64" wide bolts of fabric, black.
 2. Provide 2' turnback of face fabric. The curtains shall be installed so the turnback is at onstage edge of each panel.
 3. Curtains shall not be lined.
 4. The black traveler curtains shall have 50% fullness.
 5. The velour pile direction shall be DOWN

- I. The cyclorama backdrop shall be seamless unbleached natural muslin. End hems shall be 1". The bottom hem shall be 6". The bottom shall include a 6" pipe pocket that shall hold a 1/2" I.D. pipe batten 2" above the bottom of the curtain.
 - 1. Provide 1/2" schedule 40 pipe, threaded and with couplers for the bottom pocket of the backdrop cyc, length as necessary to run full length width of curtain.
- J. The FOH catwalk masking curtains shall be constructed similar to the border curtains but without a pipe pocket and with chain sewn into the bottom hem. Curtains shall be fabricated from a synthetic inherently flame-retardant fabric, Milliken Encore 15 oz. or approved equal. Catwalk masking curtains shall be sewn with nap DOWN.

2.13 BOX BOOM LIGHTING PIPES

- A. Provide and install horizontal box boom pipes at box boom openings in auditorium for mounting of stage lighting fixtures. Pipes to be fabricated from 1-1/2" Std. pipe. Pipes to be stripped, cleaned, and painted black prior to installation. Quantity and sizes of pipes per project drawings.
- B. Provide Rota-lock cross clamps for securing horizontal box boom pipes to vertical pipes. Confirm size of rota-lock and horizontal pipes to be compatible with vertical pipes before supply of equipment. Rota-locks to be Alvin Industrial Supply AIS 79-8 or approved equal.

PART 3 -EXECUTION

3.1 GENERAL REQUIREMENTS

- A. Examine all the drawings and the specifications, review all architectural and structural drawings, and include all necessary allowances or contingencies in bid proposal.
- B. Resolve all conflicts with code requirements, site conditions and the work of other trades.
- C. Before beginning installation, verify that approved shop drawings reflect actual field conditions and shop drawings to the Architect in writing.
- D. Provide supervision and labor necessary for the complete functioning installation of the Work of this Section.
- E. Coordinate the Work of this Section with the work of others.
- F. Avoid interferences with piping, equipment, architectural, electrical, and structural work.
- G. When interferences develop, Architect or designated representative will decide which equipment or installation must be relocated.
- H. Examine construction which affects the Work of this Section to ensure that everything is in proper condition to receive the work before beginning installation of any of the Work of this Section.
- I. Verify pertinent dimensions and sizes and the appropriateness of supporting structure and devices.
- J. Prior to installation, notify the Architect in writing of difficulties, deficiencies, or conflicts which may prevent proper installation of the Work of this Section. Failure to do so constitutes acceptance of construction as suitable to receive the Work of this Section.
- K. Request interpretations of errors or conflicts discovered in the Drawings or Specifications as necessary to accomplish the purpose of the Drawings and Specifications. Furnish and install items necessary to implement the interpretation of the Drawings and Specifications to the satisfaction of the Architect and School without additional expense.

- L. Cut no beams girders, columns, or other structural members unless specifically shown on the drawing documents and approved in writing by the Architect.
- M. If necessary, patch around cuts to match adjacent, uncut construction as directed by, and in a manner acceptable to the Architect.
- N. Clean structural steel items of rust, scale, and other foreign matter by grinding, if necessary.
- O. Contractor is responsible for repair of work or cutting of walls, floors, or other parts of the building due to contractor's neglect.
- P. Repair of work or parts of the building due to contractor's neglect are this contractor's responsibility.
- Q. Paint exposed metal furnished under this Section which is not factory finished or specified to have other than a painted finish.
- R. Touch-up paint, field connections, welds, and abraded surfaces after erection as necessary.
- S. Trim rigging sets and draperies before application for final payment.
- T. Retrim rigging and draperies at a time acceptable to the School, at least 60 days after initial final trim.
- U. Maintain the premises in a clean and orderly condition at all times. Clean up and from time to time during construction, remove all packing material and rubbish resulting from the Work of this Section from the jobsite.
- V. Remove all tools, equipment, unused material, and rubbish from the jobsite upon completion of the project.

3.2 DRAPERY CURTAINS

- A. Install on battens, tracks or other locations as shown on Project drawings or specified herein.
- B. Attach drapery curtains to traverse track carrier with harness snaps or S-hooks, unless noted otherwise.
- C. Attach drapery curtains to pipe battens with cloth ties.
- D. Insert 1/2" schedule 40 pipe in curtain bottom hems and adjust for smooth uniform surface for the following types of curtains:
 - 1. Black Masking Borders
 - 2. And as noted on Theatre Systems Consultant's Drawings
- E. Install all soft goods plumb, straight, and without puckers.
- F. After initial installation and at least 60 days of hanging, readjust traverse curtains and backdrop cyc so that fabric is plumb and straight with bottom hem at uniform height above floor.

3.3 DRAPERY CURTAIN TRAVERSE TRACKS

- A. Install tracks at locations shown on drawings and support as necessary for proper operation. Support operating line as necessary to prevent sag.
- B. Adjust position of tracks and curtains to part at stage centerline and travel symmetrically to full open. Provide stop rope between offstage ends of curtain and end of track to prevent excessive onstage travel of curtains yet permit full use of track stacking space.

3.4 APPROVED RIGGING CONTRACTORS

A. The Theatrical Rigging Contractor shall be one of the following accepted firms:

1. Stagecraft Industries
5051 North Lagoon Avenue
Portland, OR. 97217
503-286-1600
2. Protech Theatrical
3431 North Bruce Street
North Las Vegas, NV 89030
702-639-0290
3. JR Clancy
7041 Interstate Island Road
Syracuse, NY. 13209-9713
315-451-3440
4. LA ProPoint
10870 La Tuna Canyon
Sun Valley, CA 91352
818-767-6800
5. LVH Entertainment Systems
3865 Medford Street
Los Angeles, CA 90063
805-278-4584

B. Other contractors seeking acceptance must meet the qualifications listed below and must submit the following materials at least 2 weeks prior to the bid opening date. Approval of contractors will be by addenda. Failure to submit any of the required information will automatically disqualify the contractor from consideration of approval.

1. Being a dealer for any of the manufacturers of equipment noted in this specification section does not constitute acceptance as an approved contractor. Only those contractors specifically mentioned as pre-approved will be accepted without substitution approval.
2. The Rigging Contractor:
 - a. Shall have been a rigging manufacturer or have been an authorized representative or dealer of the manufacturer for a minimum of five years.
 - b. Shall have been in business for a continuous period of at least ten years.
 - c. Shall have completed at least ten installations of this type and scope within the past five years.
3. Submit a list of ten equivalent installations completed within the last five years including:
 - a. Name and address of project including date of completion and monetary value of contract.
 - b. Name and telephone number of Owner & Architect. Name of General Contractor or contract holder and Theatre Consultant (if applicable).
 - c. Listing of equipment supplied and installed including quantities of major systems or component.
4. A brief written description of the contractor's operation including facilities, financial capabilities, bonding capacity, and experience of key personnel.
5. The Architect shall be the final judge of the suitability of experience.

3.5 RIGGING HARDWARE

- A. H & H Specialties, Industry, CA
- B. J.R. Clancy / Wenger Corporation / Secoa, Owatonna, MN
- C. ProTech, Las Vegas, NV

3.6 DRAPERY CURTAIN FABRICS

- A. Milliken, Spartanburg, SC
- B. KM Fabrics, Inc, Greenville, SC
- C. J.B. Martin, Leesville, SC

END OF SECTION

SECTION 11 66 23
GYMNASIUM EQUIPMENT

1. PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Gymnasium floor game sockets.
- B. Gymnasium wall padding.
- C. Overhead - Supported basketball backstops.
- D. Volleyball equipment.
- E. Badminton equipment.
- F. Mat movers system.
- G. Equipment Control System

1.2 REFERENCES

- A. ASTM E84 - Surface Burning Characteristics of Building Materials.
- B. ASTM F2440 - Standard Specification for Indoor Wall / Feature Padding.
- C. AWS D1.1 - Structural Welding Code - Steel.
- D. CBC - California Building Code, (CCR) California Code of Regulations, Title 24, Part 2.
- E. NEMA - National Electrical Manufacturers Association.
- F. NFPA 701 - National Fire Protection Agency, Standard Methods of Fire Tests for Flame Propagation of Textiles and Films.
- G. U L - Underwriters Laboratories, Inc.
- H. NFSHA - National Federation of State High Schools Association.

1.3 DESIGN REQUIREMENTS (For manufacturers not Listed as "Basis of Design")

- A. Design gymnasium equipment including backstops, masts, backboards, and goals to meet NFHS requirements and the following:
 - 1. Withstand loads without damage to backstop.
 - 2. Transfer loads to building structural frame and walls to prevent overloading and damage to building.
 - 3. Seismic Loads: Design and size components to withstand seismic loads and sway displacement as calculated in accordance with the CBC - California Building Code, (CCR) California Code of Regulations, Title 24, Part 2.

1.4 SUBMITTALS

- A. Submit product data and manufacturer's installation instructions for each item under provisions of Section 01 33 00.
- B. Submit samples of wall padding under provisions of Section 01 33 00.
- C. Submit two samples 6 x 6 inches in size of wall padding vinyl covering.
- D. Submit structural design data signed and sealed by a qualified professional engineer licensed in the State of California for attachment of gymnasium equipment to structure for any "acceptable manufacturer" not listed as basis of design. This design data must be submitted to DSA and will be required to be approved by DSA prior to fabrication.

1.5 REGULATORY REQUIREMENTS

- A. Conform to CCR, Title 24, Part 2.
- B. Do not install gymnasium equipment until detailed plans, specifications, and engineering calculations have been accepted and signed by the Architect or Structural Engineer in general charge of design and signed by a California registered Architect or professional engineer who has been delegated responsibility covering the work shown on a particular plan or specification and approved by the Division of the State Architect.
- C. Fire Hazard Classification: Vinyl fabric mat covering shall be listed as being flame retardant by the California State Fire Marshall according to Federal Standard 191, Method 5903 and shall have a flame spread index of 25 or less and a smoke development rating of 450 or less when tested in accordance with ASTM E84.

1.6 OPERATION AND MAINTENANCE DATA

- A. Submit operation and maintenance data under provisions of Section 01 77 00.
- B. Include description and method of normal and emergency operation, complete catalog with replacement parts and schematic wiring diagrams of installed electrical components and control systems.

1.7 QUALITY ASSURANCE

- A. Products Requiring Electrical Connections: Listed and classified by U.L.
- B. Perform welding in accordance with AWS D1.1.

1.8 PROJECT CONDITIONS

- A. Verify position and elevation of floor inserts and layout of gymnasium equipment.
- B. Verify field measurements prior to fabrication.

1.9 COORDINATION

- A. Coordinate work under provisions of Section 01 31 00.
- B. Coordinate installation of floor inserts with finished flooring, court layout, and game lines.
- C. Coordinate installation and layout of overhead and wall supported gymnasium equipment with court layout and other construction including light fixtures, HVAC equipment, fire alarm and suppression systems, and public address systems.

1.10 WARRANTY

- A. Provide five year warranty under the provisions of Section 01 77 00.
- B. Provide manufacturers standard form of warranty to repair or replace components of gymnasium equipment that fail in workmanship and materials.

1.11 EXTRA MATERIALS

- A. Submit maintenance materials under provisions of Section 01 77 00.
- B. Provide one replacement net for each backstop.
- C. Provide replacement wall padding equal to two percent of the total number of wall pads installed.

2. PART 2 PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

- A. ADP Lemco, Inc., www.adplemco.com
- B. Draper, Inc., www.draperinc.com
- C. Jaypro Sports, Inc., www.jaypro.com
- D. Porter Athletic Equipment Co., www.porter-ath.com.

- E. Sports Specialties, www.sportsspecialties.com
- F. Substitutions: Under provisions of Section 01 25 13.

2.2 EQUIPMENT

- A. Gymnasium Floor Game Sockets: Porter Co., sleeper type floor anchors. Model No. 00249-000.

- B. GYMNASIUM WALL PADDING

- 1. Wall Padding: Porter Model 5701XX SuperSafe Flame Retardant Foam; No Nailing Margins or equivalent.
 - (a) Wall Pad Dimensions: 2 FT 0 IN Wide by 8 FT 0 IN High
 - (b) Foam: 2 in Thick, Flame Rated Foam
 - (c) Interior Foam: Bonded to 7/16 inch oriented strand wood board to minimize warping.
 - (d) Panel shall meet the minimum ASTM F2440 standard specification.
 - (e) Entire Pad Assembly shall meet the requirements of NFPA 101 Life Safety Code Passing NFPA 286. ASTM E84 test is not considered equal.
 - (f) Entire pad assembly shall meet the criteria set forth in the International Building Code when tested in accordance with NFPA 286.
 - (g) Entire Face of Panel: Shall be upholstered in 19-ounce, fire-retardant, high-tensile, vinyl-coated polyester fabric material. Color/s to be selected by Architect from manufacturer's full range.
 - (h) Cover material shall be designated as flame resistant in accordance with NFPA 701, and the State of California.
 - (i) Cover Material Tear Strength: 100 psi.
 - (j) Cover material Properties: Mildew resistant, rot resistant, with infection-combating fungicide.
 - (k) Cover shall be folded and securely stapled to backside of the OSB.
 - (l) Wall Pads to be attached with concealed stainless steel z-clips.

- C. OVERHEAD-SUPPORTED BASKETBALL BACKSTOPS (950): Quantity 16 - Basis of design Porter Athletic Equipment Co.

- 1. Basketball Backstops: Model 90950000 Forward Fold Front Braced Bent Mast overhead-supported basketball backstop.
 - (a) Frame: Fully welded, vertical front frame assembly consisting of main center mast of 6-5/8 inch O.D. heavy-wall structural steel tube with diagonal side sway braces of 2-1/2 inch rectangular steel tube. Bolt-together frames are not acceptable.
 - (b) Structure: Supported by 3-1/2 inch O.D. pipe or tube anchored to overhead framing members with heavy formed-steel support fittings. Fittings must be capable of supporting load exceeding 10,000 lbs with sufficient attachment points and meeting safety factor of 60 to 1. Furnish certified test results with submittals.
 - (c) Goals: Mount directly through backboard and into heavy structural steel weldment Center-Strut, clamped to vertical 6-5/8-inch O.D. center support to eliminate strain on backboard, should player hang on front-mounted goal and to be in compliance with NCAA and NFHS requirements.
 - (d) Pipe Ends: Cap when exposed.
 - (e) Finish: Metal Parts, Pipes, and Fittings shall be powder coated, color to be selected by architect from manufacturer's full range.
 - (f) Attachments: Clamping devices used in attaching backboards and other components shall be of saddle clamp design providing uniform clamping force around mast, Clamps that provide non-uniform clamping will not be considered equal.

- (g) Safety Indicator Clamp Required: Mast Attachment Indicator must be capable of supporting backboard and all weight attached to the mast with a minimum safety factor of 4, with visible indication if indicator clamp is supporting weight or if any attachments have moved.
 - (h) Frame Hangers: Tested to 20,000 pounds maximum breaking point to achieve safety factor of 50 to 1. Furnish certified test results with submittals. Minimum of 2-inches of adjustability for precise plumbing of backstop.
 - (i) Frame Hangers: Offset minimum of 1-1/2 inches from center line of main center mast to properly weight lock unit in playing position.
 - (j) Brace: Operate with 1-7/8-inch O.D. brace with folding mechanism that locks backboard in playing position with internal torsion spring that must be mechanically disengaged by the hoist cable.
 - (k) Warranty: 25 Year limited warranty on backstop structure.
2. Winch System: Model 712- 3/4 HP Electric Winch
- (a) Hoist Cable: Of sufficient length to each backstop. 1/4-inch diameter 7x19 galvanized aircraft-type cable, minimum of 7,000 pounds ultimate.
 - (b) Drum: Will hold 41ft of cable on a single layer. The top speed of the cable is 14.3 ft. /min.
 - (c) Swivel Pulleys: 4-inch diameter cast iron pulley sheave with maintenance-free, oil-impregnated bearing for proper hoist cable routing to winch.
 - (d) Pulley Assembly and Attachment to 3-1/2-Inch O.D. Support Structure: Rated at minimum 9,000-pound load rating. Furnish certified test results with submittals.
 - (e) Hold units at any position when raising or lowering.
 - (f) Saf Strap: Provide speed sensitive automatic lock designed to engage in the event of an over-speed occurrence. Must be able to withstand test using 1750 lb. fall weight. Must be able to provide independent lab test results. Capable of being automatically reset without the use of poles, ropes, levers, or buttons.
 - (g) Warranty: 5 year limited warranty.
3. Basketball Backboards: Model 208- Rectangular Glass Backboard
- (a) Backboards: 2-5/16-inch thick frame, 72 inches by 42 inches, 1/2-inch tempered plate glass cushioned in fully welded, unitized steel-tubing frame.
 - (b) Perimeter: Glare-free aluminum.
 - (c) Standard White Borders and Target Area: Fired into glass permanently.
 - (d) Warranty: Limited lifetime warranty against breakage when installed on Porter Center-Strut support systems.
4. Basketball Backboard Padding: Model 00326999- Bolt-on Edge Pads
- (a) Provide for each rectangular glass backboard, along bottom of backboard and up 15 inches on each side, meeting NCAA, NFHS, NBA, and FIBA rules.
 - (b) Pads: 2-inch thick, molded from 9-pound density polyurethane foam with integral skin. Color to be selected by architect from manufacturer's full range.
5. Basketball Goals: Model 236054 Ultra-Flex II goal
- (a) Goal: Positive-lock, pressure-release mechanism which is preset to provide rebound characteristics identical to those of a non-movable ring. Spring-loaded to automatically and instantaneously return to playing position.
 - (b) Pressure Release Mechanism: Factory preset with capability for field adjustment to comply with NCAA recommendation to test goals for rebound elasticity.
 - (c) Breakaway goals with plastic-pivot bearings are not acceptable.

- (d) Rim: 18 inch diameter, made with 5/8 inch diameter cold drawn, alloy steel, rigidly braced by 3/16-inch thick steel formed and die-cut steel brace welded in position on underside of rim for maximum support. Inside diameter of ring shall be positioned 6" from face of backboard by a heavy formed steel, hinged type housing with a removable cover to conceal mounting bolts and spring mechanisms of goal, and also protect against finger entrapment.
- (e) Goal Mounting Plate: Shall be provided with hardware and a 5" x 4" mounting hole pattern for front mounting on standard glass, wood and fiberglass backboards and is also compatible for use with all Center-Strut direct mount type support frames.
- (f) Net Attachment: Tube-tie net attachment system on rim to eliminate conventional wire-formed net locks.
- (g) Finish: Official orange powder coated.
- (h) Warranty: 5 year limited warranty when installed on Porter Center-Strut support systems.

D. Volleyball Equipment:

1. Equipment: Quantity (2) Porter Athletic Equipment Co., Model 19610XX Powr-Rib II Volleyball Package with one pair no. 1971 3-1/2 inch O.D. Extruded aluminum posts with integral heavy duty sheave and Power-winch tensioner, clear anodized finish. One pair of No. 6693XX protective pads; one each No. 2295 Universal Volleyball net, one pair No. 2297 net antennae & boundary markers; No. 669100 Judge's stand with No. 6693XX set of protective pads. Color to be selected by architect from full range of colors.

Quantity (2) Powr-Rib II Model No. 1972 3-1/2 inch O.D. intermediate extruded aluminum posts with integral heavy duty sheave and power-winch tensioner, clear anodized finish. One each No. 7171XX protective pads; (2) No. 2295 Universal volleyball nets; and (2) pairs of No. 2297 net antennae & boundary markers. All posts to include infinite height adjustment capability and height labels. Provide (quantity 6) No. 00870-200 gymnasium floor sleeves with 5" dia. brass plated cover plate.

2. Transporter: Quantity (2) Model No. 00956-100 portable transporter with swivel caster wheels.

E. BADMINTON EQUIPMENT:

1. Badminton Standards: Quantity (6) Model No. 764100 2-3/8 inch O.D. end standards with special top caps having machined grooves for rope in top hem to meet competition requirements; Powder coated finish. Color to be selected by architect from full range of colors.
2. Badminton Nets: Quantity (3) Model No. 2236110 Badminton Nets.
 - (a) 20 feet by 20 inches, 6-thread brown-treated netting, with 1-inch openings, white vinyl top binding, grommets, and tie cords.
 - (b) Net furnished with attachment cords of sufficient length for use on volleyball standards with 36 foot centers.
3. Floor Sleeves and cover plates: Quantity (6)
 - (a) 2-7/8 inch O.D. heavy-wall steel tubing, extending 9 inches into concrete footing.
 - (b) 5 inch brass plated cover plate with 1/2 inch thick recessed collar and cork gasket.
 - (c) Swivel Retainer Pin in Collar: Prevent theft.
 - (d) Cover removal key.

F. MAT MOVERS: Quantity 3 - Basis of design Porter Athletic Equipment Co.

1. Gymnasium Mat Mover (Room C101): Model 91107002 Ceiling Mounted Stationary Mat Mover-Dual Mat
 - (a) Hoist: Hoist construction shall consist of three (3) steel frame sub-assemblies. One (1) sub-assembly contains the drive mechanism and the other two (2) contain hoist cable collection drums. The sub-assemblies shall be linked together with 2.375" outside diameter tube drive shafts. The two (2) drum units are to be mounted 22'-0" on center. Standard hoist, load bar and two (2) slings shall be capable of lifting and supporting a standard 45' x 45' wrestling mat weighing one pound per square foot.

- (b) Motor: Each hoist shall be driven by one (1) heavy duty 3 HP C-faced electric motor with integral brake mechanism and automatic overload protection, attached to a 187.5:1 ratio gearbox assembly, operating with 208 volts (10.6 amps), 230 volt (9.6 amps), or 460 volt (4.8 amps), in 3 phase. Under no load conditions, RPM of motor is 1725; RPM of drum is 9.2. Approximate hoist speed shall be 4.8 feet per minute in both the up-and-down travel cycles. The motors shall be controlled by a special dual-keyed, flush wall mounted momentary key switch, which cannot be instantly reversed, providing a safety provision to prevent damage to the motor. Switch assembly shall be furnished with a 4-1/2" square stainless steel cover plate for mounting into a masonry wall box by the electrical contractor.
 - (c) The hoist mechanism shall be monitored by a factory wired, preset control panel, and shall provide the following safety/monitoring systems:
 - (1) A 16.5" x 16.5" x 6" steel enclosure, complete with lock and keys.
 - (2) A cover-mounted main disconnect switch (specify 208v, 230v or 460v, 3-phase, 60 Hz).
 - (3) Control circuit transformer with primary and secondary protection.
 - (4) Full voltage reversing contactor with motor circuit protection.
 - (5) Audible motion alarm, which activates when unit is in the raising or lowering cycle, to increase athletes' awareness of mats being moved into and out of storage.
 - (d) Control panel: Shall be mounted within close proximity of the Mat Mover® for ease in field wiring and effectiveness of the motion alarm system.
 - (e) Materials: Actual hoisting of mats shall be accomplished by means of two (2) 5/16", 6-strand, 37 wires per strand, fiber core, 4.26 ton breaking strength steel cables, each secured to a 4" diameter drum, and terminating at a heavy wall 2" x 6" x 40'-0" long steel load bar. The mats shall be carried by means of a 19 oz. vinyl fabric sling (per square yard, containing antibacterial, fungi resistant and flame-retardant chemicals to meet requirements of ASTM E-84 Class A Rating (25 Flame Spread, 450 Smoke Development), and NFPA-701 large scale, ULC S-109 large and small scale, and State of California test requirements). The sling shall be attached to the load bar by means of a 2" wide nylon strap, encompassing the full sling perimeter, terminating at the load bar with a load-rated (5,000 lb. breaking strength) ring. For safety purposes, sling capacity shall govern the lift capacity of the system.
 - (f) Structural Support Members: Will be supplied by the owner to comply with building design, specified by the architect or structural engineer, and installed by an appropriate contractor. Structural support members shall be located to accommodate each of the three (3) frame assembly's four (4) anchor point footprint.
 - (g) Wiring: Wiring of all electrical components shall be in accordance with national and local electrical codes, and in accordance with manufacturer's instructions. All conduit, wiring, junction boxes, and components not specified herein shall be furnished and installed by the electrical contractor.
2. Gymnasium Mat Mover (Room C146): Model 91107052 Wall Mounted Stationary Mat Mover- Dual Mat.
- (a) Hoist: Hoist construction shall consist of three (3) steel frame sub-assemblies. One (1) sub-assembly contains the drive mechanism and the other two (2) contain hoist cable collection drums. The sub-assemblies shall be linked together with 2.375" outside diameter tube drive shafts. The two (2) drum units are to be mounted 22'-0" on center. Standard hoist, load bar and two (2) included slings shall be capable of lifting and supporting up to two (2) standard 45' x 45' wrestling mat weighing one pound per square foot.
 - (b) Motor: Each hoist shall be driven by one (1) heavy duty 3 HP C-faced electric motor with integral brake mechanism and automatic overload protection, attached to a 187.5:1 ratio gearbox assembly, operating with 208 volts (10.6 amps), 230 volt (9.6 amps), or 460 volt (4.8 amps), in 3 phase. Under no load conditions, RPM of motor is 1725; RPM of drum is 9.2. Approximate hoist speed shall be 4.8 feet per minute in both the up-and-down travel cycles. The motors shall be controlled by a special dual-keyed, flush wall mounted momentary key switch, which cannot be instantly reversed, providing a safety provision to prevent damage to the motor. Switch assembly shall be furnished with a 4-1/2" square stainless steel cover plate for mounting into a masonry wall box by the electrical contractor.

- (c) The hoist mechanism shall be monitored by a factory wired, preset control panel, and shall provide the following safety/monitoring systems:
 - (1) A 16.5" x 16.5" x 6" steel enclosure, complete with lock and keys.
 - (2) A cover-mounted main disconnect switch (specify 208v, 230v or 460v, 3-phase, 60 Hz).
 - (3) Control circuit transformer with primary and secondary protection.
 - (4) Full voltage reversing contactor with motor circuit protection.
 - (5) Audible motion alarm, which activates when unit is in the raising or lowering cycle, to increase athletes' awareness of mats being moved into and out of storage.
 - (d) Control panel: Shall be mounted within close proximity of the Mat Mover® for ease in field wiring and effectiveness of the motion alarm system.
 - (e) Materials: Actual hoisting of mats shall be accomplished by means of two (2) 5/16", 6-strand, 37 wires per strand, fiber core, 4.26 ton breaking strength steel cables, each secured to a 4" diameter drum, and terminating at a heavy wall 2" x 6" x 40'-0" long steel load bar. The mats shall be carried by means of a 19 oz. vinyl fabric sling (per square yard, containing antibacterial, fungi resistant and flame-retardant chemicals to meet requirements of ASTM E-84 Class A Rating (25 Flame Spread, 450 Smoke Development), and NFPA-701 large scale, ULC S-109 large and small scale, and State of California test requirements). The sling shall be attached to the load bar by means of a 2" wide nylon strap, encompassing the full sling perimeter, terminating at the load bar with a load-rated (5,000 lb. breaking strength) ring. For safety purposes, sling capacity shall govern the lift capacity of the system.
 - (f) Structural Support Members: Two wall mounting brackets and hardware for connection between the brackets and each hoist sub-assembly shall be provided. Anchors into the facility wall and any additional supports or wall reinforcements required to provide adequate load capacity shall be supplied by the owner to comply with building design, specified by the architect or structural engineer, and installed by an appropriate contractor.
 - (g) Wiring: Wiring of all electrical components shall be in accordance with national and local electrical codes, and in accordance with manufacturer's instructions. All conduit, wiring, junction boxes, and components not specified herein shall be furnished and installed by the electrical contractor.
3. Wrestling Room Mat Mover (Room C104): Model 91105100N Stationary Overhead "Mini" Mat Mover (3 mats).
- (a) System: One Steel-frame with drive and lifting mechanisms enclosed.
 - (b) Standard Hoist, Load Bar, and Sling: Capable of lifting and supporting up to three (3) standard 14-foot by 42-foot wrestling mats weighing 1 pound per square foot.
 - (c) Attachment: Storage system shall attach to overhead structural support members located on 7'-9" centers as specified in Division 5 metal sections.
 - (d) Hoisting Unit: Driven by 1 heavy-duty, 1.5-hp, C-faced, electric motors, with integral 6 ft/lb brake mechanisms and automatic overload protection, attached to 200:1 ratio gearbox assembly. Operating with a 3 phase motor.
 - (e) Approximate Hoist Speed: 4.5 feet per minute, in both up and down travel cycles.
 - (f) Hoisting of Mats: Accomplished with two 5/16-inch, 6 strand, 37 wires per strand, fiber-core, 4.26-ton breaking strength, steel cables. Each cable secured to 4-inch diameter drum. Each steel cable is routed through a pulley block secured at the load bar, terminating at the hoist frame assembly. The load bar shall be comprised of a heavy wall 2"x6"x13'-0" lg. member, complete with load rated hooks.
 - (g) Sling: Mats shall be carried by 14 ounce per square yard vinyl fabric sling with antibacterial, fungi-resistant, and flame retardant chemicals.
 - (h) Sling fabric must conform to ASTM E84, Class A Rating (25 flame spread, 450 smoke development); NFPA 701 large scale; ULC S-109 large and small scale; and State of California test requirements.
 - (i) Attach Sling to Load Bar: 2-inch wide nylon strap, encompassing full sling perimeter, terminating at load bar with load-rated ring with 5,000 pound breaking strength.

G. EQUIPMENT CONTROL SYSTEM - Basis of design Porter Athletic Equipment Co.

1. Control System: Model 12555 Powr-Touch 2.5 Gymnasium Control Center.

- (a) Operation: Push-button control system capable of operating a maximum of 128 basketball backstops or other gymnasium equipment and a maximum of 32 units of auxiliary gymnasium electrical equipment.
- (b) Operation Safety: For safety of operation, touch pad requires constant pressure on pad button to control gymnasium equipment.
- (c) Equipment shall be operated individually or simultaneously by pressing single button. Control systems incapable of simultaneous control operation shall not be considered equal.
- (d) Each Relay: Programmed to accept 8 memory address assignments for a maximum of 8 different operation combinations for each basketball backstop, height adjuster, or curtain. Operate 1, 2, 3, and up to 8 units individually or simultaneously, curtain simultaneous maximum is 4 units for safety.
- (e) Security Code: Four-digit reprogrammable security code to prevent unauthorized use.
- (f) Mounting: Flush mounted in standard 2-gang electrical box, 4 inches by 4 inches by 2-1/2 inches, with 12-volt control circuit to relay panels located on walls or roof framing structure.
- (g) Relay Panels: Minimum of 1 dual-powered relay panel, with a maximum of 16 relay panels per network. Each relay panel shall contain 2 banks of eight 30-amp relays for operating 8 momentary-controlled type (up and down), 120-volt or low-voltage pieces of equipment. Each bank of relays shall be independently powered by 120-volt line power, with 2 dedicated circuit breakers per relay panel. Each relay panel shall include 2 maintained 30-amp relays.
- (h) Touch Pad LEDs: Tri-color LED at touch pad for positive user feedback. Illuminates when proper security code is entered (green), when confirming touch pad button is fully depressed (amber), and while operating equipment up or down (red). Additional LEDs at touch pad and relay panel circuit boards to ensure system is receiving power, wired correctly, and relays are functioning properly.
- (i) Legend: Control system shall come with Porter's custom graphical equipment legend to help user identify each piece of equipment.
- (j) Warranty: 1 year limited warranty.

H. Accessories: Mounting hardware as recommended by manufacturer and required for complete installation.

I. Finish: Powder coated finish.

3. PART 3 EXECUTION

3.1 EXAMINATION:

- A. Verify existing conditions before starting work under provisions of Section 01 73 00.
- B. Verify that building structural frame and walls are ready to receive equipment.
- C. Verify that finish operations for painting and flooring are complete before installation of equipment.

3.2 INSTALLATION

- A. Install equipment in accordance with manufacturer's instructions and in compliance with Section 01 73 00.
- B. Install all necessary hardware, anchors, inserts, connections, and embedded items necessary for proper installation. Coordinate with work of other sections.
- C. Install equipment in accordance with NFHS requirements.
- D. Assemble components furnished loose for field installation.
- E. Floor Game Socket Setting: Set plumb, aligned and at correct height and spacing. Top surface to be flush with finished flooring surface.

- F. Wall Padding: Mount padding with bottom edge at four inches above finished flooring. Mount panels using concealed mounting clip attachments anchored to panels and wall.
- G. Gymnasium Equipment: Erect rigid, level, plumb, square and true; anchored securely to supporting structure; in proper relationship to adjacent construction and court layout.

3.3 TEST AND ADJUST

- A. Test, adjust, and demonstrate operation of equipment under the provisions of Section 01 77 00.
- B. Test and adjust systems for smooth and proper operation.
- C. Adjust limit switches to prevent damage to equipment.
- D. Demonstrate operation of all units to the Owner's representative.

3.4 PROTECTION

- A. Protect work under the provisions of Section 01 61 00.
- B. Fully retract basketball backstops and disable operators.
- C. Fully retract mat movers and disable operator.
- D. Store movable equipment in a secure lockable area.
- E. Protect wall padding from accidental damage with temporary protective cover.

END OF SECTION

SECTION 11 66 43

INTERIOR SCOREBOARDS

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Single-sided LED basketball scoreboard
- B. Non-Backlit Logo Panel
- C. Single Sided LED basketball shot clocks

1.02 REFERENCES

- A. Standard for Electric Signs, UL 48
- B. Standard for CSA C22.2 #207
- C. Federal Communications Commission Regulation Part 15
- D. National Electric Code

1.03 SUBMITTALS

- A. Product data: Submit manufacturer's product illustrations, data and literature that fully describe the scoreboards and accessories proposed for installation.
- B. Shop drawings: Submit mechanical and electrical drawings.
- C. Maintenance data: Submit manufacturer's installation, operation, and maintenance manuals.

1.04 DELIVERY, STORAGE, AND HANDLING

- A. Product delivered on site
- B. Scoreboard and equipment to be housed in a clean, dry environment

1.05 PROJECT CONDITIONS

- A. Environmental Limitations: Do not install scoring equipment until spaces are enclosed and weatherproof, wet work in spaces is complete and dry, and ambient temperature and humidity conditions are maintained at the levels indicated for project when occupied for its intended use.
- B. Field Measurements: Coordinate scoreboard location and height with the customer. Verify dimensions by field measurements.
- C. Supply weight and mounting method for owner to verify that building structure is capable of supporting the scoreboard's weight in addition to the auxiliary equipment.

1.06 QUALITY ASSURANCE

- A. For indoor use only
- B. Source Limitations: Obtain each type of scoring equipment and electronic displays through one source from a single manufacturer.
- C. ETL listed to UL 48
- D. NEC compliant
- E. FCC compliant
- F. ETLC listed to CSA 22.2 #207

1.07 WARRANTY

- A. Provide 5 years of no cost parts exchange including standard shipping on electronics parts and radios due to manufacturing defects
- B. Provide toll-free service coordination
- C. Provide technical online and phone support during Daktronics business hours

PART 2 PRODUCTS

2.01 MANUFACTURER

- A. Daktronics, Inc., 201 Daktronics Drive, P.O. Box 5128, Brookings, SD 57006-5128
- B. Substitutions:

2.02 PRODUCT

- A. Daktronics BB-2107 single-sided basketball scoreboard displays period time to 99:59, HOME and GUEST scores to 199, PERIOD to nine, team FOULS to 19, PLAYER number to 99, player FOUL to nine, T.O.L. (time outs left) to nine and indicates possession and bonus. During the last minute of the period, scoreboard displays time to 1/10 of a second. Scoreboard can also score volleyball, wrestling and any sport requiring a clock, score and period function.

2.03 SCOREBOARD

- A. General information
 - 1. Dimensions: 6'-0" (1.83 m) high, 10'-0" (3.05 m) wide, 0'-6" (152 mm) deep
 - 2. Base weight: 260 lb (118 kg) – options may increase weight
 - 3. Base power requirement: 220 W – options may increase wattage
 - 4. Color: provide over 150 colors to choose from
- B. Construction
 - 1. All-aluminum construction
 - 2. Scoreboard back, face, and perimeter: 0.063" (1.60 mm) thick
 - 3. Cabinet withstands high-velocity impact from air-filled sports balls without the need for protective screens
- C. Digits & Indicators
 - 1. LED digit technology:
UniView® (UV) – enhanced digits with diffusant lenses over the LEDs that blend the light for a uniform bar look and 140° viewing angle
 - 2. LED color:
Amber clock/colon, PERIOD, PLAYER/FOUL and T.O.L. digits and bonus indicators with Red score and FOULS digits and possession indicators
 - 3. Clock and score digits: 13" (330 mm) high
 - 4. PERIOD, FOULS, PLAYER/FOUL and T.O.L. digits: 10" (254 mm) high
 - 5. Bonus indicators: 4" (102 mm) high
 - 6. Possession arrows: 3" (76 mm) high
 - 7. Seven bar segments per digit
- D. Captions
 - 1. Vinyl applied directly to scoreboard face
 - 2. HOME and GUEST captions: 6" (152 mm) high
 - 3. PERIOD, FOULS/SCORE, PLAYER/FOUL/MATCH and T.O.L. captions: 4" (102 mm) high
 - 4. Color: To be selected by architect from manufacturer's standard colors.
- E. Horn
 - 1. Vibrating horn mounted inside the scoreboard cabinet behind the face
 - 2. Sounds automatically when period clock counts down to zero
 - 3. Sounds manually as directed by operator
- F. Power Cord
 - 1. Cord is 11' (3.35 m) long
 - 2. Cord plugs into a standard grounded outlet
- G. Accessory Equipment:
 - 1. **Non-Backlit Logo Panel (above scoreboard) 2'-0" high x 10'-0" wide.**
 - a. Assume (4) color artwork logo to be provided at time of submittal.
 - 2. **Vinyl striping applied around the clock and scoreboard face**
 - 3. **Custom team name caption in place of HOME**
 - 4. **Volleyball captions on changeable panels**
 - 5. **Double bonus indicators in place of single bonus indicators**
 - 6. **Two 17" (432 mm) high, 33" (838 mm) wide aluminum panels in upper corners with vinyl logo/sponsor decoration**
 - a. Assume (4) color artwork logos to be provided at time of submittal.
 - 7. **Standalone Time of Day (scoreboard acts as a clock when control console is unplugged/off)**
 - 8. **Advantage time option for wrestling mode – PLAYER and FOUL digits reversed**
 - 9. **Different sounding 12 VDC horn in place of buzzer horn**
 - 10. **Hardware for corner mounting**

2.04 SINGLE SIDED LED SHOT CLOCK

- A. Daktronics BB-2114 single-sided basketball shot clock timer displays shot times up to a value of 99 seconds. It can also count down from any preset time between 0 and 99 seconds. A hand-held start/stop/reset switch is included with purchase.

2.05 SCOREBOARD

- B. General information
 - 1. Dimensions: 1'-7" (483 mm) high, 1'-10" (559 mm) wide, 0'-6" (152 mm) deep
 - 2. Weight: 15 lb (7 kg)
 - 3. Power requirement: 30 W
 - 4. Color: Semi-gloss black
- C. Construction
 - 1. All-aluminum construction
 - 2. Scoreboard back, face, and perimeter: 0.063" (1.60 mm) thick
 - 3. Cabinet withstands high-velocity impact from air-filled sports balls without the need for protective screens
- D. Digits
 - 1. LED digit technology:
UniView® (UV) – enhanced digits with diffusant lenses over the LEDs that blend the light for a uniform bar look and 140° viewing angle
 - 2. Shot clock digits: 13" (330 mm) high
 - 3. Shot clock digits: red LEDs
 - 4. Seven bar segments per digit
- E. Horn
 - 1. Internal horn sounds automatically when shot clock counts down to zero
 - 2. Sound is distinctly different from the game-clock horn
- F. Accessory Equipment:
 - 1. **Hinged metal mesh protective screen – painted to match scoreboard**
 - 2. **Visual Horn Indicator (end-of-period light)**

2.05 SCORING CONSOLE

- A. Console is an All Sport® 5000 controller
- B. Scores multiple sports using changeable keyboard inserts
- C. Controls multiple scoreboards, stats displays and shot clocks, including other All Sport 5000 controlled displays currently owned by customer
- D. Recalls clock, score, and period information if power is lost
- E. Runs Time of Day and Segment Timer modes
- F. Console includes:
 - 1. Rugged aluminum enclosure to house electronics
 - 2. Sealed membrane water-resistant keyboard
 - 3. 32-character backlit LCD to verify entries and recall information currently displayed
 - 4. Power cord that plugs into a standard grounded outlet; 6 watts max
 - 5. Control cable to connect to the control receptacle junction box (wired system only)
 - 6. Hand-held switch for main clock start/stop and horn
 - 7. Soft-sided carrying case
- G. Accessory Equipment:
 - 1. **2.4 GHz spread spectrum radio system with frequency hopping technology and 64 non-interfering channels; system includes a transmitter installed inside the console and a receiver installed inside the scoreboard(s)**
 - 2. **Hard carrying case**
 - 3. **Battery pack**

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that mounting surface is ready to receive scoreboard. Verify that placement of conduit and junction boxes are as specified and indicated in plans and shop drawings.

3.02 INSTALLATION

- A. Power conduit, cables and outlet boxes to be provided and installed by the electrical contractor. Signal raceways, conduit and boxes to be provided by the electrical contractor. Electrical contractor is also responsible for any required wire and terminators between each scoreboard and control location.
- B. Mount scoreboards and interior displays to wall in location detailed and in accordance with manufacturer's instructions. Unit to be plumb and level.

3.03 INSTALLATION—CONTROL CENTER

- A. Provide boxes, cover plates and jacks as required to meet control specification requirements. Control cables to control panels shall be concealed.
- B. Test the operation of the scoreboard, controller and all control jacks; leave control unit in carrying case and other loose items with owner's designated representative.
- C. Conduct operator training on the scoreboard/controller operation.

END OF SECTION

SECTION 11 68 33
ATHLETIC FIELD EQUIPMENT

1. PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Basketball backstops and nets.
- B. Tennis equipment.

1.2 REFERENCES

- A. ASTM A123 - Zinc Coatings on Iron and Steel Products.
- B. CCR - California Code of Regulations, Title 24, Part 2.
- C. NFSHSA - National Federation of State High School Associations, applicable published rules, latest edition.

1.3 SUBMITTALS

- A. Submit product data and manufacturer's complete installation instructions for each item under provisions of Section 01 33 00.
- B. Include all dimensional requirements to meet NFSHSA applicable requirements.

1.4 REGULATORY REQUIREMENTS

- A. Conform to CBC, California Building Code, (CCR), Title 24, Part 2 and the 2010 ADA Standards for Accessible Design for accessibility requirements.

2. PART 2 PRODUCTS

2.1 MANUFACTURERS

- A. LA Steelcraft, www.lasteelcraft.com.
- B. Porter Athletic Equipment Company, www.porterathletic.com.
- C. BSN Sports, www.bsnsports.com.
- D. Gill Athletics, www.gillathletics.com.
- E. Sports Edge, www.sportsedge.com.
- F. Sports Field Specialties, Inc., www.sportsfieldspecialties.com.
- G. Substitutions: Under provisions of Section 01 25 13.

2.2 EXTERIOR ATHLETIC EQUIPMENT

- A. Basketball Backstop
 - 1. Manufacturer: L.A. Steelcraft.
 - 2. Model: 1256 and 12056. Post mounted, single and double fan shaped backboard offset mounted.
 - 3. Post: 5-9/16 inch O.D. galvanized steel pipe with top cap.
 - 4. Offset framework: 2-3/8 inch OD galvanized steel pipe, welded, with adjustable clamps to connect to post.
 - 5. Offset Extension: 6 feet.
 - 6. Backboard Model 02: Fan shaped, 1/4 inch steel plate, galvanized, with white powder coat finish. Model No. OTA/OBM target and border.
 - 7. Goal & Net: Model 2K with nylon net.

B. Tennis Equipment:

1. Manufacturer: Porter Athletic Equipment Company.
2. Posts: Model 884.
3. Post Sleeves: Included with posts.
4. Net: Model 2235.
5. Tie Down: Model 02238000 with Model 02239000 tie down pipe.
6. Wind Screens: Model 912014, open woven vinyl polyester fabric, 703 per sq. yd. in color selected by Architect.

2.3 ACCESSORIES

- A. Concrete: As specified in Section 03 30 00. Concrete mix design to be in accordance with footing classification.
- B. Hardware: Galvanized nuts, bolts, screws, and inserts required for proper installation.

2.4 METAL FINISHES

- A. Galvanized Finish: Galvanized items to minimum 1.25 oz/sq ft zinc coating in accordance with ASTM A123.
- B. Powder Coat Finish: Manufacturers standard baked powder-coat finish with a minimum film thickness of 3 to 5 mils.

3. PART EXECUTION

3.1 EXAMINATION

- A. Verify existing conditions are acceptable prior to starting work.
- B. Verify correct layout of playfields and courts.
- C. Do not begin installation until final grading is complete.
- D. Proceed only when unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. Install equipment in accordance with manufacturer's printed instructions and as indicated on the Drawings.
- B. Install equipment in accordance with NFSHSA applicable requirements.
- C. Install all necessary hardware, anchors, inserts, connections, and embedded items necessary for proper installation.
- D. Install equipment in proper alignment without warp or distortion.
- E. Coordinate with work of other sections.

3.3 CLEANUP

- A. Repair damaged finishes to match original finish or replace equipment.
- B. Remove rubbish, debris and other waste materials and dispose of off-site.

END OF SECTION

SECTION 11 68 33.2

ATHLETIC FIELD EQUIPMENT

PART 1 - GENERAL

1.01 SECTION INCLUDES:

- A. Equipment Scheduled.
- B. Installation of required concrete footings.

1.02 Related Work Specified Elsewhere:

Concrete Form Work	Section 031100
Concrete Reinforcing	Section 032000
Artificial Grass Fieldturf	Section 321723
Synthetic Track Surfacing	Section 321823
Athletic Field Surfacing	Section 321824

1.03 Quality Assurance:

- A. The Contractor shall provide at least one person who shall be present at all times during execution of this portion of the work, who shall be thoroughly familiar with the type of materials being installed and the proper materials and methods conforming to U.S.T.C. & T.B.A.'s (U.S. Tennis Court & Track Builders) standards, the California Interscholastic Federation (C.I.F.), National Federation for State High School Associations, NCAA or IAAF for track construction.
- B. Manufacturer: Company specializing in equipment with five (5) years of experience.
- C. Source limitation: All components including scoreboard, control center, control cable, and other accessories and installation hardware shall be products of a single manufacturer.
- D. Manufacturer qualifications: Company specializing in manufacturing electronic scoreboards with 10 years minimum successful experience.

1.04 Submittals:

- A. Shop drawings plan layout of equipment, footings, mounting bolt dimensions, power requirements (wiring diagrams) and related installation details for each type of equipment specified.
- B. Product data on operating equipment, characteristics and limitations.
- C. Product data.
- D. Three samples of materials and finishes.
- E. Manufacturer's installation instructions.
- F. Operation and maintenance data. Including data for maintaining operating equipment, type and frequency of lubrication, general instructions for maintaining finishes and prevention of deterioration.
 - 1. Shop drawings showing locations, face layout, dimensions, construction, electrical wiring diagrams, interface with structural supports, and method of attachment.
 - 2. Finish samples.
 - 3. Copy of guarantee required by Paragraph 1.5 for review by Architect.
 - 4. Manufacturer's installation instructions.

1.05 Regulations:

- A. Comply with IAAF safety purposes
- B. Comply with U.S. Consumer Product Safety Commission Regulations

1.06 Maintenance Service:

- A. Provide a limited 2-year warranty Date of Certified Completion on all equipment.

1.07 References:

- A. American Society for Testing and Materials (ASTM) Publications:
 - 1. ASTM B221 - Aluminum-Alloy Extruded Bar, Rod, Wire, Shape, and Tube.

1.08 Guarantee:

- A. Provide under provisions of Section 017700 - Closeout Submittals: Guarantee to cover defects in materials and workmanship.

PART 2 - MATERIALS

All materials shall conform to the requirements of Section 212 of the Standard Specifications, except as modified herein.

2.01 Manufacturers:

- A. Products of following manufacturers from basis for design and quality intended.
 - 1. Porter Athletic Equipment Company, Chatsworth, CA
 - 2. Performance Athletics, Chino Valley, Arizona
 - 3. Aluminum Athletic Equipment (AAE), West Conshohocken, PA
 - 4. Patterson Williams Athletic MFG. CO. Mesa, Arizona
 - 5. L.A. Steelcraft, Pasadena CA
 - 6. Haws Corporation, Sparks Nevada
 - 7. SportsField Specialities, Inc. Delhi, New York
 - 8. Gill Athletics Champaign, IL

2.02 Materials:

- A. Concrete for footings: Minimum 2500 pounds per square inch, 4-inch slump.
- B. Refer to the Manufacturer's installation details for reinforcement requirements. Contractor shall submit shop drawing of the installation of all Track and Field, Baseball and Softball Fields and Football Field related equipment and for review.

2.03 Schedules for Exterior Athletic Equipment:

- A. Team Benches – 2' x 15' aluminum bench with back –Model PBA-15P, secured in concrete post base – Model PB-PC Galv. Direct Bury Frame. L.A. Steelcraft Aluminum Bench or equal.
- B. Bat Racks: Galvanize steel welded unit with cold galvanizing compound treated welds. L.A. Steelcraft Model BR-15, Aluminum bat rack (power coated finish) Sportsfield Specialties Model SUABRPL15, or equal.
- C. Baseball/Softball Fields and Bull Pen - Plates and Bases: One set each of the following equipment and One Set for Bull Pen Pitchers Warm up Area (Pitchers Mound Plate); Model 410 –FG Pitchers Mound, Model 310 Stake Down Home Plate, (3) three Model 205 BA Base Anchors with Model 230- female receptacle with plug set and (3) three 175 MLB Base Plates, Model 490-CC Pitchers Plate – Softball Fields. By L.A. Steelcraft, Sportsfield Specialties Model SHBBPB Pitching Rubber, SHP-UM Home Plate, (3) three SHBBPL Bases with Ground Anchors or equal

D. Foul Ball Poles:

1. Varsity Base Ball field – Sportsfield Specialist Model # FPW630 -30' FOUL POLE with Wing, 4" OD. X 1/8" wall Aluminum Pipe with 4.3" OD. Aluminum Wings and 4.3" OD, 48" Long Aluminum Ground Sleeve. Install per manufacturers specifications.
2. Varsity Softball Field – Sportsfield Specialist Model # FPW420 -20' FOUL POLE with Wing, 4" OD. X 1/8" wall Aluminum Pipe with 4.3" OD. Aluminum Wings and 4.3" OD, 30" Long Aluminum Ground Sleeve. Install per manufacturers specifications.

E. Batting Cage Netting and Pulley:

3. Outdoor Batting cage- Varsity Baseball: Porter - 10' High x 12' Wide x 70" Long Model Number 330170
4. Outdoor Batting cage –Varsity Softball: Porter – 10' High x 12' Wide x 50" Long. Model Number 330150.
5. Varsity Softball Field –BSN Sports Deluxe 200' Homerun Fence with Distance Banners, Model# BS314GP with Ground Sleeves Model # MK16GS12CP.

F. Backstop Schedule:

LOCATION / PLACEMENT	MANUFACTURER	MODEL NUMBER
1. Baseball - High School	LA Steelcraft or approved equal.	Heavy Duty Hooded Truss with 3 planks Model #BS-45 with Galvanized Frame and Mesh. Width opening: 96'-7" Depth: 28'-3" Sched. 40 Vertical Post: 5-9/16" O.D. Horizontal Rails" 1-5/8" O.D. Wing Width: 40' Rear Panel Width: 40' Fabric Panels/Wings: 2" – 9 GA
2. Softball- High School	LA Steelcraft or approved equal	Hooded Backstop with 3 planks Model #bs-45 with Galvanized Frame and Mesh. Width opening: 96'-7" Depth: 28'-3" Sched. 40 Vertical Post: 5-9/16" O.D. Horizontal Rails" 1-5/8" O.D. Wing Width: 40' Rear Panel Width: 40' Fabric Panels/Wings: 2" – 9 GA

G. Football Goal Post: BASE: per detail as manufactured by:

Sportsfield Specialties Inc. P.O. Box 231 41155 State Highway 1 Delhi, NY 13753 1-888-975-3343

1. Components:
 - a. Rotating and Hinged Goal Post –GP4380 with 8' offset and Access Frame Kit – Model Number GP4570.
2. Powder Coat Finish:
 - a. Yellow
3. Installation package consisting of the following components:
Ground sleeve: #4212, 8" Schedule 40 steel pipe, 5' long. Access frame: #4516 fabricated of aluminum, 565mm (22.25in) square, 152mm (6.0in) high, with eight anchor bolts. Filler plugs: (#4540) (#4521), fabricated of pressure treated plywood.
4. Accessories:
 - a. Directional wind flags.
 - b. Touch-up paint (Powder Coat Specific).
 - c. Assembly bolts, nuts and roll pins, Stainless steel

5. Install in 36-inch diameter by 72—inch deep concrete post base, including cage reinforcement of No. 5 deformed bars. Slope top and buried 3 —inch below grade. Install concrete in accordance with Section 031100 and Section 032000.
- H. Soccer Goal Set: Soccer Goal- SG824S with the Mobility Kit- SG Mobile SGMKS and SG2S Soccer Goal Safety System
1. Base: (Patent Pending) as manufactured by:
SportsField Specialties Inc.
P.O. Box 231,
Route 10
Delhi, NY 13753
888-975-3343
 2. Components: #SG2S
 - a. Safety Clamp
 - b. Fabricated of 0.25" Aluminum
 - c. Powder Coat: White
 - d. Stainless steel hardware.
- I. Shot Put:
1. Ring: # TRSPHAA
SportsField Specialties Inc.
P.O. Box 231,
Route 10
Delhi, NY 13753
888-975-3343
 2. Components:
 - a. Toe Board – # SPTBCARHS
 - b. Fabricated of 0.25" Aluminum
 - c. Powder Coat: White
 - d. Stainless steel hardware
- J. Discuss Cage:
1. Cage / Netting & Anchor System: # DCHST
SportsField Specialties Inc.
P.O. Box 231,
Route 10
Delhi, NY 13753
888-975-3343
 2. Components:
 - a. Optional Barrier Net – 7' x 63', #36 (1 ¾" square mesh, nylon black twine)
 - b. Ground Sleeves – 4.3" o.d. x 4.1" i.d. All Pipe
 3. Ring: TRDAA
SportsField Specialties Inc.
P.O. Box 231,
Route 10
Delhi, NY 13753
888-975-3343

- K. Running Track Lane Gate:
 - 1. Lane Gate with Locks and Sleeve: # LGRTL
SportsField Specialties Inc.
P.O. Box 231,
Route 10
Delhi, NY 13753
888-975-3343
 - 2. Components:
 - a. 144 " x 66" high
 - b. Powder Coat: White
- L. High Jump: Premier High Jump Standards by AAE, (1) set.
 - 1. Landing Pad: IAP-28
- M. Long Jump/ Triple Jump Sand Pit with Cover and Catchers: Model SPSCHS and SPCVRHS, by Sportsfield Specialties, Inc. or approved equal.
 - 1. Take off Board: Sportsfield Specialties LTJTOB12W
- N. Fence Guards:
 - 1. Manufacturer: Sports Edge
 - 2. Model: No. SEO1923, 0.07-inch wall thickness, color as selected.
 - 3. Mounting: Secure to fence at 24 inches o.c. with ties.
 - 4. Finish: UV resistant polyethylene

PART 3 - EXECUTION

3.01 Inspection:

- A. Verify that anchor bolts and backing are ready to receive work.
- B. Verify that proper power supply is available.
- C. Beginning work of this Section constitutes acceptance existing conditions.

END OF SECTION

SECTION 11 68 43

FOOTBALL/TRACK SCOREBOARD

PART 1 GENERAL

- 1.01 SECTION INCLUDES
 - A. Single-sided LED football/track scoreboard
- 1.02 REFERENCES
 - A. Standard for Electric Signs, UL 48
 - B. Standard for CSA C22.2 #207
 - C. Federal Communications Commission Regulation Part 15
 - D. National Electric Code
- 1.03 SUBMITTALS
 - A. Product data: Submit manufacturer's product illustrations, data and literature that fully describe the scoreboards and accessories proposed for installation.
 - B. Shop drawings: Submit mechanical and electrical drawings.
 - C. Maintenance data: Submit manufacturer's installation, operation, and maintenance manuals.
- 1.04 DELIVERY, STORAGE, AND HANDLING
 - A. Product delivered on site
 - B. Scoreboard and equipment to be housed in a clean, dry environment
- 1.05 PROJECT CONDITIONS
 - A. Environmental limitations: Do not install scoreboard equipment until mounting structure is secure and concrete has ample time to cure.
 - B. Field measurements: Verify position and elevation of structure and its layout for scoreboard equipment. Verify dimensions by field measurements.
 - C. Verify mounting structure is capable of supporting the scoreboard's weight and windload in addition to the auxiliary equipment.
 - D. Installation may proceed within acceptable weather conditions.
- 1.06 QUALITY ASSURANCE
 - A. For outdoor use
 - B. Source Limitations: Obtain each type of scoring or related equipment through one source from a single manufacturer.
 - C. ETL listed to UL 48
 - D. NEC compliant
 - E. FCC compliant
 - F. ETLC listed to CSA 22.2 #207
- 1.07 WARRANTY
 - A. Provide 5 years of no cost parts exchange including standard shipping on electronics parts and radios due to manufacturing defects
 - B. Provide toll-free service coordination
 - C. Provide technical online and phone support during Daktronics business hours

PART 2 PRODUCTS

- 2.01 MANUFACTURER
 - A. Daktronics, Inc., 201 Daktronics Drive, P.O. Box 5128, Brookings, SD 57006-5128
 - B. Substitutions: Under provisions of Section 01 25 13.

2.02 PRODUCT

- A. Daktronics FB-2023 single-sided football/track scoreboard displays period or race time to 99:59.99, HOME and GUEST scores to 99, DOWN/TO GO/BALL ON/QTR (quarter) information, and T.O.L. (time outs left) to nine. Arrows indicate possession. Scoreboard comes standard with track captions on changeable panels. During the last minute of the period, the clock displays time to 1/10 of a second.

2.03 SCOREBOARD

- A. General information
 - 1. Dimensions: 8'-0" (2.44 m) high, 25'-0" (7.62 m) wide, 0'-8" (203 mm) deep
 - 2. Base weight: 820 lb (372 kg) with vinyl captions – options may increase weight
 - 3. Base power requirement: 340 W (red/amber digits), 710 W (white digits) with vinyl captions – options may increase wattage
 - 4. Color: provide over 150 colors to choose from
- B. Construction
 - 1. Alcoa aluminum alloy 5052 for excellent corrosion resistance
 - 2. Scoreboard back, face, and perimeter: 0.063" (1.60 mm) thick
 - 3. Scoreboard top and bottom: 0.125" (3.18 mm) thick
- C. Digits & Indicators
 - 1. LED color: White
 - 2. Clock digits: 30" (762 mm) high
 - 3. HOME, GUEST, DOWN, TO GO, BALL ON, and QTR digits: 24" (610 mm) high
 - 4. T.O.L. digits: 18" (457 mm) high
 - 5. Seven bar segments per digit
 - 6. PanaView® LED digit technology
 - 7. All digits and indicators are sealed front and back with weather-tight silicone gel
- D. Captions
 - 1. Vinyl applied directly to scoreboard face; track captions are on changeable panels
 - 2. HOME and GUEST captions: 15" (381 mm) high
 - 3. DOWN, TO GO, BALL ON, QTR, T.O.L., and track captions: 12" (305 mm) high
 - 4. Color: standard white or others available upon request
- E. Identification Panel (Top)
 - 1. Non-backlit 3'-0" high x 25'-0" wide with four color logo/team name.
 - a. Logo artwork to be provided at time of construction.
- F. Message Display (Between Identification Panel and Scoreboard)
 - 1. DVXMC-96x240-19.8-RGB-SF 6'-9" high x 15'-11" wide
- G. Filler Panels (Each side of Message Display)
 - 1. Non-backlit 6'-9" high x 4'-6.5" wide
- H. Accessory Equipment
 - 1. **Vinyl striping applied around the clock and scoreboard face**
 - 2. **Custom team name caption in place of HOME**
 - 3. **LED Colon & Decimal**
 - 4. **Horn**
 - 5. **Semi-automatic track timing with the OmniSport® 2000 console**

2.04 SCORING CONSOLE

- A. Console is an All Sport® 5000 controller
- B. Scores multiple sports using changeable keyboard inserts
- C. Controls multiple scoreboards and displays, including other All Sport 5000 controlled displays currently owned by customer
- D. Recalls clock, score, and period information if power is lost
- E. Console capable of automatically calculating and displaying DOWN & TO GO for each play
- F. Runs Time of Day and Segment Timer modes
- G. Console includes:
 - 1. Rugged aluminum enclosure to house electronics
 - 2. Sealed membrane water-resistant keyboard
 - 3. 32-character LCD to verify entries and recall information currently displayed
 - 4. Power cord that plugs into a standard grounded outlet; 6 watts max
 - 5. Control cable to connect to the control receptacle junction box (wired system only)
 - 6. Hand-held switch for main clock start/stop and horn
 - 7. Soft-sided carrying case

H. Accessory Equipment

1. **2.4 GHz spread spectrum radio system with frequency hopping technology and 64 non-interfering channels; system includes a transmitter installed inside the console and a receiver installed inside the scoreboard(s)**
2. **Hard carrying case**
3. **Battery pack**

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that mounting structure is ready to receive scoreboard. Verify that placement of conduit and junction boxes are as specified and indicated in plans and shop drawings. Verify concrete has cured adequately according to specifications.

3.02 INSTALLATION

- A. All power and control cables to scoreboards and displays will be routed in conduit. Power to the scoreboards/displays as well as raceways shown on electrical plans by the Electrical Contractor. Scoreboard control wiring including conduit will be the responsibility of the contractor assigned the scoreboard equipment.
- B. Install scoreboards and exterior displays to beams in location detailed and in accordance with manufacturer's instructions. Verify unit is plumb and level.

3.03 INSTALLATION—CONTROL CENTER

- A. Provide boxes, cover plates and jacks in locations per plans.
- B. Test connect control unit to all jacks and check for proper operation of control unit, scoreboard and all features. Leave control unit in carrying case and other loose accessories with owner's designated representative.
- C. Verify earth ground does not exceed 15 ohms.

END OF SECTION

SECTION 11 68 44

BASEBALL/SOFTBALL SCOREBOARD

PART 1 GENERAL

- 1.01 SECTION INCLUDES
 - A. Single-sided LED baseball scoreboard
- 1.02 REFERENCES
 - A. Standard for Electric Signs, UL 48
 - B. Standard for CSA C22.2 #207
 - C. Federal Communications Commission Regulation Part 15
 - D. National Electric Code
- 1.03 SUBMITTALS
 - A. Product data: Submit manufacturer's product illustrations, data and literature that fully describe the scoreboards and accessories proposed for installation.
 - B. Shop drawings: Submit mechanical and electrical drawings.
 - C. Maintenance data: Submit manufacturer's installation, operation, and maintenance manuals.
- 1.04 DELIVERY, STORAGE, AND HANDLING
 - A. Product delivered on site
 - B. Scoreboard and equipment to be housed in a clean, dry environment
- 1.05 PROJECT CONDITIONS
 - A. Environmental limitations: Do not install scoreboard equipment until mounting structure is secure and concrete has ample time to cure.
 - B. Field measurements: Verify position and elevation of structure and its layout for scoreboard equipment. Verify dimensions by field measurements.
 - C. Installation may proceed within acceptable weather conditions.
- 1.06 QUALITY ASSURANCE
 - A. For outdoor use
 - B. Source Limitations: Obtain each type of scoring or related equipment through one source from a single manufacturer.
 - C. ETL listed to UL 48
 - D. NEC compliant
 - E. FCC compliant
 - F. ETL listed to CSA 22.2 #207
- 1.07 WARRANTY
 - A. Provide 5 years of no cost parts exchange including standard shipping on electronics parts and radios due to manufacturing defects
 - B. Provide toll-free service coordination
 - C. Provide technical phone support during Daktronics business hours

PART 2 PRODUCTS

- 2.01 MANUFACTURER
 - A. Daktronics, Inc., 201 Daktronics Drive, P.O. Box 5128, Brookings, SD 57006-5128
 - B. Substitutions: Under provisions of Section 01 25 13.
- 2.02 PRODUCT
 - A. Daktronics BA-2017 single-sided baseball scoreboard displays HOME and GUEST scores to 99, INNING to 19, BALL to three, STRIKE to two, and OUT to two, and AT BAT to 99.

2.03 SCOREBOARD

- A. General information
 - 1. Dimensions: 6'-0" (1.83 m) high, 14'-0" (4.27 m) wide, 0'-8" (203 mm) deep
 - 2. Weight: 216 lb (98 kg)
 - 3. Power requirement: 130 W (red/amber digits), 290 W (white digits)
 - 4. Color: provide over 150 colors to choose from
- B. Construction
 - 1. Alcoa aluminum alloy 5052 for excellent corrosion resistance
 - 2. Scoreboard back, face, and perimeter: 0.063" (1.60 mm) thick
 - 3. Scoreboard top and bottom: 0.125" (3.18 mm) thick
- C. Digits
 - 1. LED color: **White**
 - 2. HOME, GUEST, INNING, BALL, STRIKE, OUT, and AT BAT digits: 18" (457 mm) high
 - 3. Seven bar segments per digit
 - 4. PanaView® LED digit technology
 - 5. All digits are sealed front and back with weather-tight silicone gel
- D. Captions
 - 1. Vinyl applied directly to scoreboard face
 - 2. HOME and GUEST captions: 10" (254 mm) high
 - 3. BALL, STRIKE, OUT, AT BAT, and INNING captions: 8" (203 mm) high
 - 4. Color: To be selected by architect from manufacturer's standard range of colors.
- E. Accessory Equipment
 - 1. Vinyl striping applied around the scoreboard face.
 - 2. Custom team name caption in place of HOME.
 - 3. Non-backlit panel 2'-0" high x 14'-0" wide with 4 color custom artwork logo.
 - a. Artwork to be provided during construction.
 - b. Provide at softball field/s.
 - 4. Arched accent truss w/ routed aluminum logo and letters (D and S) model DA-1001-14
 - a. 3'-0" high (at peak) x 14'-0" wide.
 - b. Four color logo artwork to be provided during construction.
 - c. Provide at baseball field/s.

2.04 SCORING CONSOLE

- A. Console is an All Sport® 1600 controller
- B. Scores multiple sports using changeable keyboard inserts
- C. Controls multiple scoreboards and displays, including other All Sport 1600 controlled displays currently owned by customer
- D. Recalls clock, score, and period information if power is lost
- E. Runs Time of Day and Segment Timer modes
- F. Console includes:
 - 1. Rugged aluminum enclosure to house electronics
 - 2. Sealed membrane water-resistant keyboard
 - 3. 32-character LCD to verify entries and recall information currently displayed
 - 4. Power cord that plugs into a standard grounded outlet; 3 watts max
 - 5. Control cable to connect to the control receptacle junction box (wired system only)
 - 6. Soft-sided carrying case
- G. Accessory Equipment
 - 1. **2.4 GHz spread spectrum radio system with frequency hopping technology and 64 non-interfering channels; system includes a transmitter installed inside the console and a receiver installed inside the scoreboard(s)**
 - 2. **Hard carrying case**
 - 3. **Battery pack**

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that mounting structure is ready to receive scoreboard. Verify that placement of conduit and junction boxes are as specified and indicated in plans and shop drawings. Verify concrete has cured adequately according to specifications.

3.02 INSTALLATION

- A. All power and control cables to scoreboards and displays will be routed in conduit. Power to the scoreboards/displays as well as raceways shown on electrical plans by the Electrical Contractor. Scoreboard control wiring including conduit will be the responsibility of the contractor assigned the scoreboard equipment.
- B. Install scoreboards and exterior displays to beams in location detailed and in accordance with manufacturer's instructions. Verify unit is plumb and level.

3.03 INSTALLATION—CONTROL CENTER

- A. Provide boxes, cover plates and jacks in locations per plans.
- B. Test connect control unit to all jacks and check for proper operation of control unit, scoreboard and all features. Leave control unit in carrying case and other loose accessories with owner's designated representative.
- C. Verify earth ground does not exceed 15 ohms.

END OF SECTION

SECTION 11 90 00

MISCELLANEOUS EQUIPMENT

1. PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Bollards.
- B. Range Hood.
- C. Gun Safe.
- D. Kiln.
- E. Fume Hoods.
- F. Flammable Storage Cabinet.
- G. Acid Storage Cabinet.
- H. Locker Room Benches.
- I. Music Storage Cabinets.
- J. Band Uniform Storage Cabinets.
- K. Shower Curtains/Rods.
- L. Privacy Curtains.
- M. Fireproof File Cabinet.
- N. Bird Shock.
- O. Knox Vault.
- P. Dishwasher (Prep Room).
- Q. Dishwasher (Pantry).
- R. Ice Maker.
- S. Goggle Cabinet.
- T. Message Board.
- U. Bike Racks.
- V. Drying Rack.
- W. Anti-Graffiti Coating.
- X. Security Vault.
- Y. Range (Electric)
- Z. Self-Closing Food Service Windows

1.2 REFERENCES

- A. 2010 Americans with Disabilities Act (ADA) Standards for Accessible Design.
- B. CBC - California Building Code, (CCR) California Code of Regulations, Title 24, Part 2.

1.3 SUBMITTALS

- A. Submit product data and manufacturer's installation instructions for each item under provisions of Section 01 33 00.

1.4 REGULATORY REQUIREMENTS

- A. Conform to CBC, California Building Code, (CCR), Title 24, Part 2 and the 2010 ADA Standards for Accessible Design for accessibility.

1.5 OPERATION AND MAINTENANCE DATA

- A. Submit operation and maintenance data under provisions of Section 01 77 00.

2. PART 2 PRODUCTS

2.1 PRODUCTS

- A. Removable Internally Locking Bollard: Model Number SSR06080 Type 316 stainless steel, internally cam locking bollard with electrostatic powder coat finish as manufactured by Cal Pipe Security Bollards, www.calpipebollards.com. Bollard to be 6 inch in diameter, height of 36 inches above finished grade, with a round dome top. Provide bollard storage sleeves and removable lids for closure in same number as active bollards.
- B. Range Hood: Quantity (1) - General Electric (www.geappliances.com) 30 inch wide under cabinet S.S. range hood model JVX5300SJSS with optional remote control located to meet ADA reach requirements per CBC section 11B-308. Install per manufacturer's instructions. Approved equal per requirements in Specification Section 01 25 13.
- C. Gun Safe: Quantity (1) - SteelWater Gun Safes (www.steelwatergunsafes.com) - 59 inch high x 28 inches wide x 18 inch deep Heavy Duty Gun Safe Model EGS5928 with 1 hour UL rating, 450 Gram Dry Pack Dehumidifier, Digital Keypad with emergency Key bypass, and concrete anchor kit. Install per manufacturer's instructions. Approved equal per requirements in Specification Section 01 25 13.
- D. Kiln: Two 3 Phase 240v Rolling Kiln Model KMT-1227 manufactured by Skuit Ceramic Products with envirovent 2, dual intake kit, duct extension kit, and two Model 1227-3pk shelf kits.
- E. Fume Hood (Chemistry and Prep Rooms): Quantity (7) - Labconco (www.labconco.com) 4' Protector XStream Laboratory Fume Hood with 28" sash opening with explosion proof, Vapor tight light fixture and switch, 48 inch wide x 37.7 inch Deep x 59 inch High, Catalog # 110410000, color - Glacier White, with remote fiberglass blower providing 100 fpm at sash in fully open position and all necessary ductwork and Guardian Airflow Monitor - see mechanical drawings. Provide electrical, water, gas, and hazardous waste connections as indicated on electrical and plumbing drawings. Provide 5 feet x 31.7 inch SpillStopper epoxy resinous work surface with 3 inch x 6 inch oval polypropylene cupsink. Provide manufacturer's accessory ceiling closure panel. Provide 4 feet wide ADA base stand catalog model 9938600 by Labconco - color to match hood. Approved equal per requirements in Specification Section 01 25 13.
- F. Flammable Storage Cabinet: 23" Wide x 18" Deep x 35" High Flammable Liquid Safety Storage Cabinet (12 Gal. Capacity) with self-closing doors, Model 1924 with Cabinet Wheel Kit Model 1933 by Eagle Manufacturing (www.interstateproducts.com)
- G. Acid Storage Cabinet: Quantity (as indicated on plans) - Eagle Manufacturing (www.interstateproducts.com) - 39.5 inch Wide x 14.5 inch Deep x 60.5 inch High, 45 Gallon Metal Acid and Corrosive Safety Cabinet (12 Gal. Capacity) with self-closing doors, Model CRA47X. Install per manufacturer's instructions. Approved equal per requirements in Specification Section 01 25 13.

- H. Locker Room Benches: 1-1/2" Tufftec Locker benches with all edges rounded to a 1/4" radius by Scranton Products (www.scrantonproducts.com) of size listed on drawings. Aluminum pedestals shall be 16 inches high, and secured to bench tops with stainless steel tamper resistant Torx head screws and secured to the floor using lead expansion shields with 2 inches stainless steel Phillips head machine bolts. Bench Color selected from manufacturer's standard colors (12 minimum).
- I. Music Storage Cabinets: Musical Instrument Storage Cabinets: Wenger corp., (www.wengercorp.com), band instrument storage cabinets with lockable grille doors. Color to be selected from manufacturer's standard colors.

ROOM B139

<u>Cabinet Model No.</u>	<u>Quantity</u>
05N	3
08N	5
09N	8

ROOM B145

<u>Cabinet Model No.</u>	<u>Quantity</u>
05N, 07N, 11N	1
10N, 12, 13N, 15, 21N	2
05	5
04N	6

ROOM B150 - SHEET MUSIC STORAGE

<u>Cabinet Model No.</u>	<u>Quantity</u>
7 Shelf, 8 Unit	1

- J. Band Uniform Storage Cabinets: Wenger Corp., (www.wengercorp.com), Uniform/Robe Cabinets/Carts with lockable front doors. Color to be selected from manufacturer's standard colors.

ROOM B141

<u>Cabinet/cart</u>	<u>Quantity</u>
32T CS Cart	4
Gearboss Shelf Add-On Bay	8
Gearboss Shelf Starter Bay	3
Gearboss Shelf, 17-1/2"	11
Gearboss Shelf, 30-1/2"	11

ROOM B142

<u>Cabinet/cart</u>	<u>Quantity</u>
48T CS Cart	7

Gearboss Shelf Add-On Bay 9

Gearboss Shelf Starter Bay 3

Gearboss Shelf, 17-1/2" 12

Gearboss Shelf, 30-1/2" 12

- K. Shower Curtains/Rods (Staff Showers C118 and C135): Quantity (2) - Bradley (www.bradleycorp.com) model 9539 Stainless Steel Shower Rod with concealed mounting - 1-1/4 inch O.D. x length as needed per plans and Bradley model 9533 Antimicrobial vinyl shower curtain sized as necessary for shower openings shown on plans - color to be selected by architect from manufacturer's standard colors. Provide model 9536 shower hoods. Install per manufacturer's instructions. Approved equal per requirements in Specification Section 01 25 13.
- L. Privacy Curtains (Cot Room): Quantity (5) - Healthcare Curtains (www.healthcarecurtains.com) Parquet series curtain of color to be selected from manufacturer's standard range with 5000 series track system (style 2). Install per manufacturer's instructions. Approved equal per requirements in Specification Section 01 25 13.
- M. Fireproof Lateral File Cabinet: Quantity (1) - Fire King (www.fireking.com) - 52 inch high x 37 inch wide x 23 inch deep (4) drawer Lateral File Cabinet with 1 hour UL fireproof rating Model 4-3811-C. Color to be selected by architect from manufacturer's (11) standard colors. Install per manufacturer's instructions. Approved equal per requirements in Specification Section 01 25 13.
- N. Bird Shock: As shown on drawings - Bird Barrier America, Inc. (www.birdbarrier.com) Bird-Shock Flex-Track, 110 Volt Charge Unit with intermittent DC output, Ultra-violet stabilized PVC, stainless steel braid-strips (1.5 inch wide x 1/4 inch high), Heavy insulated 14 double gauge copper wire (5/8 inch wide x 3/8 inch high) install per manufacturer's instructions. Approved equal per requirements in Specification Section 01 25 13.
- O. Knox Vault (Auto Entry Gate): Quantity (2) - Knox (www.knoxbox.com) Model 4400 7 inch x 7 inch x 5 inch Knoxvault single lock model, color - black, exterior surface mounted to gates per manufacturer's instructions. Approved equal per requirements in Specification Section 01 25 13.
- P. Dishwasher (Prep Room): Quantity (1) - Hobart (www.Hobartcorp.com) model LxER-Energy Recovery heavy duty dishwasher with built-in booster heater and optional Door Lock and "DWT-LXe" drain water tempering kit. Install per manufacturer's instructions. Approved equal per requirements in Specification Section 01 25 13.
- Q. Dishwasher (Pantry in Building H): Quantity (1) - Summit Appliance Division, Felix Storch, Inc. (www.summitappliance.com) Model "DW2435SSADA" 24 inch wide ADA compliant built-in, ultra quiet (49.0 dBA) stainless steel dishwasher with front controls. Install per manufacturer's instructions. Approved equal per requirements in Specification Section 01 25 13.
- R. Ice Maker (Training Room): Quantity (1) - Hoshizaki (www.hoshizakiamerica.com) Model "F-450MAJ-C" stainless steel ice maker providing cubelet ice with water filter Model "H9320-52" and Hashizaki Model "B-500SF" Bin. Install per manufacturer's instructions and route condensate line to nearest floor sink. Approved equal per requirements in Specification Section 01 25 13.
- S. Germicidal Monitor and Storage Cabinet (Physics, Chemistry, and Biology Classrooms): Quantity (11) - Sellstrom (www.sellstrom.com) Model 2000 Gernicidal Monitor and Storage Cabinet with (8) removable wire racks. Install per manufacturer's instructions. Approved equal per requirements in Specification Section 01 25 13.
- T. Message Board: Quantity (1) - Daktronics (www.daktronics.com) Galaxy Model GS6-40x250-15.85-RGB-SF Full Color Message Board 2'-7" high x 13'-3" wide x 5" deep cabinet with 2'-7" high x 4'-0" wide x 5" deep ad panels on each end. Artwork for ad panels shall be (4) color logos. Graphics to be provided at time of submittal. Provide control software for remote control of Message Display and IPAWS emergency alerts. Mount sign to top of concrete monument sign per manufacturer's instructions. Approved equal per requirements in Specification Section 01 25 13.

- U. Bike Racks: Quantity (as indicated on drawings) - The Park (www.theparkcatalog.com) DoubleUp Single Sided Free-Standing Vertical Bike Rack Model 398-4002 capacity 10 bikes Quantity (5), capacity 6 bikes Quantity (3). Install per manufacturer's instructions. Approved equal per requirements in Specification Section 01 25 13.
- V. Drying Rack: Quantity (7) - Dynalon (www.grainger.com) 24 inch high x 17 inch wide Lab Glassware Drying Rack Model 259184. Install per manufacturer's instructions. Approved equal per requirements in Specification Section 01 25 13.
- W. Anti-Graffiti Coating: Provide at all glass mirrors - Graffiti Shield (www.graffiti-shield.com) Mirror shield cut to size of each mirror and installed per manufacturer's instructions. Approved equal per requirements in Specification Section 01 25 13.
- X. Security Vault: Quantity (1) - Mesa Safe Company (www.mesasafe.com) 59 inch High x 32 inch wide x 22 inch deep 1 hour fire rated Burglary & Fire Safe Model MBF6032e-P with (4) adjustable shelves and combination lock. Install per manufacturer's instructions. Approved equal per requirements in Specification Section 01 25 13.
- Y. Drop-In Electric Range: Quantity (1) - General Electric (www.geappliances.com) Model No. JD630SFSS 30 inch wide drop-in electric range with optional backguard model JXS32SS. Install per manufacturer's instructions. Approved equal per requirements in Specification Section 01 25 13.
- Z. Self-Closing Food Service Windows: Quantity and size as shown on drawings - C.R. Laurence Co., Inc. (www.crlaurence.com) Self-closing window, no bottom track at opening Model No. SCDW-1801DU with transom window and aluminum sliding window pull latch Model No. F2572. Maximum opening size 216 square inches. Provide at all concession stand windows and satellite kitchens. Approved equal per requirement in Specification Section 01 25 13.

3. PART 3 EXECUTION

3.1 INSTALLATION

- A. Install equipment in accordance with manufacturer's printed instructions and as indicated on the drawings.
- B. Furnish all necessary hardware, anchors, inserts, connections, and embedded items necessary for proper installation. Coordinate with work of other sections.

END OF SECTION

SECTION 12 25 13

MOTORIZED WINDOW ROLLER SHADES

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Roller shades, motorized operation and accessories.
 - 1. Intelligent encoded electronic drive system
 - 2. Motor controls, interfaces, and accessories.
- B. Roller shades, manual operation and accessories.
- C. Shade fabric.

1.2 RELATED SECTIONS

- A. Section 09 21 16 - Gypsum Board Assemblies: Coordination with gypsum board assemblies for installation of shade pockets, closures and related accessories.
- B. Section 09 51 13 - Acoustical Ceilings: Coordination with acoustical ceiling systems for installation of shade pockets, closures and related accessories.
- C. Division 16 - Electrical: Electric service for motor controls.

1.3 REFERENCES

- A. ASTM International (ASTM):
 - 1. ASTM G21 - Standard Practice for Determining Resistance of Synthetic Polymeric Materials to Fungi.
- B. Cradle to Cradle Products Innovation Institute (C2C):
 - 1. C2C (DIR) - C2C Certified Products Registry.
- C. National Fire Protection Association (NFPA):
 - 1. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
 - 2. NFPA 701 - Standard Methods of Fire Tests for Flame Propagation of Textiles and Films.
- D. Underwriters Laboratories (UL):
 - 1. UL (GGG) - GREENGUARD Gold Certified Products; Current Edition.
 - 2. UL 325 - Standard for Door, Drapery, Gate, Louver, and Window Operators and Systems; Current Edition, Including All Revisions.
- E. Window Covering Manufacturers Association (WCMA):
 - 1. WCMA A100.1 - Safety of Window Covering Products; 2018.

1.4 ADMINISTRATIVE REQUIREMENTS

- A. Coordination:
 - 1. Where motorized shades are to be controlled by control systems provided under other sections, coordinate the work with other trades to provide compatible products.
 - 2. Coordinate the work with other trades to provide rough-in of electrical wiring as required for installation of hardwired motorized shades.
- B. Preinstallation Meeting: One week prior to commencing work related to this section. Require attendance of all affected installers.
- C. Sequencing:
 - 1. Do not fabricate shades until field dimensions for each opening have been taken with finished conditions in place. "Hold to" dimensions are not acceptable.
 - 2. Do not install shades until final surface finishes and painting are complete.

1.5 SUBMITTALS

- A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
- B. Product Data: Manufacturer's catalog pages and data sheets for products specified including materials, finishes, dimensions, profiles, mountings, and accessories.
 - 1. Preparation instructions and recommendations.
 - 2. Styles, material descriptions, dimensions of individual components, profiles, features, finishes, accessories, and operating instructions.
 - 3. Storage and handling requirements and recommendations.
 - 4. Mounting details and installation methods.
 - 5. Manufacturer's Instructions: Include storage, handling, protection, examination, preparation, and installation.
 - 6. Project Record Documents: Record actual locations of control system components and show interconnecting wiring.
 - 7. Operation and Maintenance Data: Component list with part numbers, and operation and maintenance instructions.
 - 8. Motorized Shades: Power requirements. Typical wiring diagrams including integration of EDU controllers with building management system, audiovisual and lighting control systems as applicable.
- C. Shop Drawings: Plans, elevations, sections, product details, installation details, operational clearances, wiring diagrams and relationship to adjacent work.
 - 1. Prepare control wiring diagrams based on zones, switching and operational requirements provided by the Architect in electronic format.
 - 2. Include one-line diagrams, wire counts, coverage patterns, and physical dimensions of each item.
 - 3. Provide location plan showing all switch and control zones as per the performance requirements of the specifications. All switches, sensors and other control accessories must clearly be shown and called out in a bill of materials.
- A. Shade Automation Schedule: For all shade control zones, provide a detailed schedule of all shade movements throughout the year for a theoretical clear sky. This schedule shall clearly show the time of date, time of day and shade position.
- B. Window Treatment Schedule: For all roller shades. Use same room designations as indicated on the Drawings and include opening sizes and key to typical mounting details.

- C. Verification Samples: For each finish product specified, one complete set of shade components, unassembled, demonstrating compliance with specified requirements.
- 4. Shadecloth Sample: Mark face of material to indicate interior faces.
 - a. Test reports indicating compliance with specified fabric properties.
 - b. Verification Samples: 6 inches (150 mm) square, representing actual materials, color and pattern.
- D. Maintenance Data: Bill of materials for all components with part numbers. Methods for maintaining roller shades, precautions regarding cleaning materials and methods, instructions for operating hardware and controls.
- E. Warranty: Provide manufacturer's warranty documents as specified in this Section.
- F. Warranty: Manufacturer's warranty documents as specified in this Section.

1.6 QUALITY ASSURANCE

- A. Product Listing Organization Qualifications: An organization recognized by OSHA as a Nationally Recognized Testing Laboratory (NRTL) and acceptable to authorities having jurisdiction.
- B. Manufacturer Qualifications: Obtain roller shades system through one source from a single manufacturer with a minimum of ten years experience and minimum of five projects of similar scope and size in manufacturing products comparable to those specified in this section.
- C. Installer for Roller Shade System - Qualifications: Installer trained and certified by the manufacturer with a minimum of ten years experience in installing products comparable to those specified in this section.
 - 1. Requirements for Roller Shade Installer/Contractor:
 - a. Roller Shade Hardware, shade fabric, motor, and all related controls shall be furnished and installed as a complete two-way communicating system and assembly.
 - b. Roller Shade Installer/Contractor shall list all components and systems included in their bid, including but not limited to, the prime manufacturer of the motor control and automated equipment and shall be financially responsible for any change orders and/or back charges required by the BMS, AV, or Lighting Control Systems contractors to interface with the automatic solar tracking system and the motorized roller shade system.
- D. Product Listing Organization Qualifications: Organization recognized by OSHA as a Nationally Recognized Testing Laboratory (NRTL) and acceptable to authorities having jurisdiction.
- E. Fire-Test-Response Characteristics: Passes NFPA 701 small and large-scale vertical burn. Materials tested shall be identical to products proposed for use.
- F. Electrical Components: NFPA Article 100 listed and labeled by either UL or ETL or other testing agency acceptable to authorities having jurisdiction, marked for intended use, and tested as a system. Individual testing of components will not be acceptable in lieu of system testing.

- G. Requirements for Electronic Hardware, Controls, and Switches: Roller shade hardware, shade fabric, EDU, and all related controls shall be furnished and installed as a complete two-way communicating system and assembly.
- H. ShadeCloth Anti-Microbial Characteristics: 'No Growth' per ASTM G 21 results for fungi ATCC9642, ATCC9644, ATCC9645.
- I. Turn-Key Single-Source Responsibility for Wiring Motorized Interior Roller Shades: To control the responsibility for performance of motorized roller shade systems, assign the design, engineering, and installation of motorized roller shade systems, motors, controls, and low voltage electrical control wiring specified in this Section to a single manufacturer and their authorized installer/dealer. The Architect will not produce a set of electrical drawings for the installation of control wiring for the motors, or motor controllers of the motorized roller shades. Power wiring (line voltage), shall be provided by the roller shade installer/dealer, in accordance with the requirements provided by the manufacturer. Coordinate the following with the roller shade installer/dealer:
 - 1. Contractor shall provide power panels and circuits of sufficient size to accommodate roller shade manufacturer's requirements, as indicated on the mechanical and electrical drawings.
 - 2. Contractor shall coordinate with requirements of roller shade installer/dealer, before inaccessible areas are constructed.
 - 3. Roller shade installer/dealer shall run line voltage as dedicated home runs (of sufficient quantity, in sufficient capacity as required) terminating in junction boxes in locations designated by roller shade dealer.
 - 4. Roller shade installer/dealer shall provide and run all line voltage (from the terminating points) to the motor controllers, wire all roller shade motors to the motor controllers, and provide and run low voltage control wiring from motor controllers to switch/ control locations designated by the Architect. All above-ceiling and concealed wiring shall be plenum-rated, or installed in conduit, as required by the electrical code having jurisdiction.
 - 5. Contractor shall provide conduit with pull wire in all areas, which might not be accessible to roller shade contractor due to building design, equipment location or schedule.

1.7 MOCK-UP

- A. Provide a mock-up of one roller shade assembly for evaluation of mounting, appearance and accessories.
 - 1. Locate mock-up in window designated by Architect.
 - 2. Mockup Size: Full size.
 - 3. Intent of mock-up is to demonstrate quality of workmanship and visual appearance.
 - 4. If mock-up is not acceptable, rebuild mock-up until satisfactory results are achieved.
 - 5. Do not proceed with remaining work until, mock-up is accepted by Architect.
 - 6. Retain mock-up during construction as a standard for comparison with completed work.
 - 7. Full-sized mock-up may become part of the final installation.

1.8 DELIVERY, STORAGE, AND HANDLING

- A. Deliver in factory-labeled packages, marked with manufacturer and product name, fire-test-response characteristics, and location of installation using same room designations indicated on Drawings and in Window Treatment Schedule.

- B. Store and handle products per manufacturer's recommendations.

1.9 PROJECT CONDITIONS

- A. Environmental Limitations: Install roller shades after finish work including painting is complete and ambient temperature and humidity conditions are maintained at the levels indicated for Project when occupied for its intended use.

1.10 WARRANTY

- A. Roller Shade Hardware and Chain Warranty: Manufacturer's standard non-depreciating warranty for interior shading.
 - 1. Shade Hardware: 10 years unless otherwise indicated.
 - a. Mecho/5 with Soho fabric: 25 years.
 - b. ElectroShade with Soho fabric: 25 years.
 - 2. Standard Shadecloth: Manufacturer's standard twenty-five year warranty.
 - 3. Roller Shade Motors, Motor Control Systems, and Accessories: Manufacturer's standard non-depreciating five year warranty.
 - 4. Roller Shade Installation: One year from date of Substantial Completion, not including scaffolding, lifts or other means to reach inaccessible areas, which are deemed owners responsibility.

PART 2 PRODUCTS

2.1 MANUFACTURERS

- A. Acceptable Manufacturer: Mecho, which is located at: 42-03 35th St.; Long Island City, NY 11101; ASD Tel: 718-729-2020; Fax: 718-729-2941; Email: marketing@mechoshade.com; Web: www.mechoshade.com.
- B. Substitutions: Under provisions of Section 01 25 13.

2.2 ROLLER SHADES, MOTORIZED OPERATION AND ACCESSORIES

- A. Shade System; General:
 - 1. Motorized Shades: Comply with NFPA 70.
 - 2. Components capable of being removed or adjusted without removing mounted shade brackets.
 - 3. Operates smoothly when raising or lowering shades.
 - 4. Electrical Components: Listed, classified, and labeled as suitable for intended purpose. Test as total system. Individual component testing is acceptable.
 - a. Components: FCC compliant where applicable.
- B. Basis of Design: ElectroShade with WhisperShade IQ2 EDU. As manufactured by MechoShade Systems LLC. Motor operated fabric window shade system complete with mounting brackets, roller tubes, hembars, hardware, and accessories.
 - 1. Voltage: 24 VDC
 - 2. Description: Single roller.
 - 3. Drop Position: Regular roll.
 - 4. Mounting: Wall mounted unless noted otherwise.
 - 5. Size: As indicated on drawings.
 - 6. Fabric: As indicated under Shade Fabric article.

7. Brackets and Mounting Hardware: As recommended by manufacturer for mounting indicated and to accommodate shade fabric roll-up size and weight.
 - a. Material: Steel, 1/8 inch (3 mm) thick.
 - b. Multiple Shade Operation: Provide hardware as necessary to operate more than one shade using a single motor.
8. Roller Tubes:
 - a. Material: Extruded aluminum.
 - b. Size: As recommended by manufacturer; selected for suitability for installation conditions, span, and weight of shades.
 - c. Fabric Attachment: Utilize extruded channel in tube to accept vinyl spline welded to fabric edge. Shade band to be removable and replaceable without removing roller tube from brackets or inserting spline from the side of the roller tube.
9. Hembars: Designed to maintain bottom of shade straight and flat.
 - a. Style: Full wrap fabric covered bottom bar, flat profile with heat sealed closed ends.
 - b. Fascia: Removable extruded aluminum fascia, size as required to conceal shade mounting, attachable to brackets without exposed fasteners.
 - 1) Finish: Anodized.
 - 2) Capable of installation across two or more shade bands in one piece.
 - 3) Color: Bronze.
 - 4) Profile: Square.
 - 5) Configuration: Captured, fascia stops at captured bracket end.
10. Accessories:
 - a. Fascia: Removable extruded aluminum. Size as required to conceal shade mounting. Attachable to brackets without exposed fasteners.
 - 1) Finish: Baked enamel.
 - a) Color: To be selected by architect from full range of colors.
 - 2) Can be installed across two or more shade bands in one piece.
 - 3) Profile: Square.
 - 4) Configuration: Captured, fascia stops at captured bracket end.
 - b. Ceiling Pockets with Prewired Raceway:
 - 1) Basis of Design: ElectroPocket; Model 4156 without tile support. As manufactured by MechoShade Systems LLC. [UL 325](#) listed, extruded aluminum shade pocket for recess mounting in acoustical tile or drywall ceilings; size and configuration as indicated on drawings.
 - a) Removable closure panel.
 - b) Installed on wall or steel beam.
 - 2) Designed to accommodate installation of motor control and wiring accessories within pocket including, but not limited to, line voltage disconnect modular connector, MechoNet Wireless Controller, IQ2 Dual Splitter, and non-plenum rated daisy chain wiring.
 - c.
- C. Basis of Design: UrbanShade. As manufactured by MechoShade Systems LLC. Fabric window shade system complete with mounting brackets, roller tubes, hembars, hardware, and accessories.
 1. Drop Position: Regular. Fabric falls off roller tube, close to glass
 2. Mounting: Wall mounted U.N.O.
 3. Size: As indicated on drawings.
 4. Fabric: As indicated under Shade Fabric article.

5. Brackets and Mounting Hardware: Stamped steel. As recommended by manufacturer for mounting indicated accommodating shade fabric roll-up size and weight.
6. Roller Tubes: Extruded aluminum. Capable of being removed and reinstalled without affecting roller shade limit adjustments.
 - a. Size: As recommended by manufacturer; for installation conditions, span, and weight of shades.
 - b. Fabric Attachment: Extruded channel in tube accepts vinyl spline welded to fabric edge.
 - 1) Shade Band: Removable and replaceable without removing roller tube from brackets or inserting spline from the side of the roller tube.
7. Hembars: Maintains bottom of shade straight and flat.
 - a. Style: Full wrap fabric covered bottom bar, flat profile with heat sealed closed ends.
8. Manual Operation:
 - a. Clutch Operator: Manufacturer's standard material and design integrated with bracket/brake assembly.
 - 1) Brake Assembly: Mounted on a low-friction plastic hub with wrapped spring clutch.
 - a) Brake must withstand minimum pull force of 25 lbs (12 kg) in stopped position.
 - 2) Clutch/Brake Mounting: On support brackets, independent of roller tube components.
 - b. Lift Assist Mechanism: Provide manufacturer's standard device, contained in the idler end of roller tube, when hanging weights exceed roller tube weight limits.
9. Accessories:
 - a. Fascia: Removable extruded aluminum. Size as required to conceal shade mounting. Attachable to brackets without exposed fasteners.
 - 1) Finish: Baked enamel.
 - a) Color: To be selected by architect from full range of colors.
 - 2) Can be installed across two or more shade bands in one piece.
 - 3) Profile: Square.
 - 4) Configuration: Captured, fascia stops at captured bracket end.

2.3 INTELLIGENT ENCODED ELECTRONIC DRIVE SYSTEM

- A. Electronic Drive Unit (EDU) System General Requirements:
 1. A UL 325 listed solution.
 - a. Component certification in lieu of system testing is not acceptable.
 2. Listing Label and Motor Rating: To be visible for inspection without dismounting of shade assembly to remove motor or EDU from shade roller tube.
 3. Size and Configuration: As recommended by manufacturer for type, size, and arrangement of shades.
 4. Conceal EDU inside shade roller tube.
 5. EDU Rated Speed: The same nominal speed for shades in the same room.
 6. Hanging Weight of Shade Band: 80 percent of rated lifting capacity of shade EDU and tube assembly.
 7. Capable of upgrading firmware from anywhere on network without touching the motor.

- B. Low Voltage EDU (24 VDC):
1. Basis of Design: MechoShade Systems LLC; WhisperShade IQ2-DC System. Tubular, asynchronous, integral DC motor. 24 VDC; temperature Class B, thermally-protected, totally enclosed, maintenance-free. Powered by low voltage power supply connection equipped with disconnect plug assembly furnished with EDU.
 2. Audible Noise: 38 dBA measured 3 ft (914 mm) from motor unit, depending on motor torque.
 3. Nominal Speed: 10 to 28 RPM. Configurable. Speed managed such that it does not vary due to load/lift capacity.
 4. Low voltage power supply for powering external accessories connected to either the dry contact or network port.
 - a. Products that require accessories to be powered by a plug-in or externally-supplied power supply are not acceptable.
 5. Override Mode: Place motor into Override Mode when local switch commands shade to new position.
 - a. Local switch command sources:
 - 1) Keypad connected to EDU dry contact inputs.
 - 2) Third-party system connected to EDU dry contact inputs.
 - 3) Network keypad or other device that serially communicates with EDU and configured to issue override commands as if it were a local switch connected to EDU dry contact inputs.
 - b. Entering Override Mode: Monitor and log positioning commands from automation devices. Do not act until exiting Override Mode.
 - c. Return from Override Mode: Position shade to last commanded position in log.
 - d. Automated Return from Override Mode:
 - 1) Override Return Timer: When Override Mode is entered by changing shade position with local switch as described above, Enable override return timer to make these changes temporary such that automation can regain control of shade after configurable time duration (default of 60 minutes).
 - 2) Pocket temperature sensor integral to EDU to track pocket temperature.
 - a) When shade is in Override Mode and Heat Gain Sensing is Enabled: Sensor determines when direct sunlight and associated solar heat gain has left the window.
 - 1) When this condition occurs, after the shade has been overridden to cover the window, EDU to return from Override Mode if Override Return Timer has not done so already in order for automation controllers to once again optimize shade position for exposure to daylight.
 6. Preventative Maintenance:
 - a. Internally monitor important operating parameters to ensure motor and its shade assembly are functioning properly.
 - b. Performance Degradation: Provide visual indication via feedback LED and communicate warnings on repetitive basis through its serial port.
 - c. Warning Conditions: Logged and queryable. Allow sending of multiple warnings until condition is acknowledged.
 - d. Stop shade rotation for parameters of critical concern until reset by trained technician after being serviced.
 - e. Devices capable of receiving warnings include SolarTrac automated solar-evaluation control system.

- f. Tracked Parameters to include:
 - 1) Operating life (cycles, hours).
 - 2) Pocket temperature.
 - 3) Internal motor temperature.
 - 4) Vibration.
 - 5) Stall.
 - 6) Power reset.
 - 7) Maintenance Mode.
 - 8) Speed regulation.
 - 9) Position targeting.
 - 10) Movement without command.
 - 11) One Bus availability.
 - g. Detectable Potential Warning Conditions to Include:
 - 1) Assembly vibration/bearing wear warning.
 - 2) Tube/shade assembly drop.
 - 3) Fabric hung-up/telescoping.
 - 4) Motor mount warning.
 - 5) Lifecycle replacement warning.
 - 6) Brake/limit failure.
 - 7) Network warning.
 - 8) Motor internal temperature warning.
 - 9) Pocket temperature warning.
- C. Modes of Operation:
 - 1. Uniform Mode: Shades move to defined intermediate stop positions in order to maintain aesthetic uniformity.
 - 2. Normal Mode: Shades move to defined intermediate stop positions and any position between defined upper and lower limits.
 - 3. Maintenance Mode: Prevents shade from moving via dry contact or network control commands mode has been cleared/disabled.
- D. Alignment Positions:
 - 1. Repeatable and precisely aligned shade positions and limits.
 - a. Support positioning commands from 0 to 100 percent in 1 percent increments.
 - b. Customizable Presets: 32.
 - c. Include three intermediate dry contact presets
 - 2. Shades on same switch circuit or same network group address with same opening height, to align at each intermediate stopping position when traveling from any position, up or down.
 - 3. Shades of differing heights: Capable of custom, aligned intermediate stop positions when traveling from any position, up or down.
 - 4. Alignment of shade bands mechanically aligned on same EDU: Plus or minus 0.125 inch (3 mm).
 - 5. Alignment of standard shades on adjacent EDUs: Plus or minus 0.25 inch (6 mm) when commanded to same alignment position.
- E. Local Switch Presets:
 - 1. Minimum of three customizable preset positions accessible over the local dry contact control inputs and over the network connection.
 - 2. Preset positions: Customizable to any position between and including defined upper and lower limits (initially defaults to 25, 50, and 75 percent of shade travel).

3. Configuration of Custom Preset Positions: A handheld removable program module/configurator or a local switch.

2.4 MOTOR CONTROLS, INTERFACES, AND ACCESSORIES

- A. Unless indicated to be excluded, provide required equipment as necessary for a complete operating system providing the control intent specified. Provide components and connections necessary to interface with other systems as indicated.
- B. Wireless Controls:
 1. MechoNet Wireless Controllers:
 - a. Serves as gateway, router, and controller between EnOcean wireless devices and MechoNet network.
 - b. Communicates with EnOcean wireless devices via 902 MHz RF. Supports wireless daylight sensors, occupancy/vacancy sensors, and switches.
 - c. Controller to manage up to 16 EnOcean wireless devices.
 - d. Controller to be configurable to one of two modes of operation:
 - 1) SolarTrac Mode: Relays EnOcean wireless sensor and control information to SolarTrac automatic solar-evaluation control system.
 - 2) Solar Activated Control Mode: Utilizes EnOcean wireless sensor and control information for internal automation algorithms to adjust shade positions.
 - a) Adjusts shade positions based daylight sensors input optimizing visual comfort. Enables five shade positions; full-up, full-down, and three configurable intermediate preset stop positions. Default of three positions; full-up, full-down, and preset number two.
 - b) Configurable daylight thresholds for shade positions. Includes configurable hysteresis setting, default of 20 percent, preventing frequent cycling of shades during fluctuating daylight conditions.
 - c) Configurable delay timers inhibit shade position changes due to short duration changes in daylight conditions. Default of 300 seconds delay for up, 60 seconds delay for down.
 - d) Night Mode: Configurable night time shade position to support light pollution, privacy, and/or energy conservation requirements. Configurable daylight threshold. Default of 18.6 footcandles (200 lux), Duration: Default of 60 minutes to enter night mode, 30 minutes to exit night mode.
 - e) Occupancy/Vacancy: Where wireless occupancy/vacancy sensors are specified, enables configurable unoccupied/vacant mode shade position (default of full-down) to optimize energy conservation. Configurable timers for detection of unoccupied and occupied states.
 - f) Manual Override: Where local switches are specified. Enables manual temporary override of shade positions for configurable duration. Default of 60 minutes.
 - g) Retract Mode: Manages changes to light level based on shade position for comfort and increasing exposure of occupant to daylight. Shades move up in stepped one-position increments as daylight levels drop. Each step is maintained for one minute while controller retests daylight conditions before authorizing the next step until target is reached.

- e. Capable of being powered by a dedicated low-voltage power supply or through certain MechoNet devices without additional power supplies.
 - f. Multiple sensors to be configurable to automate the same shade control zone in order to ensure operation based on worst case comfort conditions across the zone.
 - g. Sensors to be configurable to automate multiple shade control zones.
 - h. Maintain a circular log of previous 48 hours of data received from each of 16 possible wireless devices. Data to be capable of being downloaded and stored for record keeping, performance optimization, or troubleshooting purposes.
2. Wireless Daylight Sensors:
- a. Monitors daylight through curtainwall and communicates with MechoNet Wireless Controller. Adjusts shade position based on user-defined light thresholds.
 - b. Powered by integral photovoltaic cells. No batteries or external power supplies.
 - c. Data Transmission:
 - 1) Provide the following data with each message:
 - a) Charge level.
 - b) Illuminance: 0 to 6,100 footcandles (0 to 65,656 lux). Plus or minus 5 percent accuracy.
 - 2) Transmit message when daylight level changes by three percent.
 - 3) Transmit "heartbeat" message once per minute during daylight and once per hour at night for determining when maintenance/support is required.
 - d. Mountable horizontally, vertically, and upside-down on mullion without screws.
3. Wireless Occupancy Sensors:
- a. Monitor room/area occupancy. Communicate with MechoNet Wireless Controller optimizing shade positions.
 - b. Solar-powered with battery backup.
 - c. Passive infrared (PIR) sensing.
 - d. Ceiling-mounted with 360 degree angle of detection optimized for ceiling height between 8 and 10 feet (2.4 and 3.0 m).
4. Wireless Switches:
- a. Communicates with MechoNet Wireless Controller. Adjusts shade positions based on switch operation.
 - b. Enables manual local control or network control of any individual shade motor or shade group/sub-group on MechoNet network.
 - c. Self-powered via rocker switch operation.
 - d. Finish: White.

2.5 ROLLER SHADE FABRICATION

- A. Field measure finished openings prior to ordering or fabrication.
- B. Dimensional Tolerances: Fabricate shades to fit openings within specified tolerances.
 - 1. Vertical Dimensions: Fill openings from window head to window sill or door head with 1/2 inch (13 mm) space between bottom bar and window stool.
 - 2. Horizontal Dimensions: Outside mounting.
 - a. Cover window frames, trim, and casings completely.
- C. Openings Requiring Continuous Multiple Shade Units with Separate Rollers: Locate roller joints at window mullion centers; butt rollers end-to-end.

2.6 SHADE FABRIC

- A. Basis of Design: Shade fabric as manufactured by MechoShade Systems LLC.
 - 1. Solar Shadecloths:
 - a. Fabric: Soho: 1100 series. 1 percent open. 2 x 2 basket-weave pattern of fine yarn PVC and polyester blend, same colors as in 1600 (3 percent open). Use at non-motorized shades.
 - b. Fabric: Soho: 1600 series. 3 percent open. 2 x 2 basket-weave pattern of fine yarn PVC and polyester blend, same colors as in 1100 series (1 percent open). Use at motorized shades.
 - c. Color: Selected from manufacturer's standard colors.
 - 2. Performance Requirements:
 - a. Flammability per NFPA 701: Pass. Large or small scale test.
 - b. Fungal Resistance: No growth when tested per ASTM G21.
 - 3. Openness Factor: one percent, nominal or three percent as indicated.
 - 4. Roll Width: 126 inches (1829 mm) maximum.
 - 5. Color: As selected by Architect from manufacturer's full range of colors.
 - 6. Fabrication:
 - a. Fabric Orientation: Railroaded, fabric is turned 90 degrees off the roll.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Do not begin installation until substrates have been properly prepared.
- B. If substrate preparation is the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.
- C. Start of installation shall be considered acceptance of substrates.

3.2 PREPARATION

- A. Clean surfaces thoroughly prior to installation.
- B. Prepare surfaces using methods recommended by manufacturer for achieving best result for substrate under the project conditions.
- C. Coordinate with window installation and placement of concealed blocking to support shades.

3.3 INSTALLATION

- A. Install shades level, plumb, square, and true per manufacturer's instructions and approved shop drawings. Locate so shade band is at least 2 inches (51 mm) from interior face of glass. Allow proper clearances for window operation hardware. Use mounting devices as indicated.
- B. Replace shades exceeding specified tolerances at no extra cost to Owner.
- C. Adjust and balance roller shades to operate smoothly, easily, safely, and free from binding or malfunction throughout entire operational range. Adjust level, projection, and shade centering from mounting bracket. Verify there is no telescoping of shade fabric.
- D. Clean roller shade surfaces after installation, per manufacturer's written instructions.

- E. Demonstrate operation and maintenance of window shade system to Owner's personnel.
- F. Manufacturer's authorized personnel are to train Owner's personnel on operation and maintenance of system.
 - 1. Use operation and maintenance manual as a reference, supplemented with additional training materials as required.

3.4 SYSTEM STARTUP

- A. Motorized Shade System: Provide services of a manufacturer's authorized representative to perform system startup.
- B. Turn-Key Single-Source Responsibility for Motorized Interior Roller Shades: Design, engineering, and installation of motorized roller shade systems, motors, controls, and low voltage electrical control wiring specified is to be performed by a single manufacturer and their authorized installer/dealer.
 - 1. The Architect will not provide a set of electrical drawings for installation of control wiring for motors, or motor controllers of motorized roller shades.
 - 2. Power wiring (line voltage), to be provided by roller shade installer/dealer, per requirements provided by manufacturer. Coordinate following with roller shade installer/dealer:
 - 3. Contractor to Provide the Following:
 - a. Power Panels and Circuits: Size to accommodate roller shade manufacturer's requirements, as indicated on mechanical and electrical drawings.
 - b. Coordinate with requirements of roller shade installer/dealer, before inaccessible areas are constructed.
 - c. Line voltage as dedicated home runs, of sufficient quantity, and capacity as required. Terminate in junction boxes at locations designated by roller shade installer/dealer.
 - d. Run line voltage from terminating points to motor controllers. Wire roller shade motors to motor controllers. Run low voltage control wiring from motor controllers to switch/control locations designated by Architect.
 - 1) Above-ceiling and concealed wiring to be plenum-rated, or in conduit, as required by the electrical code having jurisdiction.
 - e. Use conduit with pull wire in areas, not accessible to roller shade contractor due to building design, equipment location or schedule.

3.5 PROTECTION AND CLEANING

- A. Protect installed products until completion of project.
- B. Touch-up, repair or replace damaged products before Substantial Completion.
 - 1. Clean soiled shades and exposed components as recommended by manufacturer.
 - 2. Replace shades that cannot be cleaned to "like new" condition.

END OF SECTION

SECTION 12 48 43

FLOOR MATS

1. PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Walk off carpet tile mat.
- B. Tapered transition molding.

1.2 SUBMITTALS

- A. Submit product data and samples under provisions of Section 01 33 00.
- B. Product Data: Include manufacturer's specifications and installation instructions, construction details, material descriptions, dimensions of individual components and profiles, and finishes for floor mat and transition strip.
- C. Samples: Provide two, 6-inch square sections of floor mat, and two, 6-inch long sections of tapered transition molding showing each color available.

1.3 REGULATORY REQUIREMENTS

- A. Accessibility: Comply with accessibility requirements of the CBC - California Building Code, (CCR) California Code of Regulations, Title 24, Part 2, and the 2010 Americans with Disabilities Act (ADA), Standards for Accessible Design.

1.4 COORDINATION

- A. Coordinate size and location of areas to receive floor mats.

1.5 OPERATION AND MAINTENANCE DATA

- A. Submit maintenance data under provisions of Section 01 77 00.
- B. Maintenance Data: Provide data for cleaning and maintaining floor mats.

1.6 EXTRA MATERIALS

- A. Submit maintenance materials under the provisions of Section 01 77 00.
- B. Provide 50 square feet of floor matting and 20 lineal feet of transition molding.

2. PART 2 PRODUCTS

2.1 FLOOR MATS

- A. Walk- Off Carpet Tile Mat:
 - 1. The Mohawk Group, Collection; Tuff Stuff II, Style; First Step II, 24 x 24 inch square tile, 0.25 inch pile height. www.mohawkgroup.com. Color as selected by Architect from manufacturer's entire selection.
 - 2. Shaw Industries, Inc., Collection: Steppin Out, Style; Entrée Tile, 24 x 24 inch square tile, 0.25 inch pile height. www.shawcontract.com. Color as selected by Architect from manufacturer's entire selection.
- B. Tapered Transition Molding: Tapered vinyl or rubber carpet type edge moldings at all exposed edges of mat, with mitered corners. Color as selected by Architect.

- C. Substitutions: Under provisions of Section 01 25 13.

3. PART 3 EXECUTION

3.1 EXAMINATION

- A. Examine substrates and floor conditions, for compliance with requirements for location, sizes, and other conditions affecting installation of floor mats.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. Defer installation of floor mats until project is near Substantial Completion.
- B. Install units to comply with manufacturer's written instructions at locations indicated.
- C. Install units in continuous strip pattern.

3.3 PROTECTION

- A. Provide temporary cover of plywood or fiberboard as protective flooring over floor mats.
- B. Maintain protection until construction traffic has ended and project is near Substantial Completion.

END OF SECTION

SECTION 12 61 00

FIXED AUDIENCE SEATING

PART 1 GENERAL SPECIFICATIONS

1.1 SUMMARY:

- A. Deliver and install fixed padded and upholstered chairs as specified, floor mounted, with self-lifting seat that rises to a uniform 3/4-safety fold position.

1.2 RELATED SECTIONS

- A. Division 26 Sections for electrical connections to aisle lighting fixtures

1.3 REFERENCES

- A. Fixed seating for areas of public assembly shall comply with all requirements of CBC Section 11B-221.
- B. Comply with applicable portions of the reference standards listed below.
- C. American National Standards Institute/Hardwood Plywood and Veneer Association (ANSI/HPVA):
 - 1. ANSI/HPVA-1-2000 – American National Standard for Hardwood and Decorative Plywood
- D. American Society for Testing and Materials:
 - 1. ASTM A36/A36M-08 – Standard Specification for Carbon Structural Steel
 - 2. ASTM A513-12 - Standard Specification for Electric-Resistance-Welded Carbon and Alloy Steel Mechanical Tubing
 - 3. ASTM A1008/A1008M-12 – Standard Specification for Steel, Sheet, Cold-Rolled, Carbon, Structural, high Strength Low-Alloy and high Strength Low-Alloy with Improved Formability
 - 4. ASTM A1011/A1011M-12 – Standard Specification for Steel, Sheet and Strip, Hot-Rolled, Carbon, Structural, High-Strength Low-Alloy and High-Strength Low-Alloy with Improved Formability
 - 5. ASTM D4157-10 - Standard Test Method for Abrasion Resistance of Textile Fabrics (Ocillatory Cylinder Method)
 - 6. ASTM F851-87(2005) - Standard Test Method for Self-Rising Seat Mechanisms
 - 7. ASTM B 85: Aluminum Alloy Die Castings
- E. State of California, Department of Consumers Affairs, Bureau of Home Furnishings and Thermal Insulation:
 - 1. California Technical Bulletin 117 – Requirements, Test Procedures and Apparatus for Testing Flame Retardance of Resilient Filling Materials Used in Upholstered Furniture.
 - 2. California Technical Bulletin 133 – Flammability Test Procedure for Seating Furniture for Use in Public Occupancies.

- F. National Electrical Manufacturers Association (NEMA):
 - 1. NEMA LD 3 – High Pressure Decorative Laminates.
- G. California Electrical Code (C.E.C.)
- H. Underwriters' Laboratories, Inc. (UL) and Underwriters' Laboratories of Canada (ULC):
 - 1. Requirements for listing and labeling of products.

1.4 SUBMITTALS:

- A. Product data for each chair model specified to include construction details, material descriptions and finish options
- B. Product Data:
 - 1. Manufacturer's product description with performance data and characteristics.
 - 2. Regulatory approvals including fire tests.
 - 3. Manufacturer's installation instructions for floor and riser-mounted seating.
 - 4. Data sheet for seat end aisle light when applicable including type of light source, color temperature in CCT kelvin, dimming capability, manufacturer.
 - 5. Data sheet for seat end light voltage reduction device, when applicable, including manufacturer and model #, primary and secondary voltages, output current, number of fixture that can be connected and recommended maximum output wiring lengths.
- C. Shop Drawings:
 - 1. Seating layout (shop drawings) developed from the contract drawings that show aisle widths, chair spacing for each row, row-lettering and chair-numbering scheme, chair dimensions and back pitch. Layout drawings to also include locations for accessories, including left- and right-hand tablet arms and electrical devices, if any, accessibility provisions and attachments to other work.
 - 2. Submit initial shop drawing. Take field measurements and resubmit shop drawing with verified dimensions.
 - 3. Furnish CAD drawing without seat layout showing field dimensions as verified by the installation contractor. Architect will provide a revised layout reflecting the field dimensions. Make final layout shop drawings from this and submit with justification of any deviations from Architect's layout.
 - 4. Final seating layout developed from Architect's revised layout, which shows aisle widths, chair spacing for each row, row lettering and chair numbering scheme, chair dimensions, back pitch, floor mount details and ADA ends.
 - 5. Seating layouts installed without approved final layout are subject to remanufacture and reinstallation as needed to achieve desired layout. All additional costs for such changes will be borne by contractor.

- D. Samples for verification & finish selection to include: Submit, for verification purposes, samples of each exposed material from which seating units and accessories are composed, in each color, finish, pattern, and texture indicated. If these qualities are not indicated, submit, for initial selection, manufacturer's color charts of samples of actual materials showing full range of standard colors, finishes, patterns, and textures available. Include samples of the following:
1. Initial finish selections to be made from manufacturer's full range of standard color and fabric guides.
 2. Final powder coat selection to be approved from manufacturers standard-sized samples not less than 1" x 3".
 3. Final laminate selection to be approved from manufacturers standard-sized samples not less than 2" x 2".
 4. Final plastic color selection to be approved from manufacturers standard-sized samples not less than 2" x 3".
 5. Final wood finish selection to be approved from manufacturers standard-sized samples not less than 4" x 3".
 6. Final upholstery fabric selection to be approved from Abescon Mills Sherpa Shire line of fabric. Provide standard swatch size.
 7. Aisle light (if applicable) submit one (1) full-sized working sample mounted to end arm panel and manufacturer's photometric data.
 8. Seat padding: submit one (1) foot square sample.
 9. Row-Letter and Chair-Number Plates: Full-size units showing base material and letters and numbers font.
- E. Product certificates: Provide manufacturer's certification of flame-retardant treatment (if required.)
- F. Maintenance instructions and inspection guidelines furnished for each chair model specified.
- G. Manufacturer's standard warranty.
- H. Mock-up: Submit mock-up of section of seating consisting of two chairs representing extremes of width to be provided; include at least one aisle unit with end standard and working aisle light fixture. After approval, undamaged chair samples may be incorporated into project.

1.5 QUALITY ASSURANCE:

- A. Source Limitations:
1. Obtain each type of fixed seating required, including accessories and mounting components, from a single manufacturer.
 2. Obtain fabric of a single dye lot for each color and pattern of fabric required except when yardage requirement exceeds maximum dye lot. Multiple dye lots shall be color matched for quality assurance.
- B. Fire Performance Characteristics of Upholstered Seating:
1. Fabric shall be Class 1 according to DOC CS 191 and 16 CFR 1610.61, tested according to California Technical Bulletin 117.
 2. Padding shall comply with California Technical Bulletin 117.

- C. Electrical Components: Listed and labeled as defined in NFPA 70, by UL or other qualified testing agency acceptable to authorities having jurisdiction.
- D. Regulatory Requirements: Provide fixed audience seating to comply with 2010 ADA Standards and 2016 CBC.
- E. Field Dimensioning: After approval of submittals but prior to fabrication, confirm dimensions of fixed audience seating space, including features that will affect installation. Confirm location of electrical rough-in.
- F. Build sample chairs for each model required to demonstrate aesthetic effects and set quality standards for fabrication.
- G. References
 - 1. Comply with applicable portions of the reference standards listed below.
 - 2. American National Standards Institute/Hardwood Plywood and Veneer Association (ANSI/HPVA):
 - (a) ANSI/HPVA-1-2000 – American National Standard for Hardwood and Decorative Plywood
 - 3. American Society for Testing and Materials:
 - (a) ASTM A36/A36M-08 – Standard Specification for Carbon Structural Steel
 - (b) ASTM A513-12 - Standard Specification for Electric-Resistance-Welded Carbon and Alloy Steel Mechanical Tubing
 - (c) ASTM A1008/A1008M-12 – Standard Specification for Steel, Sheet, Cold-Rolled, Carbon, Structural, high Strength Low-Alloy and high Strength Low-Alloy with Improved Formability
 - (d) ASTM A1011/A1011M-12 – Standard Specification for Steel, Sheet and Strip, Hot-Rolled, Carbon, Structural, High-Strength Low-Alloy and High-Strength Low-Alloy with Improved Formability
 - (e) ASTM D4157-10 - Standard Test Method for Abrasion Resistance of Textile Fabrics (Oscillatory Cylinder Method)
 - (f) ASTM F851-87(2005) - Standard Test Method for Self-Rising Seat Mechanisms
 - (g) ASTM B 85: Aluminum Alloy Die Castings
 - 4. State of California, Department of Consumers Affairs, Bureau of Home Furnishings and Thermal Insulation:
 - (a) California Technical Bulletin 117 – Requirements, Test Procedures and Apparatus for Testing Flame Retardance of Resilient Filling Materials Used in Upholstered Furniture.
 - (b) California Technical Bulletin 133 – Flammability Test Procedure for Seating Furniture for Use in Public Occupancies.
 - 5. National Electrical Manufacturers Association (NEMA):
 - (a) NEMA LD 3 – High Pressure Decorative Laminates.

6. National Fire Protection Association:
 - (a) NFPA 70 – National Electrical Code (NEC).
7. Underwriters' Laboratories, Inc. (UL) and Underwriters' Laboratories of Canada (ULC):
 - (a) Requirements for listing and labeling of products.
- H. Sizes and Layout: Provide varying width backs and seats as necessary to comply with Architect's plan, with standards in each row spaced laterally so that end standards are in alignment from first to last row where arrangement of seats allows, regardless of whether aisles are constant width or converging. Seats which do not use different seat and back sizes to achieve varying widths are not acceptable. Widths required: 20", 21", 22", 23".
- I. Fixed seating shall comply with California Building Code including all seating requirements of CBC Section 11B-221.

1.6 QUALIFICATIONS

- A. Manufacturer: Company specializing in the manufacturer of upholstered chairs for performing arts with a minimum of 5 years documented experience and 5 projects of similar scope within the last 3 years.
- B. Installer: Company specializing in the installation of upholstered chairs for performing arts with a minimum of 5 years documented experience and 5 projects of similar scope within the last 3 years, and approved by the manufacturer.

1.7 PROJECT CONDITIONS:

- A. Environmental Limitations:
 1. Do not deliver or install seating until spaces are enclosed and weather tight, wet work in spaces is complete and dry, work above ceilings is complete, and temporary or permanent HVAC system is operating and maintaining ambient temperature and humidity at occupancy levels during the remainder of the construction period.
 2. Storage: Store materials in a clean, secure area, free of dust and construction debris, off the ground, protected from ground moisture and weather elements and away from mechanical abuse in the vicinity of their installation.
- B. Field Measurements:
 1. Take field measurements to verify or supplement dimensions indicated on contract drawings prior to manufacturing. Resubmit shop drawing with field measurements.

1.8 PROJECT COORDINATION:

- A. Do not deliver or install seating until space is free of lifts and/or scaffolding used by other trades which may interfere with installation and/or damage seating.
- B. Coordinate layout and installation of junction boxes, electrical wiring and devices with electrical contractor to ensure that floor junction boxes for electrical devices are accurately located for final connection to the building's power supply by the electrical contractor.
- C. Coordination of transformer(s) and driver(s) for Aisle Seat lights with Division 26.
- D. Coordinate layout and installation of seating with HVAC contractor to ensure that vents are located in a manner that will not interfere with seating installation.

- E. Coordinate concrete requirements needed for proper installation.
- F. Pre-Installation Conference and Inspection:
 - 1. Convene in accordance with Section 01.
 - 2. Resolve coordination issues with other subcontractors affecting the timely and proper installation of work under this Section including, but not limited to concrete tolerances and electrical connections.

1.9 DELIVERY AND STORAGE

- A. Delivery: Deliver chairs to the site only after the building has been fully enclosed.
- B. Storage: Store materials in a clean, secure area, free of dust and construction debris, off the ground, protected from ground moisture and weather elements and away from mechanical abuse in the vicinity of their installation.
- C. Deliver materials in manufacturer's unopened packaging.

1.10 MAINTENANCE / ATTIC STOCK

- A. Maintenance Materials and Instructions: Upon completion and acceptance of the project submit the following items, with a signed receipt from the Owner:
 - 1. Manufacturer's maintenance and inspection instructions, including:
 - (a) Methods for maintaining upholstery fabric
 - (b) Precautions for cleaning materials and methods that could be detrimental to seating finishes and performance
 - (c) Contact information for repair or replacement of all components during and after warranty period.
 - (d) Procedures for installation of replacement parts listed below
- B. Replacement Materials (Extra materials from the same production run that match products installed and that are packaged with protective covering for storage and identified with labels describing contents). Full size unit of the following seating components equal to 5 percent of the amount installed for each type and finish installed, but no fewer than two units:
 - 1. Five (5) seat covers for each size seat, tailored and sewn
 - 2. Five (5) seat backs for each size seat back, tailored and sewn
 - 3. Twenty-five (25) yards of upholstery fabric in selected color and pattern.
 - 4. Armrests: Full sized units equal to five percent of amount installed for each type of armrest.
 - 5. Aisle end panels: Two (2)
 - 6. Aisle lights: Two (2)
 - 7. Paint and Stain: One (1) gallon of each liquid finish (paint, stain, etc.) in resealable containers.

1.11 WARRANTY:

- A. Provide a manufacturer's warranty covering the material and workmanship for the specified warranty period from date of final acceptance.
- B. Warranty Periods:
 - 1. Structural Components: five years.
 - 2. Operating Mechanisms: five years.
 - 3. Plastic, Wood and Painted Components: five years.
 - 4. Upholstery Fabric: one year.
 - 5. Electrical Components: one year.

PART 2 PRODUCTS

2.1 MATERIALS AND FINISHES:

- A. Steel shall meet requirements for ASTM A 36/A 36M plates, shapes, and bars; ASTM A 513 mechanical tubing; ASTM A 1008/A 1008M cold-rolled sheet; and ASTM A 1011 hot-rolled sheet and strip.
- B. All exposed metal parts shall be powder coated with a hybrid thermosetting powder coat finish. The powder coat finish shall be applied by electrostatic means to a thickness of 2 - 5 mils, and shall provide a durable coating having a 2H Pencil hardness. Prior to powder coating, metal parts shall be treated with a three-stage non-acidic, bonderizing process for superior finish adhesion, and after coating shall be oven baked to cause proper flow of the epoxy powder to result in a smooth, durable finish. Manufacturer's standard color range shall be used.
- C. Medium-density fiberboard shall meet requirements for ANSI A208.2, Grade MD, made with binder containing no urea formaldehyde.
- D. Concealed plywood shall meet requirements for HPVA HP-1 hardwood plywood.
- E. Exposed plywood shall meet requirements for HPVA HP-1, Face Grade A, hardwood veneer core with color-matched hardwood-veneer faces, made with adhesive containing no urea formaldehyde.
- F. Hardwood lumber and veneer faces shall be maple or as selected by architect from manufacturer's standard materials. Lumber and veneer to be free of visible defects. Exposed wood shall be sanded smooth and stained to color selected with low-VOC water-based stain and top coat to provide with a high quality finish. Color to be chosen from manufacturer's standard offering.
- G. Upholstery fabric shall be determined by Architect. Fabric shall have a weight of 10 oz. per lineal yard ($\pm .5$ oz.). Fabric shall meet specifications AATCC 16 Option 3, AATCC 107 and AATCC 8 for color fastness and withstand 100,000 double rubs per ASTM D-4157. Fabric shall meet flammability resistance outlined in California Technical Bulletin 117 (Cal TB133 is not required) ; NFPA 260-1989, Class 1; UFAC, class 1. Fabric to be determined by Architect.
- H. Upholstery padding shall be molded or slab polyurethane foam.
- I. Molded Plastics:
 - 1. Structural components shall be mar and dent resistant high density glass-filled polypropylene with UV stabilizers.

2. Decorative components shall be mar and dent resistant high density polyethylene (HDPE) with UV stabilizers.
3. Plastic components shall be chosen from manufacturer's standard offering.

2.2 FIXED AUDIENCE SEATING PRODUCT AND MANUFACTURER:

- A. Permanent arrangement of fixed audience seating as shown on seating layout drawings.
 1. Approved manufacturers subject to compliance with requirements outlined herein.
- B. The basis of design product is the Citation model 90.12.66.4 by Irwin Seating Company Inc. Products by qualified manufacturers meeting performance criteria and aesthetic characteristics of the specified seat are also acceptable upon approval of the Architect.
 1. Final design options, finishes, and accessory choices to be made by Architect.
- B. Qualified manufacturers include:
 1. Irwin Seating Company, Grand Rapids, MI
 2. Hussey Seating Company, N. Berwick, ME
 3. Wenger Corporation, Owatonna, MN
- C. STANDARD MATERIALS AND FINISHES
 1. Hardwood Lumber: Clear maple, plain-sawn or sliced.
 2. Veneer Hardwood Plywood: HPVA HP-1, 11-ply, AA-grade, rotary cut. The seat back must be a minimum of 13-ply 11/16" thick plywood. The seat bottom must be a minimum of 7-ply 7/16" thick veneer plywood. Plywood edges are stained to match the veneered faces. The arm caps on the standards shall be solid beech wood.
 3. Medium Density Fiberboard: ANSI A208.2, Grade MD.
 4. Wood Finishes: Manufacturer's standard finish and stain.
 5. High-Pressure Decorative Laminate: NEMA LD-3, Grade VGS.
 6. Plastic: Polypropylene copolymer IF-727. High impact, injection molded polypropylene. Polypropylene outer seat and back panel includes a flange around the sides to provide fabric protection. Textured finish for an attractive and low maintenance surface.
 7. Metal Finishes: Manufacturer's standard baked-on black powder coating. Immediately after cleaning and pretreating, electrostatically apply manufacturer's standard, baked-polymer, thermosetting powder finish.
 8. Cushion Foam: Raw material provided by BASF Germany. Flexible, cellular, cold-molded, contoured polyurethane foam, flame-retardant-treated.
 9. Row/Seat Plaques: Plastic with stainless steel or aluminum finish with sans serif black lettering. Row and Seat Numbers.
 - (a) Architect to select finish.

- (b) Row-lettering and chair-numbering shall be provided for identification of all chairs as shown on approved seating layout drawings. The seat pans shall be recessed at the center of the front edge for the number plates, and attached by two (2) pop rivets. Row Letter plates shall be 5/8" x 1-5/8" with an aluminum or stainless steel finish and black sans serif numerals attached in recess of aisle standard armrest by an approved method. Attaching hardware shall have a finish compatible to plates.
 - D. When unoccupied, the seat shall rise automatically to a 3/4 safety fold position, and upon a slight rearward pressure, shall achieve full-fold, allowing the patron additional passing room. The seat shall rotate on two, molded, structural, glass-filled nylon hinge rods in internally molded channels with integral down-stops for exceptional strength. Seat-lift shall be accomplished by compression springs and self-lubricating plastic cams. No slow-rise mechanism to be installed or accepted.
 - E. Chair width shall vary to accommodate sightlines and row lengths.
 - F. Back height and pitch shall be fixed as shown on seating layout drawings.
 - G. Accessible Seating:
 - 1. Aisle standards designated on the contract drawings shall be designed to allow an individual to transfer from a wheelchair to the theatre chair without sacrificing decorative details of the aisle standards. The aisle panels, with associated armrest, shall be arranged to swing rearward, creating sideways access to the chair. Manual release of the swing-away decorative panel shall be readily accessible under the armrest, and return of the swing-away decorative panel shall self-latch. Aisle standards so equipped shall be provided with a label displaying an easily recognizable "handicapped" symbol.
 - 2. Chairs located as shown in the contract drawings shall be mounted upon moveable steel bases. The steel bases shall be available for sections of one (1) or two (2) chairs. No three (3) chair bases shall be installed. The bases shall be fabricated from 3/16" x 3-1/2" x 15-1/2" steel, with cross members securely fastened to the horizontal base members via Tec screws. Holes shall be provided for the attachment of the chair standards. Moveable bases are secured to the floor when the seating is in use with reverse anchors.
 - 3. Removable Seating: Individual seats for companion seating are equipped with a steel retractable wheel bracket so they can be easily rolled into place when needed. A simple release pedal will disengage the wheels.
 - 4. Removable or transfer seats which are designated to include aisle lights must be provided with them, including removable connections where seats are removable.
- 2.3 FABRICATION:
- A. Manufacture fabric-covered cushions with molded padding beneath fabric and with fabric covering free of welts, creases, stretch lines, and wrinkles. For each upholstered component, install pile and pattern run in a consistent direction.
 - B. Fabricate floor attachment plates to conform to floor slope, if any, so that standards are plumb and chairs are maintained at same angular relationship to vertical throughout project.
- 2.4 AISLE LIGHTS
- 1. Type: Beacon-style, surface-mounted LED aisle light as manufactured by Tivoli Lighting. Mount aisle light in high position unless designated otherwise on shop drawings.

2. Low voltage, non-hazardous 12-volt, D.C. System utilizing a minimum of six miniature LED light elements concealed on the underside of aisle standard armrests and providing white illumination for floor/steps adjacent to the aisle standard. Aisle standards shall be pre-wired with 18-inches of wiring extending beyond the base of the standards. Standards shall be provided with a flex-steel conduit connector thru which the wiring extension shall pass.
3. Lamps to be provided with 3,000K CCT LED array.
4. Seating supplier shall furnish as part of the aisle light package a voltage reduction device suitable for conversion to 120-volt, AC facility power to 12-volt, DC for aisle lights requirement. Voltage reduction device (transformer and driver) shall be UL listed as Class II Power Unit for proper supply of power to the aisle lights. All wiring connections from electrical distribution system to the aisle light standards shall be by the electrical subcontractor. Aisle lights shall provide illumination for intended purpose of 0.2 foot-candles at floor level for an area 3 feet from the chair to illuminate the aisle.
5. The transformer / driver for the aisle lights be capable of dimming the aisle lights in order for the aisle light level to be set at the proper light level (foot-candles).
6. Coordinate with electrical contractor as needed to determine compatible power source for aisle lights to provide dimming capability, whether forward-phase (magnetic), reverse-phase (electronic) or 0-10V. It is the responsibility of the seating contractor to determine the power source and provide the appropriate transformer/driver type.
7. Transfer-armchairs shall have aisle lights as noted on the drawings.
8. Removable seating designated for aisle lights shall have code-compliant connectors on whips and in floor-mounted receptacle boxes. Coordinate provision and installation with electrical contractor as needed.
9. Lamps shall be accessible for replacement.
10. Provide details necessary for final connection.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Prior to layout and installation examine floors, risers, and other adjacent work and conditions, with Installer present, for compliance with requirements and other conditions affecting performance of the work including, but not limited to, plumb of riser faces and concrete conditions.
- B. Measure all surfaces and areas affected by the work at the site prior to manufacturing to verify or supplement dimensions indicated on drawings. Verify that dimensions, elevations and alignment are within acceptable tolerances.
- C. Examine locations of electrical connections.
- D. Examine locations of HVAC supply ducts (if any).
- E. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. Seating is not to be installed without an approved set of shop drawings.

- B. Install seating in locations indicated and fastened securely to substrates according to manufacturer's written installation instructions.
- C. Prepare surfaces and install auditorium seating in proper alignment, plumb, level, and securely anchored in conformance with manufacturer's recommendations and installation instructions.
 - 1. Measure all surfaces and areas affected by the work prior to installation so as to ensure that installation tolerances will be met.
 - 2. Reproduce seating plan full-size, on the floor with rows laid out on the radii shown on the seating plan.
 - 3. Locate seat supports by the true radial line. No change in seat quantity may be made without written authorization of Architect.
 - 4. Make all required electrical connections; test for proper operation following connection.
 - 5. Locate control switch where shown on the drawings. Where switches are not shown, but are required, request clarification from Architect.
- D. Use installation methods and fasteners that produce fixed audience seating assemblies with individual chairs capable of supporting an evenly distributed 600-lb static load applied 3" from front edge of the seat without failure or other conditions that might impair the chair's usefulness.
- E. Install seating with chair end standards aligned from first to last row and with backs and seats varied in width and spacing to optimize sightlines .
- F. Install floor and riser-mounted attachments to maintain uniform chair heights above floor.
- G. Install chairs in curved rows at a smooth radius.
- H. Install seating so moving components operate smoothly and quietly and do not rub against each other.
- I. Install wiring conductors and cables concealed in components of seating and accessible for servicing.

3.3 FIELD QUALITY CONTROL

- A. Perform tests and inspections.
- B. Prepare test and inspection reports.

3.4 CLEANING AND ADJUSTING

- A. Clean surfaces promptly after in accordance with manufacturer's instructions; do not use abrasive materials that can mar or otherwise damage the finish surfaces. Remove excess sealants, compounds, and other substances using non-abrasive materials
- B. Adjust chair backs so that they are properly aligned with each other.
- C. Adjust self-rising seat mechanisms so seats in each row are aligned when in upright position.
- D. Verify that all components and devices are operating properly without rubs, hesitation or other impediment.

- E. Repair minor abrasions and imperfections in finishes with coating that matches factory-applied finish.
- F. Replace upholstery fabric damaged during installation.

END OF SECTION 126100

SECTION 12 66 13
TELESCOPING BLEACHERS

1. PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Wall-attached telescoping bleacher units.

1.2 REFERENCES

- A. AAMA 607.1 - Specification and Inspection Methods for Clear Anodic Finishes for Architectural Aluminum.
- B. ANSI/Vol. Prod. STD PS 1 - Construction and Industrial Plywood.
- C. ASTM A 36 - Specification for Structural Steel.
- D. ASTM A 366 - Specification for Steel, Sheet, Carbon, Cold-Rolled, Commercial Quality.
- E. ASTM A 501 - Specification for Hot-Formed Welded and Seamless Carbon Steel Structural Tubing.
- F. ASTM A 526 - Specification for Steel Sheet, Zinc-Coated (Galvanized) by the Hot-Dip Process, Commercial Quality.
- G. ASTM A 780 - Practice for Repair of Damaged Hot Dip Galvanized Coatings.
- H. ASTM B 429 - Specification for Aluminum-Alloy Extruded Structural Pipe and Tube.
- I. ASTM D 1248 - Specification for Polyethylene Plastics Molding and Extrusion Materials.
- J. AWS D1.1 - Structural Welding Code - Steel.
- K. AWS D1.3 - Structural Welding Code - Sheet Steel.
- L. DSA - Division of the State Architect, Interpretations of Regulations.
- M. NFPA 102 - Standard for Assembly Seating, Tents and Membrane Structures.
- N. SPIB - Southern Pine Inspection Bureau - Standard Grading Rules for Southern Pine Lumber.
- O. SSPC - Paint 20 - Paint Specification No. 20 Zinc-Rich Primers (Type I, "Inorganic," and Type II, "Organic").
- P. SSPC - SP1 - Surface Preparation Specification No. 1 Solvent Cleaning.
- Q. SSPC - SP5 - Surface Preparation Specification No. 5 White Metal Blast Cleaning.
- R. SSPC - SP8 - Surface Preparation Specification No. 8 Pickling.
- S. 2010 Americans with Disabilities Act (ADA) Standards for Accessible Design.
- T. CBC - California Building Code, (CCR) - California Code of Regulations, Title 24, Part 2.
- U. CEC - California Electric Code, (CEC) - California Code of Regulations, Title 24, Part 3.

1.3 DEFINITIONS

- A. Telescoping bleachers are operable systems of multiple-tiered benches on interconnected, folding supports that permit closing, without requiring dismantlement, into a nested relationship for purposes of storing or moving.

1.4 SYSTEM DESCRIPTION

- A. Telescoping bleacher units incorporating manufacturer's standard telescoping system of seating and understructure members that permit opening and closing with respect to adjacent rows, that allow any or all rows to be locked open for use, and that close with vertical faces of upper skirts in same vertical plane.

- B. Manufacturer's standard powered operation of bleacher units by means of a series of electric motor-driven units mounted under first rows of bleacher units that apply tractive force to floor. Use units with nonmarking rubber rollers or tracks that will not mar or damage type of floor over which bleacher units move. Control units remotely, by key-operated switch.
- C. Coordinate wiring requirements and current characteristics of motors and control stations with electrical system. Power and control system shall be Underwriters Laboratories, Inc. (UL) approved and listed.

1.5 DESIGN AND REGULATORY REQUIREMENTS

- A. Conform to CBC - CCR, Title 24, Part 2, DSA IR16-5.07 and the following:
 - 1. Design to resist a live load of not less than 120 lbs. per linear foot.
 - 2. Vertical live load of 100 lbs. per square foot.
 - 3. Horizontal sway load of 24 lbs. per linear foot parallel to seating.
 - 4. Horizontal sway load of 10lbs. per linear foot perpendicular to seating.
 - 5. Railings, posts, and sockets designed to withstand the following forces applied separately.
 - (a) 200 lbs. per foot applied at any point and in any direction.
 - (b) 50 lbs. per foot acting outward at top rail.
 - (c) 25 lbs. per foot acting outward at mid-rail.
- B. Conform to (CBC) - CCR, Title 24, Part 2 and the 2010 ADA Standards for Accessible Design for accessibility.
- C. Safety Standard: Telescoping bleachers shall comply with provisions of NFPA 102.
- D. Do not fabricate bleachers until detailed plans, specifications, and engineering calculations have been accepted and signed by the Architect or Structural Engineer in general charge of design and signed by California State licensed Architect or Professional Engineer who has been delegated responsibility covering the work shown on a particular plan or specification, and approved by the Division of the State Architect.

1.6 TESTS

- A. Provide inspection and testing under provisions of Section 01 45 29.
- B. Perform load test and welding tests required by the Division of the State Architect.

1.7 SUBMITTALS

- A. Submit shop drawings under provisions of Section 01 33 00.
- B. Submit shop drawings indicating:
 - 1. Layout of telescoping bleacher units coordinated with field measurements.
 - 2. Seat heights, row spacing and rise, aisle widths and locations, overall dimensions in closed and open position, connections and relationship to adjoining work.
 - 3. Accessories, types of materials and finishes.
 - 4. Structural computations, material properties, and other information needed for structural analysis that has been signed and sealed by a California State licensed professional engineer responsible for their preparation.
 - 5. Wiring diagrams from manufacturer for electrically operated units.
 - 6. Refer to Section 01 33 00 for additional deferred approval requirements.
- C. Submit product data under provisions of Section 01 33 00.
- D. Submit product data for complete bleacher system.
- E. Submit samples under provisions of Section 01 33 00.

- F. Submit samples illustrating molded plastic seats and lumber material.
- G. Submit manufacturer's certificate under provisions of Section 01 33 00 that products meet or exceed specified requirements.
- H. Submit manufacturer's installation instructions under provisions of Section 01 33 00.

1.8 OPERATION AND MAINTENANCE DATA

- A. Submit maintenance data under provisions of Section 01 77 00.
- B. Include detailed instructions indicating proper means for operating and maintaining bleachers units and accessories.
- C. Include cleaning and stain removal methods and recommended cleaning materials, polishes, and waxes.

1.9 QUALIFICATIONS

- A. Manufacturer: Company specializing in the manufacture of products specified in this Section with minimum ten years documented experience.
- B. Installer: Company specializing in applying the work of this Section with minimum five years documented experience approved by manufacturer.
- C. Design telescopic bleachers under direct supervision of a Professional Structural Engineer experienced in the design of this work and licensed in the state of California.
- D. Welding: Qualify procedures and personnel according to AWS D1.1 and AWS D1.3.

1.10 DELIVERY, STORAGE, AND HANDLING

- A. Deliver, store and protect products to site under provisions of Section 01 61 00.

1.11 SEQUENCING AND SCHEDULING

- A. Coordinate work under the provisions of Section 01 31 00.
- B. Coordinate work of this section with the installation and finish of flooring.

2. PART 2 PRODUCTS

2.1 MANUFACTURERS

- A. Hussey Seating Co., www.husseyseating.com.
- B. Interkal, Inc., www.interkal.com.
- C. The Folding Bleacher Co., (Irwin Seating), www.foldingbleachers.com.
- D. Substitutions: Under provisions of Section 01 25 13.

2.2 MATERIALS

- A. Lumber: Softwood, kiln dried, surfaced 4 sides, complying with SPIB "Grading Rules" for C and Better finish grade.
- B. Plywood: Softwood plywood panels, 5/8-inch nominal thickness, 5-ply construction with grade designation APA A-C Exterior, with solid crossbands, Group 1 veneer species for all plies, and exterior glue, APA grade trademarked, complying with ANSI/Vol. Prod Std. PS-1.
- C. Structural Steel Shapes, Plates and Bars: ASTM A 36, except where higher strength steel is indicated or standard with manufacturer.
- D. Uncoated Steel Sheet: ASTM A 366, commercial quality, cold-rolled sheet, stretcher leveled.
- E. Galvanized Steel Sheet: ASTM A 526, G60 coating designation, phosphatized, stretcher leveled.
- F. Steel tubing: ASTM A 501, hot-formed.
- G. Aluminum Tubing: ASTM B 429, 6063-T6, Schedule 40.

- H. Polyethylene Plastic: ASTM D 1248, Type III, Class B; 1/4 inch thick, molded, color-pigmented, textured, impact-resistant, structural formulation; color as selected by Architect. Allow for a three-tone color combination for seat/seat and seat/base color selection.
- I. Fasteners: Vibration proof, of size and material standard with manufacturer.

2.3 FABRICATION

- A. General: Manufacturer's standard telescopic bleacher system fabricated to comply with requirements indicated. Smoothly round corners, edges, and exposed fasteners, if any, to eliminate snagging and pinching hazards. Form exposed sheet metal with flat, flush surfaces, true to line and level, and without cracking and grain separation. Perform welding by operators and processes complying with AWS requirements.
- B. Bench Seats and Upper Risers: Fabricate from the following materials to form seats with uniform heights per bleacher unit of not less than 16 inches or more than 18 inches, as standard with manufacturer.
 - 1. Material: Polyethylene plastic, contoured to form individual seats, with recesses for number plates.
- C. Lower Risers and Foot Rests: Recessed lower riser and fully closed footrest construction. Fabricate riser from steel sheet with baked enamel, vinyl cladding, or galvanized finish as standard with manufacturer. Fabricate footrest from plywood as standard with manufacturer.
- D. Understructure: Structural steel members of size, spacing, and form required to support design loads with cantilevered bench seat supports to produce toe space uninterrupted by vertical bracing.
- E. Support Column Wheels: Manufacturer's standard wheel assembly under each support column. Include wheels of size, number, and design required to support bleacher units and to achieve smooth operation without damage to flooring surface, but not less than 6 per column or less than 3-1/2 inches in diameter and 1 inch wide.
- F. Aisles: Fabricate bleacher units with the following aisle configuration, at locations and of widths indicated:
 - 1. Footrest Level Configuration: Interrupt bench seats to provide aisle walking surfaces at footrest level. Provide manufacturer's standard metal nosing for aisles with wood walking surfaces.
- G. Row Spacing: Fabricate units with a row spacing of 24 inches.
- H. Row Rise: Fabricate units with row rise of 9-5/8 inches.
- I. Type of Bleacher Units: Provide assemblies of the following type fabricated in lengths and number of rows indicated.
 - 1. Wall-attached type: Construct units to provide for permanent attachment of rear of understructure to wall/floor construction.

2.4 OPERATION

- A. Electrical Operation; Automatic, friction-type integral power unit. Each unit to be a minimum of 1/2 hp., 208V, 3 phase motor. Power unit located under lockable Row 1 skirtboard.
- B. Control Device: Key operated wall mounted control switch.
- C. Limit Switches: Automatically stop integral power system when telescoping seating reaches the fully open or closed position.
- D. Motion Monitor: Flashing light with self-contained warning horn, rated at 85 decibels(dB) at 10 feet, mounted under seating for audio and visual warning during integral power operation.
- E. Wiring: All wiring within seatbank from power source to power unit to be integral within seating unit. Wiring, motors, housings shall be grounded and be in compliance with the California Electric Code, CEC.

2.5 ACCESSORIES

- A. Provide accessories of manufacturer's standard design and construction at locations indicated or required.
- B. End panels covering exposed ends of bleacher units in closed position.
- C. Rear deck fillers including supports for closing openings between top row and rear wall of adjoining construction.

- D. End railings of telescoping, self-storing type, 3'-0" high above seat designed with intermediate rail to prevent 4 inch diameter sphere passage.
- E. Accessible Seating Area: Manufacturer's standard permanent accessible seating notch out, 2 to 5 seats wide, located as shown on drawings. Notch outs must be located at section joints only to avoid interference with understructure. Include all fascia panels, front rails. Fascia panels shall have manufacturer's standard polydeck finish to match deck board surface. Accessible seating and companion seating shall be in accordance with the CBC, Section 11B-221 and be permanently identified at each location.
- F. Provide skirtboard locks at Row 1 on all sections.

2.6 FACTORY FINISHING

- A. Aluminum: AA-M12C22A41 (Mechanical Finish: As fabricated, nonspecular; Chemical Finish: Etched, medium matte; Anodic Coating: Class I Architectural, clean film thicker than 0.7 mil) complying with AAMA 607.1.
- B. Galvanized Steel Sheet Finishes:
 - 1. Surface Preparation: Clean surfaces of dirt, grease, and other contaminants followed by a conversion coating of type suited to organic coating applied over it. Clean welds, mechanical connections and abraded areas; then apply galvanizing repair paint specified below to comply with ASTM A 780.
 - 2. Galvanizing Repair Paint: High zinc-dust-content paint for regalvanizing welds in steel, complying with SSPC-Paint 20.
 - 3. Baked Enamel Finish: Immediately after cleaning and pretreatment, apply manufacturer's standard 2-coat baked enamel finish consisting of prime coat and thermosetting topcoat.
- C. Steel Finishes:
 - 1. Surface preparation: Solvent-clean surfaces in compliance with SSPC-SP-1 to remove dirt, oil, grease and other contaminants that could impair paint bond. Remove mill scale and rust, if present, from uncoated steel in compliance with SSPC-SP 5 (White Metal Blast Cleaning) or SSPC-SP 8 (Pickling).
 - 2. Baked enamel finish: Immediately after cleaning and pretreatment, apply manufacturer's standard 2-coat baked enamel finish consisting of prime coat and thermosetting topcoat to exposed and concealed metal surfaces including understructure.
- D. Wood Finishes:
 - 1. Wood and Transparent Finish: Prepare surfaces by machine sanding, supplemented by hand sanding where required, followed by application of sealer coats and transparent top coats of type, in number, and by process standard with manufacturer. Apply to wood surfaces except where otherwise indicated. Provide textured finish for all walking surfaces.
- E. Railings: Finish with powder-coated semi-gloss paint. Color as selected by Architect.

3. PART 3 EXECUTION

3.1 EXAMINATION

- A. Verify that areas to receive telescopic bleachers are ready for installation and are in compliance with requirements for tolerances and other conditions affecting performance of the work.
- B. Verify that required utilities are available, in proper locations, and ready for use.
- C. Beginning of installation means installer accepts existing conditions.

3.2 INSTALLATION

- A. Install telescoping bleacher units to comply with manufacturer's instructions and final shop drawings approved by the Division of the State Architect (DSA).
- B. Provide accessories indicated and anchors, fasteners, inserts, and other items required for installation of units and permanent attachment of units to adjoining construction.

3.3 ADJUSTING

- A. Adjust work under provisions of Section 01 77 00.
- B. Upon completion of installation, including work of other trades, lubricate, test, and adjust each telescoping bleacher unit to operate easily and in compliance with manufacturer's specifications.

3.4 CLEANING

- A. Clean work under provisions of Section 01 77 00.
- B. Clean installed bleacher units on exposed and semi exposed surfaces. Touch up shop-applied finishes to restore damaged or soiled areas.

3.5 DEMONSTRATION

- A. Provide systems demonstration under provisions of Section 01 77 00.
- B. Demonstrate telescopic bleacher operation.

3.6 PROTECTION

- A. Protect finished installation under provisions of Section 01 61 00.
- B. Provide final protection and maintain conditions, in a manner acceptable to manufacturer and Installer, that ensures that telescoping bleachers are without damage or deterioration at time of Substantial Completion.

END OF SECTION

SECTION 13 11 00

SWIMMING POOL GENERAL REQUIREMENTS

1. PART 1 GENERAL

1.1 WORK INCLUDED

- A. The scope of the work included under this Section of the Specifications shall include swimming pool(s) as illustrated on the Drawings and specified herein. The General and Supplementary Conditions of the Specifications shall form a part and be included under this Section of the Specifications. The Swimming Pool Subcontractor shall provide all supervision, labor, material, equipment, machinery, plant and any and all other items necessary to complete the work. ALL OF THE WORK IN SECTIONS 13 11 00 – 13 11 08 IS TO BE THE RESPONSIBILITY OF ONE EXPERIENCED SWIMMING POOL SUBCONTRACTOR PRIMARILY ENGAGED IN THE CONSTRUCTION OF COMMERCIAL PUBLIC-USE SWIMMING POOLS. A SWIMMING POOL SUBCONTRACTOR SHALL BE CONSIDERED PRIMARILY ENGAGED AS REQUIRED HEREIN IF THE SUBCONTRACTOR DERIVED 50% OF ITS ANNUAL REVENUE FROM PUBLIC-USE SWIMMING POOL CONSTRUCTION FOR EACH OF THE LAST FIVE YEARS. THE SUBCONTRACTOR MUST HAVE ALSO, IN THE LAST FIVE YEARS CONSTRUCTED AT LEAST FIVE (5) COMMERCIALY DESIGNED MUNICIPAL AND PUBLIC-USE SWIMMING POOLS, EACH OF WHICH SHALL HAVE INCORPORATED A MINIMUM SIZE OF 6,000 SQUARE FEET OF WATER SURFACE AREA WITH A CONCRETE AND CERAMIC TILE PERIMETER OVERFLOW GUTTER AND SELF-MODULATING BALANCE TANK. The Swimming Pool Subcontractor shall furnish and install the swimming pool structures, finishes, cantilever forming, swimming pool mechanical and electrical systems, and all accessories necessary for a complete, functional swimming pool system, as herein described. Work shall include start-up, instruction of Owner's personnel, as-built drawings and warranties as required.

1.2 CODES, RULES, PERMITS, FEES

- A. The swimming pools shall be constructed in strict accordance with the applicable provisions set forth by authorities having jurisdiction over swimming pool construction and operation in the State of California.
- B. The Swimming Pool Subcontractor shall give all necessary notices, obtain all permits, and pay all government sales taxes, fees, and other costs in connection with his work; file all necessary plans, prepare all documents and obtain all necessary approvals of governmental departments having jurisdiction; obtain all required certificates of inspection for his work and deliver same to the Designated Representative before request for acceptance and final payment for the work.
- C. The Swimming Pool Subcontractor shall include in the work any labor, materials, services, apparatus, or drawings in order to comply with all applicable laws, ordinances, rules and regulations, whether or not shown on Drawings and/or specified.
- D. The Contractor shall submit all required documents and materials to all Governmental Departments having jurisdiction for any deferred approval items or substituted materials or products to obtain final approval to installation.

1.3 DESCRIPTION OF WORK

- A. Furnish and perform supervision, coordination, all layout, formwork, excavation, hand trim, disposing off-site of all unused material or debris to complete the swimming pool excavation to the dimensions shown on the plans.
- B. Furnish and install complete swimming pool structures, including reinforcing steel and cast-in-place or pneumatically placed concrete walls and floors.
- C. Furnish and install swimming pool finishes, including ceramic tile and marble plaster or other waterproof finishes.
- D. Furnish and install complete swimming pool mechanical system(s), including, but not limited to, circulation systems, filtration systems, pool water heating systems, water chemistry control systems, domestic water fill line systems, booster pump and special effects systems, and all pumps, piping, valves, and connections between system(s) and swimming pool(s).
- E. Furnish and install complete swimming pool electrical system(s) from P.O.C. in Mechanical Room, including, but not limited to, underwater lighting systems, water level control systems, timing systems, scoreboards,

special effects systems, control circuitry, motor starters, time clocks, bonding, and all conduits, conductors, contactors, and switches between the system(s) and swimming pool(s).

- F. Furnish and install all swimming pool cantilever forming, deck equipment and required anchors and inserts for the specified equipment as required by code, shown on the Drawings and specified herein.
- G. After the initial filling of the swimming pool system(s), should any repairs, continuing work, or other Subcontractor responsibility require drainage or partial drainage of the swimming pool systems, the Swimming Pool Subcontractor shall be responsible for any subsequent refilling and shall complete the project with the swimming pool system(s) full of water, water in chemical balance, complete in every way, and in full operation.

1.4 ASSIGNED RESPONSIBILITIES AND RELATED WORK

- A. It is the intent of this section of the Specifications to clarify Work responsibilities of the trades directly and indirectly involved in construction of the pool systems. All labor, equipment, materials and supplies furnished by the Swimming Pool Subcontractor and other Subcontractors shall be as directed by the Owner through his Designated Representative.
- B. THE SWIMMING POOL SUBCONTRACTOR SHALL NOT SUBCONTRACT ANY PORTION OF THE SWIMMING POOL CONSTRUCTION OR SWIMMING POOL EQUIPMENT INSTALLATION TO ANYONE OTHER THAN A SUBCONTRACTOR THAT SATISFIES THE REQUIREMENTS OF SECTION 13 11 00
- C. References to "swimming pool systems" shall include the swimming pools, equipment, and accessories.
- D. The Owner will provide one complete water filling of the swimming pool(s), but will not assume any responsibility for the swimming pool system(s) until they have been proved fully operational, complete in every way and accepted by the Designated Representative.

1.5 RESPONSIBILITIES OF THE CONTRACTOR

- A. The Contractor shall grade the swimming pool site(s), establish benchmarks, cut and fill as necessary to provide as level an area as possible at swimming pool deck elevation before swimming pool layout.
- B. The Contractor shall be responsible for horizontal dimensions and grade elevations accurately from established lines and benchmarks (as indicated on the Drawings) and be responsible for those grades.
- C. The Contractor shall provide adequate temporary light, electric power, heat and ventilation per Federal and State OSHA requirements to construct the swimming pool system(s).
- D. The Contractor shall not permit any heavy equipment activity over any area or within five (5) feet of any area under which swimming pool piping is buried. There shall be no exceptions to this requirement.
- E. The Contractor shall keep the swimming pool excavation(s) and swimming pool structure(s) free of construction residue and waste materials of his workmen or Subcontractors, removing said material from the swimming pools as required.
- F. The Contractor shall protect the swimming pool(s) from damage caused by his construction equipment and /or workmen and Subcontractors.
- G. The Contractor shall provide a representative at time of swimming pool start-up to coordinate all trades related to swimming pool system(s).

1.6 RESPONSIBILITIES OF THE MECHANICAL SUBCONTRACTOR

- A. The Mechanical Subcontractor shall be licensed in the State of California and provide written notifications to Swimming Pool Subcontractor and contractor when necessary to excavate and backfill within the swimming pool construction site.
- B. The Mechanical Subcontractor shall not utilize any swimming pool piping trench for installation of any sanitary sewer, storm sewer, domestic water, hot water, chilled water or natural gas line.
- C. The Mechanical Subcontractor shall furnish and install all sanitary sewer piping, including vent stacks (if necessary), for backwash pits, floor drains and floor sinks as required by code, shown on Drawings, and herein specified.
- D. The Mechanical Subcontractor shall furnish and install all storm sewer piping and site drainage systems as

required by code, shown on the Drawings, and herein specified.

- E. The Mechanical Subcontractor shall provide a minimum 75 psi water supply for swimming pool construction work within fifty (50) feet of the swimming pool construction site(s).
- F. The Mechanical Subcontractor shall furnish and install reduced pressure backflow protected domestic water lines to P.O.C. within swimming pool Mechanical Room as required by code, shown on the Drawings, and herein specified.
- G. The Mechanical Subcontractor shall furnish and install natural gas piping, pressure regulation and valving to P.O.C. within swimming pool Mechanical Room as required by code, shown on the drawings, and herein specified.
- H. The Mechanical Subcontractor shall furnish and install all ductwork, louvers, and all HVAC equipment within swimming pool Mechanical Room as required by code, shown on the Drawings, and herein specified.
- I. The Mechanical Subcontractor shall provide a representative at time of swimming pool start-up to coordinate work related to swimming pool system(s).

1.7 RESPONSIBILITIES OF THE ELECTRICAL SUBCONTRACTOR

- A. The Electrical Subcontractor shall be licensed in the State of California and shall furnish and install electrical service to swimming pool Mechanical Room sized to accommodate all necessary swimming pool equipment as shown on the Drawings and herein specified.
- B. The Electrical Subcontractor shall furnish any temporary power needed by the Swimming Pool Subcontractor within fifty (50) feet of the swimming pool construction site(s).
- C. The Electrical Subcontractor shall furnish and install all conduits, conductors, starters/disconnects, panels, circuits, switches and equipment as required for lighting, ventilation and HVAC equipment within swimming pool Mechanical Room as required by code, shown on the Drawings, and herein specified.
- D. The Electrical Subcontractor shall furnish and install all conduits, conductors, panels, circuits, switches and equipment for area lighting as required by code, shown on the Drawings, and herein specified.
- E. All equipment, material and installation shall be as required under Division 16 of the Specifications and shall conform to NEC Article 680 (latest revision), State and Local Codes, and as may be required by all authorities having jurisdiction over swimming pool construction within the State of California.
- F. The Electrical Subcontractor shall provide a representative at time of swimming pool start-up to coordinate work related to swimming pool system(s).

1.8 INTENT

- A. It is the intention of these specifications and Drawings to call for finished work, tested and ready for operation. Wherever the work "provide" is used, it shall mean "furnish and install complete and ready for use."
- B. Minor details not usually shown or specified, but necessary for proper installation and operation, shall be included in the work, the same as if herein specified or shown.

1.9 SCHEDULE OF VALUES

- A. Provide a Schedule of Values for all work specified in each of the technical specifications listed in the table below, regardless of whether the work is performed by the swimming pool contractor or others. Values listed shall be fully burdened, with contractor general conditions, overhead, profit and bonds included. Payments for swimming pool work completed shall not be approved until Schedule of Values has been submitted to and approved by Architect.

SWIMMING POOL SCHEDULE OF VALUES			
No.	Section #	Description	Value
1.	13 11 01	Swimming Pool Excavation	
2.	13 11 02	Swimming Pool Concrete	
3.	13 11 03	Swimming Pool Shotcrete	
4.	13 11 04	Swimming Pool Ceramic Tile	
5.	13 11 05	Swimming Pool Plaster	

6.	13 11 06	Swimming Pool Equipment	
7.	13 11 07	Swimming Pool Mechanical	
8.	13 11 08	Swimming Pool Electrical	
Total			

1.10 SUBMITTAL PROCEDURES

- A. General: Electronic copies of CAD Drawings of the Contract Drawings will not be provided by Architect for Subcontractor's use in preparing submittals.
- B. Coordination: Coordinate preparation and processing submittals with performance construction activities.
 - 1. Coordinate each submittal with fabrication, purchasing, testing, delivery, other submittals, and related activities that require sequential activity. Coordinate transmittal of different types of submittals for related parts of the Work so processing will not be delayed because of need to review submittals concurrently for coordination.
 - a. Architect reserves the right to withhold action on a submittal requiring coordination with other submittals until related submittals are received.
- C. Submittals Schedule: Comply with requirements in Division 1 Section "Construction Progress Documentation" for list of submittals and time requirements for schedules performance of related construction activities.
- D. Processing Time: Allow enough time for submittal review, including time for re-submittals as follows. Time for review shall commence on Architect's receipt of submittal.
 - 1. Initial Review: Allow fifteen (15) days for initial review of each submittal. Allow additional time if processing must be delayed to permit coordination with subsequent submittals. Architect will advise Contract when a submittal being processed must be delayed for coordination.
 - 2. Concurrent Review: Where concurrent review of submittals by Architect's consultants, Owner, or other parties is required, allow twenty-one (21) days for initial review of each submittal.
 - 3. Direct Transmittal to Consultant: Where the Contract Documents indicate that submittals may be transmitted directly to Architect's consultants, provide duplicate copy of transmittal to Architect. Submittal will be returned to Architect before being returned to Subcontractor.
 - 4. If intermediate submittal is necessary, process it in same manner as initial submittal.
 - 5. Allow fifteen (15) days for processing each submittal.
 - 6. No extension of the Contract Time will be authorized because of failure to transmit submittals enough in advance of the Work to permit processing.
- E. Identification: Place a title block on each submittal for identification.
 - 1. Indicate name of firm or entity that prepared each submittal on title block.
 - 2. Provide a space on title block to record Subcontractor's review and approval markings and action take by Architect.
 - 3. Include the following information on title block for processing and recording action taken: (See Attached Sample)
 - a. Project name.
 - b. Date.
 - c. Name and address of Subcontractor.
 - d. Name of Subcontractor.
 - e. Name of Supplier.
 - f. Name of Manufacturer.
 - g. Unique identifier, including revision number.
 - h. Number and title of appropriate Specification Section.
 - i. Drawing number and detail references, as appropriate.
 - j. Other necessary identification.

SUBMITTAL FOR:	SUBMITTAL TO:	SUBCONTRACTOR:
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Item Number:	_____
Section Number:	_____
Section Description:	_____
Subcontractor:	_____
Supplier:	_____
Manufacturer:	_____
Product Code:	_____
Quantity:	_____

Subcontractor Certification:	Contractor's Submittal Stamp:
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It is hereby certified that the equipment or material designated in this submittal is proposed to be incorporated in the above-named project and is in compliance with the contract drawings and / or specifications and is submitted for approval.

Certified by: _____
Date: _____
Job Superintendent: _____
Revisions: _____

Architect's Review Stamp and Comments

- F. Deviations: Highlight, encircle, or otherwise identify deviations from the Contract documents on submittal.
- G. On all catalogue or cut sheets identify which model or type is being submitted.
- H. Transmittal: Package each submittal individually and appropriately for transmittal and handling. Product data and shop drawings shall be packaged within a three-ring binder and colored samples shall be packaged on a heavy cardboard. Transmit each submittal using a transmittal form.
 - 1. On an attached separate sheet, prepared on Subcontractor's letterhead, record relevant information, request for data, revisions other than those requested by Architect on previous submittals and deviations from requirements of the Contract documents, including minor variations and limitations. Include the same label information as the related submittal.
 - 2. Include Subcontractor's certification stating that information submitted complies with requires of the Contract Documents.
 - 3. Transmittal Form: Provide locations on form for the following information:
 - a. Project name.
 - b. Date.
 - c. Destination (To:).
 - d. Source (From:).
 - e. Names of Subcontractor, manufacturer, and supplier.
 - f. Category and type of submittal.
 - g. Submittal purpose and description.
 - h. Remarks.
- I. Distribution: Furnish copies of final submittals to manufacturers, Subcontractors, suppliers, fabricators, installers, authorities having jurisdiction and others as necessary for performance of construction activities. Show distribution on transmittal forms.
- J. Use for Construction: Use only final submittals with mark indicating action taken by Architect in connection with construction.

1.11 SUBSTITUTIONS

- A. To obtain approval to use unspecified products, bidders shall submit requests for substitution at least ten (10) days prior to bid date. Requests shall only be considered if they clearly describe the product for which approval is asked, including all data necessary to demonstrate acceptability. All unspecified products and equipment will be considered on an "or equal" basis at the discretion of the Designated Representative. Requests for substitution received after the specified deadline will not be considered. Where a conflict exists between the requirements of the General Conditions / Special Conditions / Division 1 concerning substitutions and the requirements of this Article, this Article (Section 13 11 00, Article 1.10) shall govern.
- B. Where the Swimming Pool Subcontractor proposes to use an item of equipment other than that specified or detailed on the Drawings which requires any redesign of the structure, partitions, foundations, piping, wiring, or any other part of the architectural, mechanical, or electrical layout, all such redesign and all new drawings (stamped by California Licensed Engineer) and detailing required shall be prepared by the Swimming Pool Subcontractor, at his own expense, submitted for review and approval by the Designated Representative prior to bid.
- C. Where such approved deviation requires a different quantity and arrangement of piping, supports and anchors, wiring, conduit, and equipment from that specified or indicated on the Drawings, the Swimming Pool Subcontractor shall furnish and install any such piping, structural supports, controllers, motors, starters, electrical wiring and conduit, and any other additional equipment required by the system, at no additional cost to the Owner.

1.12 SURVEYS AND MEASUREMENTS

- A. The Swimming Pool Subcontractor shall base all measurements, both horizontal and vertical, from benchmarks established by the Contractor. All work shall agree with these established lines and levels. The mechanical Drawings do not give exact details as to elevations of piping, exact locations, etc. and do not show all offsets, control lines, pilot lines and other installation details. Verify all measurements at site and check the correctness of same as related to the work.

1.13 DRAWINGS

- A. Drawings are diagrammatic and indicate the general arrangement of the systems and work included in the Subcontractor. Drawings are not to be scaled. The architectural drawings and details shall be examined for exact dimensions. Where they are not definitely shown, this information shall be obtained from the Designated Representative.

1.14 SWIMMING POOL SUBSUBCONTRACTOR

- A. The swimming pool construction work as herein described and specified in Division 13 of the Project Manual shall be the complete responsibility of a qualified and specifically licensed (C-53 license classification within the State of California) Swimming Pool Subcontractor with extensive experience in commercial public use swimming pool installations.
- B. The Contractor shall require the Swimming Pool Subcontractor to furnish to the Contractor performance and payment bonds in the amount of 100% of the Swimming Pool Subcontractor's bid written by a surety Company properly registered in the State of California and listed by the U.S. Treasury. The expense of the bond(s) is to be borne by the Subcontractor. The Contractor shall clearly specify the amount and requirements of the bond(s) in the Contractor's written or published request for subbids. The Contractor's written or published request for subbids shall also specify that the bond(s) expense is to be borne by the Subcontractor.
- C. Subcontractor certifies that it meets the qualifications and experience requirements established in Swimming Pool General Requirements, Section 13 11 00, as follows:
1. Subcontractor has derived 50% of its annual revenue from public-use swimming pool construction for each of the last five (5) years.
 2. Subcontractor has, in the last five (5) years, constructed at least five (5) commercially designed municipal and public-use swimming pools, each of which have incorporated a minimum size of 6,000 square feet of water surface area with a concrete and ceramic tile perimeter overflow gutter and self-modulating balance tank.
 3. The following list of projects meet the requirements of section (b) above and the contact as reference by the Contractor, the Awarding Authority of their agent or designee.

- a. Owner: _____
Scope of Project: _____
Contact Person: _____
Phone Number: _____
Architect for Project: _____
- b. Owner: _____
Scope of Project: _____
Contact Person: _____
Phone Number: _____
Architect for Project: _____
- c. Owner: _____
Scope of Project: _____
Contact Person: _____
Phone Number: _____
Architect for Project: _____
- d. Owner: _____
Scope of Project: _____
Contact Person: _____
Phone Number: _____
Architect for Project: _____
- e. Owner: _____
Scope of Project: _____
Contact Person: _____
Phone Number: _____
Architect for Project: _____

- D. Swimming Pool Deck Subcontractor other than the swimming pool Subcontractor certifies that it meets the qualifications and experience requirements established in Swimming Pool General Requirements, Section 13 11 00, as follows:

1. Subcontract has, in the last five (5) years, constructed at least five (5) commercially designed cantilevered pool decks over perimeter gutters, each of which have incorporated a minimum size of 6,000 square feet of water surface area of the swimming pool.
2. The following list of projects meet the requirements of section (b) above and the contact as reference by the Contractor, the Awarding Authority of their agent or designee.

SWIMMING POOL DECK SUBCONTRACTOR

a.	Owner:	
	Scope of Project:	
	Contact Person:	
	Phone Number:	
	Architect for Project:	
b.	Owner:	
	Scope of Project:	
	Contact Person:	
	Phone Number:	
	Architect for Project:	
c.	Owner:	
	Scope of Project:	
	Contact Person:	
	Phone Number:	
	Architect for Project:	
d.	Owner:	
	Scope of Project:	
	Contact Person:	
	Phone Number:	
	Architect for Project:	
e.	Owner:	
	Scope of Project:	
	Contact Person:	
	Phone Number:	
	Architect for Project:	

1.15 OPERATING INSTRUCTIONS

- A. The Swimming Pool Subcontractor shall determine from actual samples of pool water supplied by the Owner, the proper water management program necessary for maximum operating efficiency and comfort. The Swimming Pool Subcontractor shall provide the services of experienced personnel familiar with this type of pool system operation, in conformance with Section 13 11 05 of the Specifications.

1.16 MAINTENANCE MANUALS

- A. The Swimming Pool Subcontractor shall provide six (6) bound sets for delivery to the Designated Representative of instructions for operating and maintaining all systems and equipment included in this Contract. Manufacturer's advertising literature or catalog pictures will not be acceptable for operating and maintenance instructions.
- B. Bound in ring binders shall be all parts lists, periodic maintenance instructions and troubleshooting guidelines for all pool equipment, including but not limited to filters, pumps, controllers, water chemistry control equipment, etc.

1.17 SECURE FROM THE OWNER

- A. A complete Owner-furnished filling of the swimming pools.
- B. The Owner's assistance, as specified herein, from the time of start-up until final written acceptance of the swimming pool system(s).
- C. Chemicals as required for swimming pool operation after Swimming Pool Subcontractor completes initial water chemistry balance and water treatment during the maintenance period described in Section 13 11 05 of

the Specifications.

1.18 WARRANTY

- A. The Swimming Pool Subcontractor shall warrant all swimming pool structures, finishes and systems against defects in material and workmanship for a period of one year after the date of acceptance by the Owner. Any repair or replacement required due to defective material or workmanship will be promptly corrected by the Swimming Pool Subcontractor.

2. PART 2 PRODUCTS
NOT USED

3. PART 3 EXECUTION
NOT USED

END OF SECTION

SECTION 13 11 01

SWIMMING POOL Excavation

1. PART 1 GENERAL

1.1 DESCRIPTION

- A. Finish and fine grading to bring the surface of the ground to the required grades and elevations as indicated on the Drawings.
- B. Subgrade improvements and placing of compacted fills.
- C. Excavation and backfill for all swimming pool, surge chamber and structural requirements, including footings, foundations, slabs and walls.

1.2 QUALITY ASSURANCE

- A. Requirements of Regulatory Agencies: Conform with requirements of the General Conditions, and more specifically the following:
 - 1. Comply with California Building Code, latest edition.
 - 2. Comply with applicable construction safety orders, latest edition, Federal and State OSHA.
 - 3. Comply with applicable trench safety provisions, latest edition, Federal and State OSHA.
- B. Qualifications of Workers:
 - 1. The entity performing the work of this Section shall have been successfully engaged in the respective trade for at least five (5) years immediately prior to commencement of the Work.
 - 2. For actual construction operations, use only trained and experienced workers with a minimum of three (3) years experience with the materials and methods specified.
 - 3. Provide at least one person who shall be present at all times during execution of the work of this Section, with a minimum of five (5) years experience with the type of materials being installed, the referenced standards, and who shall direct all Work performed under this Section.
- C. Project/Site Conditions:
 - 1. Be familiar with site and subsurface conditions.
 - 2. Excavation is unclassified and includes excavation to sub-grade elevations indicated or necessary, regardless of character of materials and obstructions encountered.
 - 3. Provisions for mitigation of wet soils due to seepage or rain shall be made during excavation and throughout construction. If wet soils are encountered within the swimming pool excavations, de-watering shall be provided and the Geotechnical Engineer shall make recommendations for moist soil mitigation.
 - 4. Where slope instability is encountered, all excavations within those areas shall be 1:1 or flatter. Forming of vertical walls may be necessary, and all soil conditions shall be field verified by the Geotechnical Engineer.
 - 5. Contractor shall review the Geotechnical Investigation Report as furnished by the Owner to determine the suitability of the soils.
- D. Adverse Weather Conditions:
 - 1. During the periods when site soil moisture content is substantially in excess of moisture content required for optimum compaction, do not perform fill compaction.
 - 2. When unfavorable weather conditions necessitate interrupting filling and grading operations, prepare areas by compaction of surface and grading to avoid collection of water. Provide adequate temporary drainage to prevent erosion.

1.3 SUBMITTALS AND SUBSTITUTIONS

- A. Provide submittals in conformance with requirements of Section 01 33 00. Requests for substitution shall conform to requirements of Article 1.10 of Section 13 11 00.
- B. Required submittals include:
Offsite fill material, if applicable.
- C. Submit proof of qualifications as specified in Article 1.2.B of this Section.

1.4 EXCAVATING & TRENCHING, GENERAL REQUIREMENTS

- A. Refer to Section 01 50 00, Temporary Facilities and Controls.
- B. All trenches, holes, etc. are to be completely protected using solid barricades, steel plates, and plywood both during construction and during off hours, including night time.
- C. Flashing warning light barricades are required on sidewalks, roads, and any other critical areas that require night time protection.
- D. Roads, paths and sidewalks shall not be blocked at any time or in any way. Trenching across roads, paths or sidewalks involves special instructions and review of the construction procedure by the Owner at least three (3) days prior to the Work actually being started.
- E. Construction equipment, including all trucks, cars, etc. shall not be parked or driven on roads, paths or sidewalks. Items not allowed on roads, paths or sidewalks include hoses, power cords, ropes, construction materials, dirt and debris, etc.
- F. All roads, paths and sidewalks must remain clear and the Contractor shall maintain temporary safe and effective pedestrian access at all times.
- G. Drawings show existing major underground utilities using the best information available. The Contractor shall also fully check public works reference drawings prior to excavation. Call local Dig Alert to locate utilities to ensure safety.

2. PART 2 PRODUCTS

2.1 MATERIALS

- A. Fill Material, General: All material shall be subject to the review of the Geotechnical Engineer to determine acceptability.
- B. In general, the on-site, low-expansion potential, silty and poorly graded sand materials shall be suitable for re-use as fill.
On-site and import soils to be placed as fill shall be free of trash, debris, roots, vegetation, contaminated material, or deleterious materials. Fill shall generally be free of rocks or hard lumps of material larger than approximately 4 inches in diameter. Rock or hard lumps larger than about 4 inches in diameter shall be broken into smaller pieces or shall be removed from the site.

Imported materials shall consist of clean, granular material with a low expansion potential, corresponding to an expansion index of 50 or less as evaluated in accordance with ASTM Standards (CBC, 2013).

3. PART 3 EXECUTION

3.1 INSPECTION

- A. Verify drawing dimensions and elevations with actual field conditions. Inspect related Work and adjacent surfaces and report discrepancies and conditions which prevent proper execution of the Work to the Owner's Representative.

3.2 SUBGRADE IMPROVEMENTS

- A. Clearing: Strip site area (as defined within the Drawings) of any topsoil containing vegetation, trees and roots, organic matter, and other debris, and dispose of as specified.
- B. Fill soils placed shall be compacted in horizontal lifts to a relative compaction of 90 percent or more in general accordance with ASTM D 1557. The lift thickness for fill soils will vary depending on the type of compaction equipment used but shall generally be placed in horizontal lifts not exceeding 8 inches in loose thickness. Fill soils shall be placed at slightly above the optimum moisture content as evaluated by ASTM D 1557.
- C. Bedding sand within the pipe zone of necessary utility trenches beneath the lower pool slab should be vibrated in-place or compacted using hand-held equipment until the compacted surface is firm and unyielding.

3.3 EXCAVATION

- A. Checking Layout: Contractor shall, before commencing the excavation work, check all lines, stakes and levels for dimensions, angles, elevations and grades with the survey.
- B. Dimensions: Excavate to proper dimensions as shown, cut square and smooth with firm level bottoms. Prepared excavations shall be approved by Geotechnical Engineer. Excavations shall be free of loose or disturbed materials.
- C. Excess Water Control: Keep all excavations free from standing water by pumping, draining or providing proper protection against water intrusion. If soil becomes soft, soggy or saturated, perform additional excavation to firm soil not affected by water.
- D. Form Removal: Make all excavations of sufficient size to permit installation and removal of forms and all other required work.
- E. Alternate Forming: Sides of structures may be formed by neat excavations where banks will stand without caving. If banks cave, provide forming as required and widen excavation to permit forming, bracing and inspection. Provide forming in conformance with Section 13 11 02 and all recognized safety standards. Form all grade beams.

3.4 BACKFILLING

- A. Method: After concrete has been placed, forms removed and concrete work approved, backfill the excavations with earth to indicated or required grades. Carry on backfilling simultaneously on each side of walls or grade beams. Remove all rubbish and wood from the excavations before placing backfill.
- B. Concrete Protection: Prior to placing any backfill, adequately cure all concrete and provide any bracing required to ensure the stability of the structure. Protect waterproofing and dampproofing against damage in a manner acceptable to the Owner's Representative. Remove bracing as backfill operations progress.
- C. The on-site granitic bedrock may be utilized for trench backfill once it is processed. The on-site lean and fat clay should not be used for trench backfill. Imported fill should be free of organic material and rocks over 2 ½ inches in diameter.
- D. Backfill of all trenches should be placed in thin lifts and mechanically compacted to achieve a relative compaction of not less than 95 percent in paved areas and 90 percent in other areas per ASTM 1557. Care should be taken not to damage utility lines.
- E. Moisture: Rigidly control the amount of water used to insure optimum moisture conditions for the type of fill material used. Excessive amounts of water causing saturation of earth will not be permitted. Compaction by flooding or jetting is prohibited.

3.5 GRADING

- A. Slopes: Grade to finish grades indicated on Drawings, with uniform slopes between all points.
- B. Subgrades: Blade to required grade and roll or tamp subgrades for exterior slabs, decks and paving.

3.6 CLEAN-UP

- A. Disposal: Haul away rubbish, debris, and rocks from site promptly and dispose of legally. Burning rubbish on site is prohibited.
- B. Dust and Noise Abatement: During entire period of construction keep area and material being loaded sprinkled to reduce dust in air and annoyance to premises and surrounding property.

END OF SECTION

SECTION 13 11 02

SWIMMING POOL CONCRETE

1. PART 1 GENERAL

1.1 WORK INCLUDED

- A. Forming for cast-in-place concrete and shotcrete associated with the swimming pool and pool decks.
- B. Reinforcement for cast-in-place concrete and shotcrete associated with the swimming pool. and pool decks.
- C. Cast-in-place concrete for the swimming pool structures. Do not use water proofing admixture of any kind.
- D. Cast-in-place concrete for swimming pool decks with Xypex C-500 crystalline waterproofing admixture. Waterproofing admixture for swimming pool decks only.
- D. Provide labor, materials and equipment as required to install sealant for al pool deck expansion joints, or any other caulking, as indicated on the aquatic drawings and herein specified.

1.2 QUALITY ASSURANCE

A. Qualifications of Workers:

- 1. The entity performing the work of this Section shall have been successfully engaged in the respective trade for at least five (5) years immediately prior to commencement of the Work.
- 2. For actual construction operations, use only trained and experienced workers with a minimum of three (3) years experience with the materials and methods specified.
- 3. Provide at least one person who shall be present at all times during execution of the work of this Section, with a minimum of five (5) years experience with the type of materials being installed, the referenced standards, and who shall direct all Work performed under this Section.

B. Standards:

- 1. In addition to complying with the California Building Code (latest edition), comply with all pertinent recommendations contained in "Recommended Practice for Concrete Formwork," Publication ACI 347-78 of the American Concrete Institute.
- 2. In addition to complying with California Building Code (latest edition), comply with all pertinent recommendations contained in "Manual of Standard Practice for Detailing Reinforced Concrete Structures," Publication ACI 315-74 of the American Concrete Institute.
- 3. In addition to complying with all local codes and regulations, comply with all pertinent recommendations contained in American Society for Testing and materials (ASTM); ASTM C 920 "Standard Specification for Elastometric Joint Sealants."

- C. Tolerances: Construct all swimming pool concrete straight, true, plumb and square within a tolerance horizontally of one in 200 and vertically of one in 2000.

1.3 SUBMITTAL AND SUBSTITUTIONS

- A. Provide submittals in conformance with the requirements of Section 01 33 00.

B. Samples and Certificates, Concrete Reinforcement:

- 1. Provide all data and access required for testing as described in Section 01 45 00 of the Specifications.
- 2. All material shall bear mill tags with heat number identification. Mill analysis and report shall be made available upon request.
- 3. Material not so labeled and identifiable may be required by the Owner to be tested by the testing laboratory selected by the Owner and at no additional cost to the Owner, in which case random samples will be taken for one series of tests from each 2-1/2 tons or fraction thereof of each size and kind of reinforcing steel.
- 4. Design mix from batch plant demonstrating previous use history and associated strengths at 28 days.

5. The Contractor shall submit a mix design stamped and signed by a licensed engineer for approval by the Owner's Representative prior to any placement of concrete.
 6. The Contractor shall submit a separate mix design stamped and signed by a licensed engineer for the swimming pool decks which contains the specified Xypex C-500 crystalline waterproofing admixture for approval by the Owner's Representative prior to any placement of concrete.
- C. Submit proof of qualifications as specified in Article 1.2.A of this Section.
 - D. Submit reinforcing shop drawings for pool walls, gutters, floors, dike walls and balance tanks, etc. as shown on the construction drawing.

1.4 PRODUCT HANDLING

- A. Delivery: Deliver materials to the Project Site in the manufacturer's original unopened containers with all labels intact and legible.
- B. Storage: Store materials under cover in a manner to prevent damage and contamination, and store only the specified materials at the Project Site.
- C. Protection: Use all means necessary to protect the swimming pool concrete before, during, and after installation and to protect the installed Work specified in other Sections.
- D. Replacements: In the event of damage, immediately make all repairs and replacements necessary to the approval of the Owner.

2. PART 2 PRODUCTS

2.1 CONCRETE FORMWORK

- A. Form Materials:
 1. Form Lumber: All form lumber in contact with exposed concrete shall be new except as allowed for reuse of forms in Part 3 of this Section, and all form lumber shall be one of the following, a combination thereof, or an equal approved in advance by the Owner's Representative.
 - a. "Plyform," Class I or II, bearing the label of the Douglas Fir Plywood Association; "Inner-Seal" Form as manufactured by Louisiana-Pacific, or approved equal.
 - b. Douglas Fir-Larch, number two grade, seasoned, surfaced four sides.
 2. Form Release Agent: Colorless, non-staining, free from oils; chemically reactive agent that shall not impair bonding of paint or other coatings intended for use.
- B. Ties and Spreaders:
 1. Type: All form ties shall be a type which do not leave an open hole through the concrete and which permits neat and solid patching at every hole.
 2. Design: When forms are removed, all metal reinforcement shall be not less than two (2) inches from the finished concrete surface.
 3. Wire Ties and Wood Spreaders: Do not use wire ties or wood spreaders.
- C. Alternate Forming Systems: Alternate forming systems may be used subject to the advance approval of the Owner's Representative.

2.2 CONCRETE REINFORCEMENT

- A. Bars: Bars for reinforcement shall conform to "Specifications for Deformed Billet-Steel Bars for Concrete Reinforcement," ASTM A-615, Grade 60.
- B. Wire Fabric: Wire fabric shall conform to "Specifications for Wire Fabric for Concrete Reinforcement," ASTM A-185.
- C. Tie Wire: Tie wire for reinforcement shall conform to "Specifications for Cold-drawn Steel Wire for Concrete Reinforcement," ASTM A-82 black annealed 16-gauge tie wire.

2.3 CAST-IN-PLACE CONCRETE

A. Concrete:

1. All concrete, unless otherwise specifically permitted by the Owner's Representative, shall be transit-mixed in accordance with ASTM C94. Concrete for water retaining structures that do not receive a waterproofing finish such as ceramic tile or swimming pool plaster shall receive a topical waterproofing finish.
2. The control of concrete production shall be under the supervision of a recognized testing agency, selected by the Owner in accordance with Section 01 25 00 of the Specifications.
3. Quality: All concrete shall have the following minimum compressive strengths at twenty-eight (28) days and shall be proportioned within the following limits:
 - a. 3,000 psi minimum compressive strength for cast-in-place concrete swimming pool structures.
 - b. 4,000 psi minimum compressive strength for cast-in -place swimming pool decks with Xypex C-500 waterproofing admixture.
 - c. 1" maximum size aggregate.
 - d. 6.0 minimum sacks of cement per cubic yard.*
 - e. Maximum water to cement ratio of 0.55.
 - f. 4" maximum slump.
 - g. Xypex Admix C-500 2%-2.5% by weight of cement content. Contact Xypex Technical Services to confirm dosage. (To be used for swimming pool decks only.)

* For estimate only: to be determined by mix design.
4. Cement: All cement shall be Portland Cement conforming to ASTM C-150, Type II or V, and shall be the product of one manufacturer.
5. Aggregates:
 - a. Shall conform to "Standard Specifications for Concrete Aggregates," ASTM C33, except as modified herein.
 - b. Coarse Aggregate: Clean sound washed gravel or crushed rock. Crushing may constitute not more than 30% of the total coarse aggregate volume. Not more than 5% flat, thin, elongated or laminated material nor more than 1% deleterious material shall be present. 1" aggregate graded from 1/4" to 1", fineness modulus 6.90 to 7.40. 1-1/2" graded from 1/2" to 1-1/2", fineness modulus 7.80 to 8.20.
 - c. Fine Aggregate: Washed natural sand of hard, strong particles and shall contain not more than 1% of deleterious material, fineness modulus 2.65 to 3.05.
 - d. Aggregate must be certified, non expansive from a "known" good source.
6. Water: Clean, fresh, free from acid, alkali, organic matter or other impurities liable to be detrimental to the concrete (potable).
7. Admixtures: Admixtures shall be used upon approval of the Owner's Representative.
 - a. Air-entraining admixture: Conform to ASTM C260.
 - b. Water-reducing admixture: Conform to ASTM C494.
 - c. Waterproofing admixture for swimming pool decks only: Xypex C-500, no substitutions permitted. Conform to ASTM C494.
8. Xypex Admix C-500 Dosage: To be used for swimming pool decks only.
 - a. General: Xypex Admix must be added to concrete mix at time of batching. It is important to obtain a homogeneous mixture of Xypex Admix with the concrete. Do not add dry Admix powder directly to wet mixed concrete as this could cause clumping and thorough dispersion may not occur.
 - b. Dosage Rate: Under normal conditions, the crystalline waterproofing powder shall be added to the concrete mix at the following rates:
 - 1.) Xypex Admix C-500 2% – 2.5% by weight of cement content
 - c. Weather Conditions: For mixing, transporting and placing concrete under conditions of high temperature or low temperature, follow concrete practices such as those referred to in ACI 305R (Hot Weather Concreting) and ACI 306R (Cold Weather Concreting) or other applicable standards.
 - d. Concrete Batching & Mixing Procedures: Procedures for the addition of Xypex admixture will vary

according to type of batch plant operation and equipment. Prior to the placement of any concrete, the concrete batch plant and the contractor shall be responsible to consult with the local Xypex representative concerning additional procedures for the addition, mixing and to confirm dosage.

Note: For enhanced chemical protection or for meeting specific project requirements or where the concrete mix design contains higher than 25% type F fly ash content or includes a portland cement/slag cement/type C fly ash blend, consult with manufacturer or its authorized representative to determine appropriate dosage rates.

- B. Construction Joints: Use keyform for slab pour joints. Either preformed galvanized or PVC construction joint forms of a standard manufacturer may be used. Install per manufacturer's recommendations and tool edges of slabs.
- C. Waterstops: PVC bulb-type for use between concrete pours / lifts, conforming with ASTM D 570, D 624, and D 638. Provide in configuration(s) as recommended by manufacturer for specific application. Greenstreak, W.R. Meadows, or approved equal.
- D. Curing Materials:
 - 1. Liquid Membrane (covered slab): Chlorinated rubber membrane forming, curing-sealing compound conforming to ASTM C309.
 - 2. Liquid Membrane (exposed slab): Clear methyl and butyl methacrylate non-staining, membrane forming, curing-sealing compound conforming to ASTM C309.
- E. Cement Grout and Drypack:
 - 1. Cement Grout: Mix 1 part by volume of Portland Cement, 1/2 part by volume of water and fine aggregate enough to make mixture flow under its' own weight.
 - 2. Drypack: Mix 1 part by volume of Portland Cement, 1/2 part by volume of water and fine aggregate enough to make a stiff mix that will mold into a ball. Mix no more than can be used in 30 minutes.

2.4 JOINT SEALANT MATERIALS

- A. Caulking: Multipart, non-sag gun grade polyurethane-based sealant meeting the requirements of ASTM C920-02, Type S or M, Mamemco International, Pecora, Sika Corp., Sonneborn Building Products, Tremco or approved equal. Self-leveling caulking materials are not allowed.
- B. Primer: Non-staining type, recommended by sealant manufacturer to suit application.
- C. Joint Cleaner: Non-corrosive and non-staining type, recommended by sealant manufacturer; compatible with joint forming materials.
- D. Sealant Backer Rod: Provide compressible polyethylene or polyurethane backer rod as recommended by the sealant manufacturer.
- E. Bond Breaker Tape: Provide polyethylene tape or other plastic tape as recommended by sealant manufacturer, to be applied to sealant-contact surfaces where bond to substrate or joint filler must be avoided for proper performance of sealant.
- F. Sand: Cover the surface of the caulking with #30 silica sand.

2.5 OTHER MATERIALS

- A. All other materials, not specifically described but required for proper completion of the work of this Section, shall be as selected by the Contractor subject to the advance review by the Owner's Representative.

3. PART 3 EXECUTION

3.1 SURFACE CONDITIONS

- A. Inspection:

- 1. Prior to all Work of this Section, carefully inspect the installed Work of other trades and verify that all

such Work is complete to the point where this installation may properly commence.

2. Verify that all Work may be constructed in accordance with all applicable codes and regulations, the referenced standards, and the original design.

B. Discrepancies:

1. In the event of discrepancy, immediately notify the Owner's Representative.
2. Do not proceed with installation in areas of discrepancy until all such discrepancies have been fully resolved.
3. Failure to notify the Owner's Representative and give written notice of discrepancies shall constitute acceptance by the Contractor of existing conditions as fit and proper to receive work.

3.2 CONCRETE FORMWORK

A. Construction of Forms:

1. General: Construct all required forms to be substantial, sufficiently tight to prevent leakage of concrete paste, and able to withstand excessive deflection when filled with wet concrete.
2. Layout:
 - a. Form for all required cast-in-place concrete to the shapes, sizes, lines and dimensions indicated on the Drawings.
 - b. Exercise particular care in the layout of forms to avoid necessity for cutting concrete after placement.
 - c. Make proper provisions for all openings, offsets, recesses, anchorages, blocking and other features of the Work as shown or required.
 - d. Perform all forming required for Work of other trades and do all cutting and repairing of forms required to permit such installation.
 - e. Carefully examine the Drawings and Specifications and consult with other trades as required relative to providing for pipe and conduit penetrations, reglets, chases and other items in the forms.
3. Imbedded Items: Set all required steel frames, angles, bolts, inserts and other such items required to be anchored in the concrete prior to concrete being placed.
4. Bracings:
 - a. Properly brace and tie the forms together so as to maintain position and shape and to ensure safety to workmen.
 - b. Construct all bracing, supporting members and centering of ample size and strength to safely carry, without excessive deflection, all dead and live loads to which they may be subjected.
 - c. Properly space the forms apart and securely tie them together, using metal spreader ties that give positive tying and accurate spreading.
5. Wetting: Keep forms sufficiently wetted to prevent joints from opening up before concrete is placed.

B. Plywood Forms:

1. Design: Nail the plywood panels directly to studs and apply in a manner to minimize the number of joints.
2. Joints: Make all panel joints tight butt joints with all edges true and square.

C. Footing Forms:

1. Wood Forms: All footing forms shall be wood unless otherwise specifically approved by the Owner's Representative, or as specified in paragraph 3.2(C)(2).
2. Earth Forms:
 - a. Side walls for footings may be of earth provided the soil will stand without caving and the sides of the bank are made with a neat cut to the minimum dimensions indicated on the Drawings.
 - b. For excavation and backfill of earth forms, conform with applicable provisions of Section 13 11 01.

D. Reuse of Forms:

1. Reuse of forms shall be subject to advance approval of the Owner's Representative.
2. Except as specifically approved in advance by the Owner's Representative, reuse of forms shall in no

way delay or change the schedule for placement of concrete from the schedule obtainable if all forms were new.

3. Except as specifically approved in advance by the Owner's Representative, reuse of forms shall in no way impart less structural stability to the forms nor less acceptable appearance to finished concrete.

E. Removal of Forms:

1. General:

- a. In general, side forms of footings may be removed seven (7) days after placement of concrete, but time may be extended if deemed necessary by the Owner's Representative.
- b. Forms for footings, foundations, grade beams, slabs, walls, and other formed concrete may be removed fourteen (14) days after placement of concrete.

2. Removal:

- a. Use all means necessary to protect workers, passersby, the installed Work of other trades and the complete safety of the structure.
- b. Cut nails and tie wires or form ties off flush, and leave all surfaces smooth and clean.
- c. Remove metal spreader ties on exposed concrete by removing or snapping off inside the wall surface and pointing up and rubbing the resulting pockets to match the surrounding areas.
- d. Flush all holes resulting from the use of spreader ties and sleeve nuts using water, and then solidly pack throughout the wall thickness with cement grout applied under pressure by means of a grouting gun; grout shall be one-part Portland Cement to 2-1/2 parts sand; apply grout immediately after removing forms.

3.3 CONCRETE REINFORCEMENT

A. Bending:

1. General:

- a. Fabricate all reinforcement in strict accordance with the Drawings.
- b. Do not use bars with kinks or bends not shown on the Drawings.
- c. Do not bend or straighten steel in a manner that will injure the material. (When opposite end is already encased in concrete.)

2. Design:

- a. Bend all bars cold.
- b. Make bends for stirrups and ties around a pin having a diameter of not less than two (2) times the minimum thickness of the bar.
- c. Make bends for other bars, including hooks, around a pin having a diameter of not less than six (6) times the minimum thickness of the bar.

B. Placing:

1. General: Before the start of concrete placement, accurately place all concrete reinforcement, positively securing and supporting by concrete blocks, metal chairs or spacers, or by metal hangers.
2. Clearance:

- a. Preserve clear space between bars of not less than one and one-half (1-1/2) times the nominal diameter of the round bars.
- b. In no case let the clear space be less than one and one-half (1-1/2) inches nor less than one and one-third (1-1/3) times the maximum size of the aggregate.
- c. Provide the following minimum concrete covering of reinforcement:
 - 1) Concrete deposited against earth: three (3) inches minimum.
 - 2) Concrete below grade deposited against forms: two (2) inches minimum.
 - 3) Concrete elsewhere: As indicated on Drawings or otherwise approved by the Owner's Representative.

3. Splicing:

- a. Horizontal Bars:
 - 1) Place bars in horizontal members with minimum lap at splices sufficient to develop the strength of the bars.
 - 2) Bars may be wired together at laps except at points of support of the member, at which points preserve clear space described above.
 - 3) Whenever possible, stagger the splices of adjacent bars.
 - 4) Splice forty (40) bar diameters minimum.
 - 5) Provide non-contact lap slices for shotcrete.
- b. Wire Fabric: Make all splices in wire fabric at least one and one-half (1-1/2) meshes wide.
- c. Other Splices: Make only those other splices that are indicated on the Drawings or specifically approved by the Owner's Representative.
- 4. Dowels: Place all required steel dowels and securely anchor them into position before concrete is placed.
- 5. Obstructions: In the event conduits, piping, inserts, sleeves and other items interfere with placing reinforcement as indicated on the Drawings or otherwise required, immediately consult with the Owner's Representative and obtain approval of a new procedure prior to placing concrete.
- C. Cleaning Reinforcement: Steel reinforcement, at the time concrete is placed around it, shall be free from rust scale, loose mill scale, oil, paint and all other coatings which will destroy or reduce the bond between steel and concrete. Bend down all tie wire away from the top of the pool deck. Maintain a 2" clear from the top of the concrete to the tie wire.

3.4 SHOTCRETE REINFORCEMENT

- A. The maximum size of reinforcement shall be No. 5 bars unless it can be demonstrated by preconstruction tests that adequate encasement of larger bars can be achieved. When No. 5 or smaller bars are used, there shall be a minimum clearance between parallel reinforcement bars of 2-1/2 inches (64 mm). When bars larger than No. 5 are permitted, there shall be a minimum clearance between parallel bars equal to six diameters of the bars used. When two curtains of steel are provided, the curtain nearest the nozzle shall have a minimum spacing equal to 12 bar diameters and the remaining curtain shall have a minimum spacing of six bar diameters.
- B. Lap splices in reinforcing bars shall be by the non-contact lap splice method with at least 2 inches clearance between bars. The enforcement agency may permit the use of contact lap splices when necessary for the support of the reinforcing provided it can be demonstrated by means of preconstruction testing, that adequate encasement of the bars at the splice can be achieved, and provided that the splices are placed so that a line through the center of the two spliced bars is perpendicular to the surface of the shotcrete work.

3.5 CAST-IN-PLACE CONCRETE

- A. Conveying and Placing Concrete:
 - 1. Before placing concrete, mixing and conveying equipment shall be well cleaned, and the forms and space to be occupied by concrete shall be thoroughly cleaned and wetted. Ground water shall be removed until the completion of the work.
 - 2. No concrete shall be placed in any unit of work until all formwork has been completely constructed, all reinforcement has been secured in place, all items to be built into concrete are in place, and form ties at construction joints tightened.
 - 3. Concrete shall be conveyed from mixer to place of final deposit in such a way to prevent the separation or loss of ingredients. It shall be placed as nearly as practicable in its' final position to avoid rehandling or flowing. Concrete shall not be dropped freely where reinforcing bars will cause segregation, nor shall it be dropped freely more than six (6) feet. Use tremies, spouts and dump boxes in deep sections. Vibrators are not acceptable for facilitating concrete transport.
 - 4. Concrete shall be tamped and spaded to insure proper compaction into all parts of forms and around reinforcement. A mechanical vibrator shall be used to thoroughly compact the concrete. Vibration must be by direct action in the concrete and not against forms or reinforcement.
 - 5. Mixing and transport time as indicated in ASTM C94 is required. If air temperatures are between 85° and 90° F the delivery time is to be reduced to 75 minutes. When air temperatures is in excess of 90° F the delivery time should be reduced to 60 minutes.

6. Truck mixes without batch certificates will be rejected.
- B. Construction Joints / Expansion Joints: Construction joints and expansion joints shall be provided at locations and in the manner shown on the Drawings. With exception of existing concrete / new shotcrete joints, use PVC bulb-type waterstops appropriate for design condition between all concrete pours / lifts to avoid cold joints. Waterstops shall be placed in such a way to protect reinforcing steel from rust and oxidation. All expansion joints must be the full depth of the concrete section in which they are located.
- C. Slab Finishes: Concrete slabs shall be compacted and screeded uniformly to grades shown. Push large aggregates below the surface with a screen tamper, screed and bull float. As soon as the surface becomes workable, it shall be wood floated, then finished as indicated on the Drawings to a uniform smooth, true surface in a neat and workmanlike manner. Carefully coordinate slab finish requirements with other trades (ceramic tile, pool plaster) to insure concrete finish is appropriate substrate for final finish material.
1. Contractor shall provide three mock-up deck samples, minimum 3'x 3', with a wedge anchor installed in one sample. These (3) samples shall be constructed; one with a light broom finish, one (1) with a medium broom finish and one (1) with a heavy broom finish for determination and selection of an appropriate deck finish. Each sample shall be edged on all four sides to demonstrate a 3/4" radius edge. Anchor installation shall demonstrate acceptable interface between anchor and the top of deck. Deck samples shall remain on job site through final inspection for reference.
 2. Pool Floor Slab: Heavy Wire Broom Finish.
- D. Protection and Curing:
1. Concrete shall be protected from injurious action of the elements and defacement of any nature during construction.
 2. All forms must be kept wet to prevent drying out of the concrete.
 3. All concrete surfaces including footings must be kept wet for at least seven (7) days after concrete is placed.
 4. Apply the appropriate curing materials, as specified in 2.3 of this Section, immediately after finishing slabs. Application shall be as specified by the manufacturer.
- E. Form Removal:
1. Take care in removing forms so that surfaces are not marred or gouged and that corners are true, sharp and unbroken.
 2. No steel spreaders, ties or other metal shall project from or be visible on any concrete surfaces.
- F. Defective Work:
1. Should the strength of any concrete for any portion of the work indicated by tests of molded cylinders and core tests fall below minimum 28 days strength specified or indicated, concrete will be deemed defective work and shall be replaced.
 2. Concrete work that is not formed as indicated, is not true to intended alignment, not plumb or level where so intended, not true to intended grades or elevations, not true to specified or selected finish, contains sawdust shavings, wood, or embedded debris, which exhibits cracks or contains fine or coarse sulfide particles, or expansive aggregates detrimental to performance or appearance of the concrete shall be deemed defective.
 3. Promptly perform work required to replace and properly clean (by sandblasting if necessary) any defective concrete panels (control joint or expansion joint to control joint or expansion joint), at Contractor's expense, including all expense of additional inspection, tests, or supervision made necessary as a result of defective concrete.

3.6 EXPANSION JOINTS

- A. Temperatures: Do not install sealants when air temperature is less than 40°F.
- B. Tooling: Tool exposed joints to a slightly concave surface using slicking materials recommended by the manufacturer. The tooling procedure shall press sealant against the sides of the joint. No materials shall be left "feathered" out or smeared on the abutting materials. Completed joints shall have a uniform professional appearance.
- C. Joint Construction: Sealant joint width, thickness and cross-sectional profile to be constructed in strict accordance with the sealant manufacturer's recommendations.

D. Sand: At the appropriate time cover the sealant with sand to provide a sanded finish.

3.7 CLEAN-UP

A. Upon completion of the Work of this Section, immediately remove all swimming pool concrete materials, debris and rubbish occasioned by this Work to the approval of the Owner's Representative.

END OF SECTION

SECTION 13 11 03

SWIMMING POOL SHOTCRETE

1. PART 1 GENERAL

1.1 WORK INCLUDED

- A. Provide labor, materials and equipment as required to install wet mix shotcrete for swimming pool structures as indicated on the Drawings and herein specified.

1.2 QUALITY ASSURANCE

A. Qualifications of Workers:

1. The entity performing the work of this Section shall have been successfully engaged in the respective trade for at least five (5) years immediately prior to commencement of the Work.
2. For actual construction operations, use only trained and experienced workers with a minimum of three (3) years experience with the materials and methods specified.
3. Provide at least one person who shall be present at all times during execution of the work of this Section, with a minimum of five (5) years experience with the type of materials being installed, the referenced standards, and who shall direct all Work performed under this Section.

- B. Standards: Except as otherwise indicated, provide shotcrete per American Concrete Institute Standard ACI 506. In addition, conform to recommendations contained in "Shotcrete," Brochure G-84 as published by the Guniting Contractors Association, Sylmar, California and the California Building Code (latest edition).

- C. Mix Design: The Contractor shall submit a mix design stamped and signed by a licensed engineer for approval by the Owner's Representative prior to any placement of shotcrete. Mix design shall indicate source of aggregate and brands of cement and admixtures used. All mix designs shall take character of locally available aggregate into consideration and make adjustments as necessary to conform with specified design criteria.

- D. Testing and Inspection: One test panel shall be provided for each 50 yards (or portion thereof) of shotcrete placed. The size of the strength test panel shall be per the direction of the Special Shotcrete Inspector. At least three (3) cores shall be taken from each test panel. (At least three (3) cores shall be taken from the completed work for each day of shotcrete operation.) Testing shall be performed by the Owner's designated Testing Lab and comply with Section 1705A.3 and 1908A.10, California Building Code. Continuous inspection of the shotcrete operation by a deputy inspector provided by the Owner shall be required. Inspection of shotcrete work shall comply with Section 1908A of California Building Code, and coring, sampling, soaking and testing per 1908A.10 and preconstruction test per 1908A.5 is required. Contractor shall provide test panels for all required tests.

- E. Tolerances: Construct all swimming pool shotcrete straight, true, plumb and square within a tolerance horizontally of one in 200 and a tolerance vertically of one in 2000.

1.3 SUBMITTALS AND SUBSTITUTIONS

- A. Provide submittals in conformance with the requirements of Section 01 33 00.

- B. Materials List: Within thirty (30) days after issuance of Notice to Proceed, and before shotcrete materials are delivered to the project site, submit to the Owner a complete list of materials proposed to be used in this portion of the Work, showing manufacturer's name and catalog number of all items such as admixtures and curing membranes, and the name and address of the supplier of cement and aggregate to be used.

- C. Submit proof of qualifications as specified in Article 1.2.A of this Section.

1.4 PRODUCT HANDLING

- A. Protection: Use all means necessary to protect shotcrete materials before, during and after installation and to protect the installed Work specified in other Sections.

- B. Replacements: In the event of damage, immediately make all repairs and replacements necessary to the approval of the Owner and at no additional cost to the Owner.

2. PART 2 PRODUCTS

2.1 MATERIALS

- A. Cement: Cement shall be Type II Portland Cement conforming to ASTM C150. Cement type shall be the same for all shotcrete work.
- B. Aggregate: ASTM C33, washed hard dense durable clean sharp sand from approved pit, free of organic matter and opaline, feldspar, or silicious magnesium substances and containing not more than 3% by weight of deleterious substances. When tested for organic impurities by ASTM C40 method, fine aggregate color not darker than reference standard color. When tested for soundness by ASTM C88 method, loss after 5 cycles not over 10% of fine aggregate.
- C. Water: Potable, clean, fresh, free from acid, alkali, organic matter or other impurities liable to be detrimental to the shotcrete.
- D. Admixtures: Admixtures shall only be used upon approval of the Owner's Representative.

3. PART 3 EXECUTION

3.1 EXECUTION

- A. Inspection:
 - 1. Prior to all Work of this Section carefully inspect the installed Work of other trades and verify that all such Work is complete to the point where this installation may properly commence.
 - 2. Verify that items to be imbedded in shotcrete are in place and that shotcrete may be placed to the lines and elevations shown on the Drawings, with all required clearance from reinforcement.
- B. Discrepancies:
 - 1. In the event of discrepancy, immediately notify the Owner's Representative.
 - 2. Do not proceed with installation in areas of discrepancy until all such discrepancies have been fully resolved.
 - 3. Failure to notify the Owner's Representative and give written notice of discrepancies shall constitute acceptance by the Contractor of existing conditions as fit and proper to receive the Work.

3.2 PREPARATION

- A. General:
 - 1. Thoroughly clean all areas where shotcrete is to be placed to insure proper bonding of shotcrete.
 - 2. Where shotcrete is to be placed against smooth surfaces (i.e., cast-in-place concrete), sandblast surfaces to receive shotcrete to provide clean aggregate surface, thereby insuring proper bond between materials.
- B. Ground Wires: Adequate ground wires, to be used as screeds, shall be installed to establish the thickness and surface planes of the shotcrete work. Ground wires shall be placed so that they are tight and true to line and grade and in such a manner that they can be easily tightened.

3.3 PROPORTIONING AND MIXING

- A. Accurately control proportion of water to Portland cement to produce thorough and uniform hydration of the shotcrete that, when shot, forms a homogeneous mass containing neither sags nor dry sand formation.
- B. Strength: Minimum 3,000 psi 28-day compressive strength unless otherwise indicated.
- C. Discontinue shotcrete work if the time between the addition of mixing water to cement and aggregate, or cement to aggregates, and placement of shotcrete exceeds ninety (90) minutes when the ambient temperature is below 85 degrees Fahrenheit, or exceeds sixty (60) minutes when the ambient temperature is above 85 degrees Fahrenheit.

3.4 SHOTCRETE PLACING, FINISHING, AND CURING

- A. Operations: Utilize a standard type of air compressor, capable of providing a minimum of 250 cubic feet of air per minute per nozzle.
- B. Placing: Except when shooting reinforcing, hold the nozzle perpendicular to and 2-1/2 to 3 feet from surface. At reinforcing bars, hold the nozzle so as to direct shotcrete behind the bars, and shoot each side of each bars separately. A nozzleman's helper equipped with an air jet shall precede the nozzle and blow out rebound or sand lodged behind bars, on forms, or placed shotcrete. Placing shotcrete horizontal members from the top is not allowed unless approved methods are employed to eliminate all rebound. Material shall emerge from the nozzle in a uniform flow. If flow becomes intermittent for any reason, direct the nozzle away from the surface until the flow is again steady and constant. Do not reuse rebound or loose sand for any purpose.
- C. Puddled Shotcrete: Use of "puddled shotcrete" in which the air pressure is reduced and the water content is increased to facilitate placing in difficult locations is not allowed. Do not place shotcrete where nozzle stream cannot impinge directly on the involved surface. Where difficult shooting conditions occur, obtain proper results by maintaining correct air pressure and water ratio and reduce supply of material.
- D. Construction Joints: Form joints with sloping beveled edges. Clean and dampen the hardened joint surfaces before placing additional shotcrete. Square edged construction joints are not allowed. The film of laitance which forms on the surface of the shotcrete shall be removed within approximately two hours after application by brushing with a stiff broom. If this film is not removed within two hours, it shall be removed by thorough wire brushing or sand blasting. Construction joints over eight hours old shall be thoroughly cleaned with air and water prior to receiving shotcrete.
- E. Finishing: Rod exposed surfaces to true planes and lines on reaching the thickness and plane established by forms and ground wires. Tamp and wood float surfaces level and provide a rough raked finish. Carefully coordinate finish requirements with other trades (ceramic tile, pool plaster) to insure shotcrete finish is appropriate substrate for final finish material.
- F. Curing: Keep shotcrete continuously damp for not less than seven (7) days after placing. Use sealed curing sheeting or other approved curing method where water curing is not feasible. Do not use curing compound of any kind.

3.5 DEFECTIVE WORK

- A. Cut out, remove and replace, or repair to the satisfaction of the Owner's Representative, shotcrete not meeting minimum strength, not true, plumb or level, not to required elevations, containing cracks detrimental to performance or appearance, containing shavings, debris or with honeycombs or voids.
- B. Promptly perform Work required to repair, patch, replace, render properly cleaned surfaces (by sandblasting if necessary) or otherwise make good any defective shotcrete at Contractor's expense, including all expense of additional inspection, tests, or supervision made necessary as a result of defective shotcrete.

3.6 CLEAN-UP

- A. Upon completion of the Work of this Section, immediately remove all swimming pool shotcrete materials, debris and rubbish occasioned by this work to the approval of the Owner's Representative.

END OF SECTION

SECTION 13 11 04

SWIMMING POOL CERAMIC TILE

1. PART 1 – GENERAL

1.1 WORK INCLUDED

A. Swimming pool ceramic tile detailed on the Drawings, including, but not limited to, the following:

1. Waterline Face Tile. (Deep Gutter Pool)
2. Gutter Cap Tile. (Deep Gutter Pool)
3. Lane Line / Target Tile / 4'-6" Depth Tile
4. Depth Marker Tile. (At Cantilever Deck)
5. Depth / Caution Marker Tile. (At Deep Gutter Pool Deck)
6. Trim Tile (at Steps.)

1.2 QUALITY ASSURANCE

A. Qualifications of Workers:

1. The entity performing the work of this Section shall have been successfully engaged in the respective trade for at least five (5) years immediately prior to commencement of the Work.
2. For actual construction operations, use only trained and experienced workers with a minimum of three (3) years experience with the materials and methods specified.
3. Provide at least one person who shall be present at all times during execution of the work of this Section, with a minimum of five (5) years experience with the type of materials being installed, the referenced standards, and who shall direct all Work performed under this Section.

B. Standards: In addition to complying with all pertinent codes and regulations:

1. Manufacture of all tile shall be in accordance with ANSI A-137.1.
2. Install ceramic tile in accordance with the recommendations contained in the 2019 "Handbook for Ceramic Tile Installation" of the Tile Council of America, Inc.

C. Tolerances: Install all swimming pool ceramic tile straight, true, plumb and square within a tolerance horizontally of one in 200 and a tolerance vertically of one in 500. Waterline and gutter bullnose tile shall be level to 1/8" (+/- 1/16") around entire perimeter of swimming pools.

1.3 SUBMITTALS AND SUBSTITUTIONS

A. Provide submittals in conformance with the requirements of Section 01 33 00.

B. Samples: Submit samples of each color and pattern in the specified groups. Character samples can be representative for review prior to screening of actual tile.

C. Master Grade Certificate: Prior to opening ceramic tile containers, submit a Master Grade Certificate, signed by the manufacturer of the tile used and issued when the shipment is made, stating the grade, kind of tile, identification marks for the tile containers, and the name and location of the Project.

D. Specifications: Submit manufacturer's recommended installation specifications for the Work.

E. Submit proof of qualifications as specified in Article 1.2.A of this Section.

1.4 PRODUCT HANDLING

A. Delivery: Deliver all materials to the Project Site in the manufacturer's original unopened containers with all labels intact and legible.

B. Storage: Store all materials under cover in a manner to prevent damage and contamination, and store only

the specified materials at the Project site.

- C. Protection: Use all means necessary to protect swimming pool ceramic tile before, during and after installation and to protect the installed Work specified in other Sections.
- D. Replacements: In the event of damage, immediately make all repairs and replacements necessary to the approval of the Owner's Representative.

2. PART 2 – PRODUCTS

2.1 TILE

A. Waterline Face Tile: (Deep Gutter Pool)

- 1. Material: All waterline face tile shall be glazed ceramic tile (Group III standard) as manufactured by Dal-Tile or approved equal.
- 2. Size: 6 x 6 inches.
- 3. Color: Dal-Tile #D-129, 'Sky Blue'. Contact Kylee Midura kylee.midura@daltile.com (858) 344-0019.

B. Gutter Cap Tile: (Deep Gutter Pool)

- 1. Material: All gutter cap tile shall be glazed ceramic tile (Group III standard) as manufactured by Dal-Tile or approved equal.
- 2. Size: 2-1/2 x 6 inches (#A-7250).
- 3. Color: Dal-Tile #D-129, 'Sky Blue'.

C. Lane Line / Target / 4' - 6" Depth Tile:

- 1. Material: Group 3 quality, frost proof unglazed ceramic mosaic tile with absorption rate of less than 1% as manufactured by Dal-Tile or approved equal.
- 2. Size: 1 x 1 inches.
- 3. Color: Dal-Tile #D-311, 'Black' in 25-yard direction.

D. Depth Marker Tile (At Cantilever Deck Face):

- 1. Material: All depth marker tile shall be glazed ceramic tile as manufactured and/or distributed by Dal-Tile, Precision Tile Co., or approved equal.
- 2. Size: 4-1/4 x 4-1/4 inches.
- 3. Color: Dal-Tile #X-114, 'Desert Gray' with Black silk screen numbers.

E. Depth / Caution Marker Tile (at deep gutter pool deck):

- 1. Material: Group 3 quality, frost proof unglazed ceramic mosaic tile with absorption rate of less than 1% as manufactured by Dal-Tile or approved equal.
- 2. Size: 1 x 1 inches.
- 3. Color: Dal-Tile #D-311, 'Black' letters and numbers on #D-014, 'Light Gray' field.

F. Trim Tile (on underwater steps):

- 1. Material: Group 3 quality, frost proof unglazed ceramic mosaic tile with absorption rate of less than 1% as manufactured by Dal-Tile or approved equal.
- 2. Size: 1 x 1 inches with S-812 quarter round. Color: Dal-Tile #D-311, 'Black'.
- 3. Size 2 x 6 inches with integral quarter round. Color: Black, non-slip. Inlays #CPC00022.

2.2 MORTAR

- A. Sand for Mortar: Comply with requirements of fine aggregate for concrete.
- B. Cement: Type I Portland Cement, conforming to ASTM C150.
- C. Hydrated Lime: Conforming to ASTM C206 or 207, Type S.

- D. Water: From a potable source.

2.3 THIN SET MORTAR

- A. Laticrete 254 Platinum. Laticrete, Custom or equal.
- B. Water: From a potable source.
- C. Mortar shall meet ASTM C627.

2.3 GROUT

- A. All tile grout shall be waterproof grout complying with the recommendations of TCA and ANSI A118.6 (4) standards. Grout color shall be grey for dark backgrounds, white for light backgrounds (verify colors with Architect).

2.4 OTHER MATERIALS

- A. All other materials, not specifically described but required for a complete and proper installation of ceramic tile as indicated on the Drawings, shall be new, first quality of their respective kinds, and subject to the approval of the Owner's Representative.

3. PART 3 – EXECUTION

3.1 SURFACE CONDITIONS

- A. Inspection:
 - 1. Prior to all Work of this Section, carefully inspect the installed Work of other trades and verify that all such Work is complete to the point where this installation may properly commence.
 - 2. Verify that ceramic tile can be installed in accordance with the original design and all referenced standards.
- B. Discrepancies:
 - 1. In the event of discrepancy, immediately notify the Owner's Representative.
 - 2. Do not proceed with installation in areas of discrepancy until all such discrepancies have been fully resolved.
 - 3. Failure to notify the Owner's Representative and give written notice of discrepancies shall constitute acceptance by the Contractor of existing conditions as fit and proper to receive its Work.

3.2 INSTALLATION

- A. Method:
 - 1. Install all ceramic tile in strict accordance with installation method P601-90 of the 2019 Handbook for Ceramic Tile Installation of the Tile Council of America, Inc.
 - 2. Be certain to install all ceramic tile perfectly level, flush, plumb, and to the finish grades and elevations indicated on the Drawings.
- B. Interface:
 - 1. Carefully establish and follow the required horizontal and vertical elevations to insure proper and adequate space for the work and materials of other trades.
 - 2. Coordinate and cooperate as required with other trades to insure proper and adequate interface of ceramic tile Work with the Work of other trades.

3.3 GROUTING

- A. Follow grout manufacturer's recommendations as to grouting procedures and precautions.
- B. Remove all grout haze, observing grout manufacturer's recommendations as to use of acid and chemical

cleaners.

3.4 EXTRA STOCK

- A. Provide one (1) unopened box of extra tile for 2.1A, 2.1B, 2.1C and 2.1E for Owners use at a future time.

3.5 CLEAN-UP

- A. Upon completion of the swimming pool ceramic tile installation, thoroughly clean and polish the exposed surfaces of tile work. Completely clean work area of debris and rubbish occasioned by this Work and dispose of to the approval of the Owner's Representative.

END OF SECTION

SECTION 13 11 05

SWIMMING POOL PLASTER

1. PART 1 GENERAL

1.1 WORK INCLUDED

- A. Swimming pool plaster and waterproofing of swimming pool structures as indicated on the Drawings and herein specified.
- B. Start-up and operation instructions to Owner's operations and maintenance personnel and properly balance swimming pool water chemistry until the Owner takes occupancy.

1.2 QUALITY ASSURANCE

- A. Qualifications of Workers:
 - 1. The entity performing the work of this Section shall have been successfully engaged in the respective trade for at least five (5) years immediately prior to commencement of the Work.
 - 2. For actual construction operations, use only trained and experienced workers with a minimum of three (3) years experience with the materials and methods specified.
 - 3. Provide at least one person who shall be present at all times during execution of the work of this Section, with a minimum of five (5) years experience with the type of materials being installed, the referenced standards, and who shall direct all Work performed under this Section.
- B. Standards: Swimming pool plaster shall conform with requirements of Chapter 31B of California Building Code, latest edition. In addition, meet requirements of applicable portions of most current edition of the "Technical Manual," National Plasterers Council, Mission Viejo, California.
- C. Start-up:
 - 1. Furnish a swimming pool water chemistry consultant, with a minimum of five (5) years experience, possessing either AFO (Aquatic Facility Operator) or CPO (Certified Pool Operator) certification(s), to supervise and properly balance swimming pool water chemistry.
 - 2. Demonstrate to the Owner that all systems are fully operational and that calcium hardness, total alkalinity, chlorine residual and pH levels are within specified limits.
 - 3. Standards: Furnish labor and chemicals as required to condition the water properly to the following specifications:
 - a. Calcium Hardness: 200-400 parts per million (PPM)
 - b. Total Alkalinity: 80-100 PPM, minimum
 - c. Chlorine Residual: 1.00 to 2.00 PPM
 - d. pH Factor: 7.2 to 7.6

1.3 SUBMITTALS AND SUBSTITUTIONS

- A. Provide submittals in conformance with the requirements of Section 01 33 00.
- B. Submit proof of qualifications as specified in Article 1.2 and 1.2.C.1 of this Section.

1.4 PRODUCT HANDLING

- A. Delivery: Deliver materials to the Project Site in the manufacturer's original unopened containers with all labels intact and legible.
- B. Storage: Store materials under cover in a manner to prevent damage and contamination, and store only the specified materials at the Project Site.
- C. Protection: Use all means necessary to protect the swimming pool plaster before, during, and after installation

and to protect the installed Work specified in other Sections.

- D. Replacements: In the event of damage, immediately make all repairs and replacements necessary to the approval of the Owner.

1.5 ENVIRONMENTAL CONDITIONS

- A. No plastering shall be done under unsuitable conditions of weather or temperature. No plastering shall be done when prevailing temperature is 40 degrees Fahrenheit or less.
- B. Do not install plaster during rain and, if rain commences after plastering has begun, immediately protect the plaster from rain by all means necessary until the plaster has set.
- C. Do not install plaster during wind greater than 10 mph and, if wind commences after plastering has begun, immediately protect the plaster from wind by all means necessary until the plaster has set.

2. PART 2 PRODUCTS

2.1 CEMENT / AGGREGATE

- A. Luna Quartz® tiny pebble finish by Wet Edge Technologies. Altima® quartz finish by Wet Edge Technologies. Pebble-Fina® pool finish by Pebble Technologies.

2.2 COLOR

- A. All swimming pool plaster shall be white in color. Wet Edge Technologies shall be Luna Quartz® "Polar White". Wet Edge Technologies shall be Altima® "White". Pebble Technology shall be Pebble-Fina® "Classico". Contractor to obtain written approval on selected pebble color from the local Health Department prior to installation. Submit cut sheet, color sample and written approval for review by Architect and Owner.

2.3 WATER

- A. Water for swimming pool plaster shall be clean and free from injurious amounts of acid, alkali, and organics.

2.4 GUTTER, PUMP PIT, BACKWASH PIT & SURGE CHAMBER WATERPROOFING

- A. Xypex, Miracote Miraflex Membrane C, or approved equal. Mix and apply per manufacturer's recommendations for specific application. Color shall be Gray.

3. PART 3 EXECUTION

3.1 SURFACE CONDITIONS

- A. Inspection:
 - 1. Prior to Work of this Section, carefully inspect the installed Work of other trades and verify that all such Work is complete to the point where this installation can properly commence.
 - 2. Verify that swimming pool plaster can be installed in accordance with the original design and all referenced standards, including proprietary application techniques and application training/certifications.
- B. Discrepancies:
 - 1. In the event of discrepancy, immediately notify the Owner's Representative.
 - 2. Do not proceed with installation in areas of discrepancy until all such discrepancies have been fully resolved.
 - 3. Failure to notify the Owner's Representative and give written notice of discrepancies shall constitute acceptance by the Contractor of existing conditions as fit and proper to receive the Work.

3.2 INSTALLATION OF GUTTER, PUMP PIT, BACKWASH PIT & SURGE CHAMBER WATERPROOFING

- A. Provide two (2) coats of the specified gutter and surge chamber waterproofing prior to plastering the swimming pool. Prepare surfaces to receive waterproofing and cure in conformance with manufacturer's recommendations. Provide steel trowel application method to ensure uniform smooth, dense surface finish.

3.3 INSTALLATION OF POOL PLASTER

A. Outdoor Pools or Spas:

1. Completion of other work: DO NOT commence plastering of swimming pool(s) or spa(s) until the following conditions have been met:
 - a. The Health Department and/or other governing agencies have approved the pool(s) and/or spas) for plaster.
 - b. All concrete pool deck construction is complete and the pool decks have been thoroughly cleaned.
 - c. All landscaping in areas adjacent to the pool(s) or spa(s) is complete and the landscape irrigation system is operable.
 - d. All painting in the pool area is complete.
 - e. All welding and grinding in locations adjacent to the pool area are complete.
 - f. The backwash sewer connection is complete.
 - g. Pool(s) and/or spa(s) area(s) perimeter fencing installation is complete.
 - h. All trash and debris have been removed from areas adjacent to the pool(s) or spa(s), particularly those areas that are normally upwind from the pool(s) or spa(s).
 - i. All dust raising construction and/or activities in areas adjacent to the pool(s) or spa(s) are complete or mitigated.
 - j. The circulation pump(s) is/are operational.
 - k. The mechanical system has been flushed sufficiently to remove all dirt and debris from the piping system.
 - l. All necessary chemicals (Chlorine, pH adjuster, Sodium Bicarbonate and Calcium Chloride or any other required chemicals) are on site and ready for use.
 - m. Obtain written approval from the Owner and the Architect.

B. Indoor Pools or Spas:

1. Completion of Other Work: DO NOT commence plastering of swimming pool(s) or spa(s) until the following conditions have been met:
 - a. The Health Department has approved the pool(s) and/or spa(s) for plaster.
 - b. All work above the pool(s) and/or spa(s) is complete.
 - c. All painting in the pool area is complete.
 - d. All welding and grinding in locations adjacent to the pool area are complete.
 - e. The backwash sewer connection is complete.
 - f. All concrete pool deck construction is complete and the pool decks have been thoroughly cleaned.
 - g. The circulation pump(s) is/are operation.
 - h. The mechanical system has been flushed sufficiently to remove all dirt and debris from the piping system.
 - i. All necessary chemicals (Chlorine, Acid, Sodium Bicarbonate and Calcium Chloride) are on site and ready to use.
 - j. Obtain written approval from the Owner and the Architect.

- C. Contractor accepts all liability from damage done to the pool plaster if the pool(s) or spa(s) is (are) plaster before the completion of the above listed items or without the written approval of the Owner and the Architect.

D. POOL PLASTER AUTHORIZATION FORM:

1. The pool(s) and or spa(s) at Oxnard High School is/are hereby approved for the installation of the pool plaster. Pursuant to the requirements of specification section 13 11 05, paragraph 3.3.

Owner

Date

Architect / Project Manager

Date

E. Preparation:

1. Do not apply plaster over dirt, rust, scale, grease, moisture, scuffed surfaces or conditions otherwise detrimental to the formation of a durable plaster finish.
2. Consult with manufacturer on application to specific surfaces being treated. Follow manufacturer's recommendation for curing of cast-in-place concrete or shotcrete surfaces prior to application of plaster.
3. Protect ceramic tile, decking, deck equipment, gratings, fittings and other items by suitable covering or masking.
4. Mask or remove all hardware, hardware accessories, machined surfaces, plates, lighting fixtures and similar items in place not to receive pool plaster. Following completion of plaster for each space or area remove masking. Re-install all removed items utilizing workers skilled in the trades involved.

F. Application:

1. Finish shall be applied to a uniform thickness of 3/8" to 1/2" over the entire surface. The walls shall be scratch-coated followed by a finish coat. Material applied to the floor after the walls have been applied shall be accelerated to assure uniform setting time throughout the pool surface.
2. Float the plaster to a uniform plane and trowel to a smooth, dense, impervious surface using extreme care to avoid stains.
3. Take special care in finishing around pool fittings, making sure to mask off or plug openings so as not to fill such openings with excess plaster. Be certain to completely enclose pool fittings with plaster to insure a leak-proof seal around pipes, fittings, lights, anchors, etc.
4. Accurately interface with the finish planes of items installed by other trades.
5. Quartz-cement plaster is to be applied by a licensed applicator as approved by the manufacturer, and in accordance with manufacturer's training.

3.4 CURING

- A. Preparation: Anticipate the need for required equipment and have all such equipment immediately available for use upon completion of pool plastering.

B. Pool Filling:

1. After the plaster has sufficiently dried and before drying has proceeded to a damaging point, cure the plaster by gradually filling the pool with water, preventing all damage to finished plaster surfaces.
2. Flow the water continuously until the pool is filled.
3. When the weather is hot and/or water pressure is low, keep the pool walls damp while the pool is filling.
4. Coordinate with Contractor to ensure that the pool is continuously monitored while filling to prevent overflow.

3.5 EQUIPMENT ACTIVATION

- A. All water chemistry and filtration mechanical equipment shall be operational upon filling of pool after plaster. Chemicals and other related support items as supplied by Contractor, shall be in supply at start-up.
- B. For the first fourteen (14) calendar days after completion of the pool plaster, brush all plastered surfaces at least twice a day and coordinate with General Contractor to ensure that the plaster is carefully maintained after the initial fourteen-day period. In addition, coordinate with the Contractor to ensure that pool filtration equipment is continuously running during the initial fourteen-day period.
- C. Start-up and provide qualified personnel to operate pool equipment for a period not less than fourteen (14) days after the pool is placed in operation, or until the Owner takes occupancy of the facility or letter of substantial completion. During this time, Contractor shall instruct and supervise the Owner's personnel in the various operating and maintenance techniques involved. Contractor shall be responsible for supply of chemicals during this not less than fourteen (14) day period and at time of turnover to Owner, chemical storage tanks shall be full. (Owner's personnel shall be fully trained and capable of assuming swimming pool maintenance tasks, training may begin before Owner takes occupancy).

3.6 CLEAN-UP

- A. Upon completion of swimming pool plaster, remove all materials, equipment and debris occasioned by this Work and leave the job site in a clean and presentable condition. Perform all such clean-up to the approval of the Owner's Representative.

3.7 WARRANTY

- A. All applicators must provide a minimum of five (5) year warranty for application and workmanship additional to the manufacturer's warranty for product.

END OF SECTION

SECTION 13 11 06

SWIMMING POOL EQUIPMENT

1. PART 1 GENERAL

1.1 WORK INCLUDED

- A. Swimming pool equipment items required for this Work as indicated on the Drawings and specified herein.

1.2 QUALITY ASSURANCE

A. Qualifications of Workers:

1. The entity performing the work of this Section shall have been successfully engaged in the respective trade for at least five (5) years immediately prior to commencement of the Work.
2. For actual construction operations, use only trained and experienced workers with a minimum of three (3) years experience with the materials and methods specified.
3. Provide at least one person who shall be present at all times during execution of the work of this Section, with a minimum of five (5) years experience with the type of materials being installed, the referenced standards, and who shall direct all Work performed under this Section.

- B. All equipment supplied or work performed shall comply with regulations governing public swimming pools and spas as contained within Chapter 31 of California Building Code, latest edition.

1.3 SUBMITTALS AND SUBSTITUTIONS

- A. Provide submittals in conformance with the requirements of Section 01 33 00.

B. Required submittals include:

1. Swimming Pool Safety Equipment and Maintenance Equipment as specified in Article 2.1 and 2.2 of this Section.
2. Swimming Pool Fittings, Deck and Mechanical Equipment as specified in Article 2.3-2.12 of this Section.

- C. Submit proof of qualifications as specified in Article 1.2.A of this Section.

- D. The equipment shown on the plans represent the first listed items in the technical specifications. The Contractor shall be responsible for all required field coordination and installation of any approved equal product to provide a fully working and warranted system. The Contractor shall submit detailed shop drawings for any products used other than the first listed specified items. Contractor provided shop drawings shall include details and quality equal to the original plans and construction documents. The Contractor shall provide any and all required engineering including but not limited to structural and anchorage requirements for any proposed equipment other than the first listed specified equipment. The Contractor is responsible to provide a factory certified representative(s) to start-up and provide on-site training for all swimming pool mechanical equipment provided.

1.4 PRODUCT HANDLING

- A. Protection: Use all means necessary to protect swimming pool equipment items before, during and after installation and to protect the installed work specified in other Sections.

- B. Replacements: In the event of damage, immediately make all repairs and replacements necessary to the approval of the Owner's Representative.

2. PART 2 PRODUCTS

2.1 SAFETY EQUIPMENT

- A. First Aid Kit for 50 Persons with two (2) wool blankets: Marine Rescue or approved equal. Quantity as required by the Department of Health, one (1) minimum.

- B. Rescue Tubes (minimum 49" long) and Life Ring Buoy (minimum 24" in diameter) U.S. Coast Guard Approved: Marine Rescue or approved equal. Quantity as required by the Department of Health, one (1) minimum.
- C. Throw Rope (3/16" diameter) complete with lemon foot, for use with Life Ring Buoy: Kiefer, United Industries, or approved equal. Quantity as required by the Department of Health, one (1) minimum.
- D. Rescue Hooks, 16' long x 1-1/2" aluminum pole and stainless-steel mounting hardware: Kiefer, Pentair, or approved equal. Quantity as required by the Department of Health, one (1) minimum.
- E. Pool Safety Signs: As required by the Department of Health. Submittal required. Placement at the pool site shall be in conformance with Health Department Inspector. Two (2) sets minimum.
- F. Eyewash / Shower: Haws model #8309WC CRP combination eyewash / shower, with corrosion resistant protection. Two (2) required. See MEP sheets for water supply piping.

2.2 MAINTENANCE EQUIPMENT

- A. Commercial Pool Vacuum: Provide pool vacuum cart with lid-mounted handle, separate lid-mounted bracket for electrical cord, and two rubber-tired ball bearing wheels with grease fittings. Cart and filter shall be fabricated from schedule 304 stainless steel with welds treated and passified. Provide an all-bronze pump with a 1 1/2 hp, 115/230 volt, maximum 20 amp draw @ 120 volts, single phase motor and a 6" bronze trap. Pump shall be UL and NSF listed, have 2" suction and 1 1/2" discharge fittings, and have a brass priming valve with hose bib. Entire pump assembly shall be anchored to vacuum cart with two stainless steel bolts. Provide a 100 foot 10 AWG 3/C SJ electrical cord with ground fault interrupter (GFI) plus. Cord shall be wired to a double pole, 30-amp switch which shall be mounted on pump motor. One (1) required.
- B. Heavy Duty Vacuum Hose: 2" x 50', with hose connector. Pentair, Smooth Bore or approved equal. Two (2) required.
- C. Utility Pole: 24' fiberglass with connectors. Pentair, Skimlite or approved equal. Two (2) required.
- D. Commercial Vacuum Head: 24" wide "flexible" vacuum head. Pentair Model #R201186, or approved equal. One (1) required.
- E. Pool Wall Brush: 36" wide professional quality. Pentair or approved equal. One (1) required.
- F. Leaf Skimmer: 30" x 8" x 12", professional quality. Pentair, Spectrum or approved equal. One required.
- G. Water Quality Test Kit, Professional Grade, Taylor Technologies Model #1741C, LaMotte Model #PRO250-NJ, or approved equal. One (1) required.

2.3 FITTINGS

- A. Main Drain Frame & Grate (18" x 36"): Lawson Aquatics #MLD-FG-1836, Super Sump with VGB Compliant Grates, or approved equal, two (2) required. Provide two (2) Hayward #SP-1056 1-1/2" collector tubes and two (2) #SP-1055 Hayward 1-1/2" hydrostatic relief valve, one per main drain sump. Contractor shall provide to the Owner a Certificate of Compliance, signed by a licensed design professional, for main drain sump(s) and frame(s) and grate(s), as required by the Virginia Graeme Baker Act.
- B. Gutter Outlet Frame and Grate (12"x12"): Lawson Aquatics #MLD-FGD-1212. Twelve (12) required.
- C. Floor Return Inlet 1-1/2" Adjustable: StaRite #08417-0000, United Industries, or approved equal. Fifty four (54) required.
- D. Swimming Pool Underwater Lights: 'PureWhite LED' #LPL-F5W-120-100 (100' cord) with polished stainless steel face rings, 87 watt lamps and LWC (J & J Electronics); provide stainless steel light niches, #78210600 with 1" rear hubs, 'Pentair' or approved equal. Thirty-two (32) required.
- E. Junction Box for Underwater Lights, complete with strain reliefs: Hydrel #1719, Appleton, or approved equal. Sixteen (16) required.

2.4 DECK EQUIPMENT

- A. Starting Platform Anchors: KDI Paragon 'Competitor' #23103DW, 6" deep, no known equal. Eleven (11) required, for concrete deck. 'Competitor' #23074, cover for dual wedge, 'Competitor' #23303, cover removal tool, two (2) required.
- B. Adjustable Starting Platforms: Track Start Competitor, side step #25427 no known equal. Eleven (11) required.
- C. Stanchion Sockets: 1.90" I.D. Bronze. KDI-Paragon 38201TC, no known equal. Fourteen (14) required.
- D. Stanchion Posts: 1.90" O.D. x .145 wall. KDI-Paragon, Six (6) #38105, and Six (6) #38301, no known equal.
- E. Lane Line Anchors: Heavy eye bolt with insert. KDI-Paragon #73017/18 or equal. Forty-four (44) required.
- F. Rope Anchors: Commercial cup anchor with insert. 'Spectrum' #58316 custom stainless steel, no known equal. Two (2) required.
- G. Racing Lanes, Anti Wave' maximum 6", no known equal, verify colors with Owner prior to ordering. Fourteen (14) required. Provide vinyl covered stainless steel lane line extensions, Knorr System model #EP-009-0020 or approved equal, two (2) per lane line. Provide floating water polo goal tethers, eight (8) total. Provide two (2) additional lanes to be utilized with floating water polo goals as side lanes and three (3) lanes utilized for stationary water polo courses.
- H. Racing Lane Reel with Cover: KDI-Paragon #75111SS with cover #75133, no known equal. Three (3) required.
- I. Moveable Lifeguard Chair: 1.90" O.D. x .065 wall. KDI-Paragon 20302, Spectrum 20160 or equal. Two (2) required.
- J. Figure 4 Grab Rails: KDI-Paragon #30102, 1.90" O.D. x .109" wall, no known equal. Three (3) sets required.
- K. Cross Braces Ladder: Paragon #42123, with custom 5" wide stair treads, no known equal. Three (3) required.
- L. Recessed Steps, Set of 3: KDI-Paragon #3212, no known equal. Three (3) set of three required.
- M. Handrail: KDI Paragon #34203, 3 bend, 1.90" O.D. x 0.65" wall. Three (3) required.
- N. Anchor Sockets for Grab Rails & Handrails: KDI-Paragon 28102, no known equal. Twenty-four (24) required.
- O. Stainless Steel Escutcheon Plates for Grab Rails, Handrails and Ladders: Spectrum Model #35214, no known equal. Twenty-four (24) required.
- P. Stationary Water Polo Goals: KDI-Paragon 36104, 36201, no known equal. Furnish complete with anchors and nets. Two (2) pair required.
- Q. Floating Water Polo Goals: 'Antiwave' #AW060 or equal. One (1) pair complete with nets and tethers.
- R. Assessible Lift: Spectrum Traveler XRC 500 #27610 Swim-Lift II self operated, or approved equal. Furnish complete with anchors, cover, extra battery pack and transporter cart. One (1) required.
- S. Backstroke Pennants: 'Champion' 3/16" diameter vinyl coated cable #50-175; 'Champion' hardware package #53-030, and 'Champion' 12" x 18" vinyl coated polyester pennants #53-020 Lincoln Equipment, Knorr Systems or equal.
- T. Pool Cover System:
 - 1. A pool cover system as described below shall be provided and shall include all the specified features, without exception. Submittal data must include complete documentation relating to all the specified features and include manufacturer's sales literature, specification sheets, and installation/operation/maintenance manuals. Upon written request by the specifying agent, the following samples must be provided: samples of tubing used for storage reel winding tubes and end frames; a sample winding tube bearing; a sample castor wheel assembly; and a cover sample measuring at least 8" x 11", including weighted side edge, reinforced end edge, and grommet.

2. Cover Material:

- a. Material shall be woven, 10 by 10 count per inch, high-density polyethylene, ultraviolet stabilized film fabric, laminated to both sides of 1/8" thick, closed cell, medium density, white, polyethylene foam. The woven polyethylene film fabric shall be coated on both sides with an ultraviolet stabilized, chemically resistant polyethylene coating. The combination of film, foam and woven components shall be non-toxic, non-absorbent, non-permeable and buoyant. Color shall be blue on upper surface and black on under surface. In addition to the above, cover must meet the following requirements:

Thickness	1/8 inch minus or plus 10%
Foam Density	2 lbs. per cubic foot
Weight	5 oz. per square foot
*Tensile Strength	318 lbs. (ASTM 1682264)
*Tear Strength	60 lbs. (ASTM D2261-71)
*Bursting Strength: (Mullen Tester)	425 psi (ASTM 751-73)
Service Temperature	-40°F to +160°F
K Factor	.25 BTU/sq. ft.-Hr – degrees F/inch (ASTM D2326)
Reinforced Edge Tear Strength	1225 lbs. pull strength, corner to corner
Open Seam Tear Strength	70 lbs.

3. Cover Design Criteria:

- a. Cover panels shall totally cover the surface of the pool without gaps or overlaps with reinforced cutouts to accommodate rounded corners, step areas, rails, etc. Cover panels shall be of the following quantities and sizes:

Qty.	Size
8	13 feet, 11 inch x 75 feet, 1 inch

- b. Along end and side edges of each panel, a weighted material shall be sewn in and shall be continuous, non-corrosive and conform to the flat shape of the cover. End edges shall be reinforced with a double layer of polyethylene-coated film fabric and designed in such a manner as to prevent panels from dividing when the covers are being pulled across the water. On all corners, weighted edge shall wrap corners and be itself encapsulated by the two layers of end reinforcement. The entire corner construction shall be reinforced with an 1/8" thick load dispersion plate and non-corrosive grommet.
- c. Both ends of each cover panel shall be equipped with no less than three (3) non-corrosive grommets and quick-release loops for easy connection to the storage reel or to the next cover panel. All sewing shall be ultra-violet stabilized and chemically resistant 100% polyester thread. Main body seams shall be welded, glued or heat sealed. Complete mechanical attachment with lock-stitched thread shall be required. Warning labels consistent with the recommendations of the Federal Consumer Protection Agency shall be permanently affixed to each end of each cover panel and to the sides of perimeter panels.

4. Storage Reels:

- a. The following quantity, type, and size of storage reels shall be provided:

Qty.	Winding Tubes Per Reel	Length of Winding Tubes
2	3	16 Foot
1	2	16 Foot

- b. Storage reel frame, winding tubes, castors, brake shafts, cranks and fasteners shall be made of type 304 stainless steel. Each reel shall have six wheels, each of which shall be 6 inches in diameter, be rated at 1150 pounds load capacity and be made of solid polyurethane. Wheels shall be lubricateable through grease fittings on stainless steel axle shafts and have stainless steel swivel yoke assemblies. The reel shall have two frame mounted, screw-type brakes with pads that lock directly to the pool deck and have a total of 18 square inches of total braking surface. Castor brakes or other types of foot-operated or lever-operated brakes will not be considered equal. Each winding tube shall be 4 1/2 inches in diameter; have a wall thickness of .120 inches; and shall consist of continuous length of tubing without joints or welds. Reels with tubes fabricated from two or more pieces of tubing joined together will not be acceptable. End frames shall be fabricated from 1 1/2 inch square Schedule 304 stainless steel box beam tubing with .120" wall thickness. To facilitate field repair, 3/8" stainless steel bolts, nuts and washers shall be used to connect major reel frame parts, wheels, brakes, bearings and winding tubes. Reels that use welding to connect these components will not be considered equal. Winding

tube bearings shall be heavy duty, self-aligning, pillow block ball bearings with set screws to secure tube shafts and prevent their lateral movement. All bearings shall be lubricateable through grease fittings. Plastic surface bearings will not be acceptable.

- c. Each storage reel shall be provided with a protective cover constructed of vinyl-laminated polyester cloth, 1000 denier, totaling 13 ounces per square yard.

5. Measuring and Training:

- a. A representative of the manufacturer shall visit pool site to confirm measurements prior to fabrication of cover, and once cover is delivered, train operating personnel and supervise initial installation of cover.

6. Warranty:

- a. Cover panels shall be provided with manufacturer's three- year full replacement warranty covering defects in material and workmanship. Storage reel shall be provided with manufacturer's 10-year warranty covering defects in material and workmanship.

2.5 SWIMMING POOL STRAINER

- A. 'MerMade' F.O. series FRP reducing basket strainer: One (1) 10" x 8" standard, with acrylic lid and two (2) stainless steel strainers each (150 lbs.)

2.6 SWIMMING POOL CIRCULATION PUMP

- A. 'Paco' #6015-7; 6" x 8" x 15" Type 'LC' end suction centrifugal pump; outdoor rated, 1150 RPM 460V, 3PH; 30 HP; rated at 1,400 GPM @ 60 Ft. TDH; 87% efficient; premium efficiency TEFC motor; epoxy coat all wet surfaces. 'Paco', 'Aurora' or equal. (760 lbs.) Provide smart pump control system SPCS-EKO-FLEX #SPCS030EF4 (20.5" x 49" x 17") variable frequency drive for use with 'BecSys 7' controller. Coordinate mounting location to maintain required clearances, 480V 3PH. (228 lbs.)

2.7 SWIMMING POOL FILTRATION SYSTEM (Stark, Eko3, EPD, or equal)

The filter system specified herein shall be the standard cataloged product of a company regularly engaged in the manufacture of water treatment equipment. The purpose of this specification is to establish the minimum design, performance, quality, and service standards for the proposed equipment. Equipment provider shall have a minimum of five year's experience in the manufacture of such specified Commercial/Industrial grade water treatment equipment. The equipment shall consist of filter vessel(s), internal distribution and collection system, immediate face piping, operating valves, backwash sightglass, air relief systems, gauges, hydraulic pressure supply system, electronic operational control systems, system operating setup/startup and fifteen (15) year warranty.

Requests for substitutions for the specified components and materials will not be considered unless equal to the specified system in every respect and must be submitted to the specifying agent not less than twenty (20) calendar days prior to bid date. Requests for substitutions must include, but not be limited to:

- List containing contact name and telephone number of ten like systems, each of which shall utilize all specified features and employ fiberglass filament wound vessels, and electronic filter control devices.
- Complete documentation and that proves proposed unit includes all of the specified features.
- Manufacturer's sales literature.
- Engineering drawings, structural and seismic calculations prepared by a licensed Civil Engineer.
- Certification listings.
- Installation/operation/maintenance manuals.
- Name and address of the site-local, factory-authorized startup and service representative with affidavit of last date of certification.

Failure to provide this or any other information necessary to confirm that all specified features are provided will be cause for rejection of substitution request. Prior to ten (10) days before bid date, all prospective bidders will be notified in writing of any proposed substitutions.

- A. Filter Area and Flow Rate:

1. The filter system(s) shall consist of one (1) SS4-96-10 tank system high-rate permanent media filter vessels with a total effective filter area of 108 square feet. When operating at 15 gallons per minute, per square foot of filter area, the filter system will have a capacity of filtering 1620 gallons per minute.

B. Filter Vessel:

1. Vessel :

- a. The filter vessel will be 42" inside diameter, will have 20 square feet of filter area and shall be designed for a maximum working pressure of 100 psi with a 4-to-1 safety factor for minimum burst. The design shall be capable of withstanding, without leaks or structural failure, a repetitive pressure test consisting of 250,000 cycles of 0 to 100 psi. This is required to ensure long service life, reduce potential liability and guarantee safe operation.
- b. Materials used in the construction of the vessel shall be in accordance with Article RM-1 of ASME Boiler and Pressure Vessel Code, Section X and ASME RTP-1, most current versions. The vessel shell shall be fabricated throughout of a continuous and woven premium grade glass fiber roving with a laminate matrix of un-pigmented polyester resin and hardener. High stress areas shall be reinforced with Kevlar® and/or carbon fiber. Resin-rich layers shall be resistant to UV, weathering, stress cracking and de-laminating, and shall have a field history of performance. The minimum laminate properties shall be as follows:

Tensile Strength (ASTM D-638)	-	42,000 psi
Tensile Modulus	-	2.2 x 10 ⁶ psi
Flexural Strength (ASTM D-790)	-	50,000 psi
Flexural Modulus	-	1.6 x 10 ⁶ psi
Heat Distortion Temp. (ASTM D-638)	-	180° F @ 264 psi
Barcol Hardness (ASTM D-2533)	-	45 (Mod #934)
Structural Adhesive Bond Strength	-	1,500 psi

- c. Attachments, if any, to the vessel shall be made with a structural adhesive compatible with the laminate used to fabricate the vessel.
- d. The vessel shall incorporate two (2), six-inch (6") grooved pipe ports located in the top of the vessel side shell to serve as influent and effluent plumbing connections. One (1), three-inch (3") port shall be located in the lower front portion of the vessel to serve as a winterizing and media dump port connection. One (1), three-inch (3") port shall be located in the upper-most portion of the side shell to serve as a connection for a manual air relief valve. Bulkhead through-port connections will not be considered for this application in order to preclude fitting failure and structural weaknesses inherent with vessels using bulkhead fittings.
- e. A 12" x 16" viewing window/access manway shall be fitted at the front end of the vessel to provide operation and periodic media examination, and ease of access for media loading. Manways or manholes located in the side shell of the vessel will not be permitted. Manways or manholes with metal reinforcement will not be allowed, due to inherent weaknesses.
- f. Following fabrication, the entire vessel shall be cured to ensure uniformity of strength.
- g. Each filter vessel shall be subjected to an in-shop hydro pressure test of 100 psi for a period of four (4) hours. Verification of this test and results shall be submitted to the Owner at time of delivery.
- h. Vessel shall be supported by two (2) foam-filled, molded polyethylene saddles, which shall allow the vessel to withstand load forces specified for seismic zone 4 without damage. Certified engineering drawings are required to confirm this capability. Saddles shall be attached to vessel with a permanent adhesive. Vessel to saddle attachment with tank through-bolts is not acceptable. A positioning template, and four (4) 3/4" x 7" anchor bolt sets with leveling shims shall be provided with each vessel to ensure proper installation.
- i. Coated and/or non-coated metal vessels and/or fiberglass vessels with metal reinforcement or fiberglass vessels employing inner tanks (bladders) will not be considered for this application. Historical problems, related to corrosion of metal tanks, an inability to bond inner and outer fiberglass tanks (bladders), and the extreme difficulty associated with the repair of tank bladders, will not allow their use.

2. Distribution and Collection System

- a. Internal components shall be hydraulically balanced to prevent migration and channeling of the filter media during the filter cycle and must uniformly fluidize the filter media in the backwash cycle

- without breakthrough at any one location. Internal component design shall accommodate, during "OFF" cycle, that the filter system shall remain full of water.
- b. The influent distribution system shall be fabricated of no less than 12 ABS distribution lenses - each having two-inch (2") IPS connections, PVC pipe, and fittings. The distribution system design shall accommodate a Reynolds Number not to exceed 2000. The collection system shall consist of PVC fittings, six-inch (6") Schedule 80 PVC pipe and molded polypropylene reverse "V" slotted laterals. The laterals shall be designed to retain filter media with minimum head loss. A minimum of 20 molded laterals shall be utilized in the filter vessel with flow velocity not exceeding 6 feet per second at designed filter flow rate. Non-molded laterals will not be considered acceptable for this application. Collection system hydraulic design calculations will be required.
3. Air Relief System
 - a. An automatic air bleed system shall be provided. An anti-plug protective shield screen shall be a part of the assembly. A manually operated external air relief shall also be provided for the vessel.
 4. Winterizing/Drain and Media Dump Port
 - a. At the lowest point of the front of the vessel a three-inch (3") port shall be provided. The port shall allow the evacuation of all water from the vessel for the purpose of winterizing or service. No media shall be allowed to leave the vessel during the draining process. The port shall also facilitate the removal of the filter media from the vessel.
- C. Backwash Valving and Piping: Each filter vessel within the system shall be cleaned individually using filtered water provided by adjacent filter vessels. Reverse flow backwash with raw source water will not be allowed. Maximum allowable backwash flow rate will be 450gallons per minute.
1. Backwash Valve:
 - a. One (1), two-way, three-port, six-inch (6") backwash valve shall be supplied with each vessel. The valve body shall be injection-molded of ABS plastic all external components will incorporate UV inhibitors. Valves using metal bodies and covers, coated or non-coated, will not be approved. Grooved-type fittings shall be provided at each of the valve ports for connection to the filter vessel and manifold piping. Couplers shall be provided at each of the valve ports for connection to the filter vessel and manifold piping. The couplers shall be injection-molded of Isoplast 101LGF40NAT plastic and shall contain UV inhibitor. Each valve shall be fitted with a hydraulic diaphragm designed to operate a sliding flow direction piston. Valve internal shaft, nuts, washers and bolts shall be 316 stainless steel. All stainless-steel components shall be passivated and rinsed after forming and machining.
 - b. The backwash valve shall be designed to allow for continuous circulation pump operation during the backwash of the filter system that will prevent the loss of circulation pump prime and damage to boiler, chemical feed systems and piping that can result by repetitive on/off cycling of circulation pump. Valves requiring external linkage for synchronization of their operation will not be allowed.
 2. Rate of Flow Valve:
 - a. A tamperproof, gate-type valve shall be supplied for use on the effluent manifold. The valve shall be made of PVC, will be field-adjustable, ensuring the proper system flow rate. The rate of flow valve shall be manually set using a removable tool. Standard butterfly and/or gate-type valves will not be allowed.
 3. Backwash Sightglass Valve:
 - a. A tamperproof, gate-type valve shall be supplied for use on the waste manifold. The valve shall be made of PVC, will be field-adjustable, ensuring the proper system backwash flow rate. The backwash rate shall be manually set using a removable tool. Standard butterfly and/or gate-type valves and separate sightglass will not be allowed.
 4. Piping:
 - a. To minimize floor space requirements and provide unhindered access to filter controls, backwash valves, media dump port, and vessel access openings, all piping shall be located on top of the

horizontal filter vessel. All 6" manifolds shall be fabricated from Schedule 80 PVC pipe and fittings. All manifolds 8" and larger shall be fabricated Schedule 80 piping with pulled fittings, in manifold sections not exceed two tank lengths. Influent and effluent manifolds shall be 10" IPS and the waste manifold shall be 6" IPS. All piping shall be factory-assembled and pressure tested.

D. Operational Control

1. Automatic Control Device:

- a. An Automatic Control System (ACS) shall be provided, which will allow for the automatic and manual manipulation of the filter backwash operation.

2. Functions and Features

- a. The ACS shall perform the following functions and features:

3. Automatic Filter Backwash:

- a. Initiate - at filter system via field-adjustable differential set point
- b. Ability for the optional initiation of backwash via an external device, i.e., time of day/day of week set point time clock or System6 chemical controller
- c. Initiate - manually activated automatic backwash cycle
- d. Initiate - backwash by manual manipulation of multiport valve
- e. Initiate on/off - Pressure Accumulation System "HydroForce" pump actuation

4. Multiport Valve:

- a. Distribute water for the hydraulic actuation of filter system valves
- b. 24 VAC, continuous drive motor
- c. Constructed of non-corrosive ABS and stainless steel; metallic multiport valves will not be approved - multiple solenoid valves will not be approved

5. Housing and Mounting:

- a. The ACS shall be housed in a non-metallic NEMA 4X rated enclosure. The enclosure and connections shall be designed to eliminate any possibility of corrosion or damage to the internal components of the control.

6. Multiport Valve:

- a. The multiport valve wetted components shall be injection-molded ABS with stainless steel shaft and springs. The unit shall distribute water for the hydraulic actuation of the filter system valves. Porting shall be 3/8" IPS minimum, employing 1/2" IPS tubing, and shall not retard the opening or closing of the backwash valves beyond 10 seconds. The multiport valve will be equipped with an indicating dial for valve operating sequence and home position. The multiport valve 24 VAC stager drive motor shall be installed in an independent enclosure of the NEMA 4X type.
- b. System serial number, model number, operating pressure, media information and basic operating instructions shall be permanently affixed to the multiport valve enclosure. The label shall be treated to resist the mechanical room environment. The enclosure shall be directly attached to the filter system.

7. Transformer:

- a. A line voltage to 24 VAC transformer shall be provided. The transformer shall be mounted in an independent enclosure of the NEMA 4X type. The transformer and enclosure shall be of the wall-mount type and shall be posted near the electronic mechanical room control device.

E. Gauges:

- 1. Two (2), four-inch (4") pressure gauges shall be provided. The gauges shall indicate influent and effluent pressures of the filter. The gauges shall be mounted with the filter system multiport valve enclosure, within a common gauge-mounting bracket.

F. Hardware:

1. All fasteners (nuts, bolts, washers) employed in the system shall be cadmium-plated steel.

G. Service Access:

1. Access to manway, backwash valves, and filter control console shall be from the front of the filter system and shall not require disassembly of any piping or climbing over or around vessel, manifolds or valves to perform operation, service or routine maintenance.

H. Filter Media

1. Filter media depth shall be as indicated on the drawings; measurements will be taken at the site and will be from top of the collection laterals to the top of the media. The media shall be of a single grade, consisting of uniformly graded, angular shaped, crushed silica sand, which shall be free of limestone or clay.
2. Filter system manufacturer shall provide a filter media analysis for the media being utilized. Media supplier shall supply two (2) pounds of filter media from installation site. Consulting engineer, prior to its installation, must approve filter media analysis.
3. #20 Sand
 - a. Filter media shall be Grade #20, effective size .45 millimeter with a uniformity coefficient of 1.5 maximum.

MEDIA ANALYSIS

Sieve No. US Series	MM Opening	Percent Retained On Sieve (By Weight)
20	0.833 (0.333 in)	2
30	0.589 (0.023 in)	58
40	0.417 (0.016 in)	36
50	0.295 (0.012 in)	4

4. Alternate Filter Media

a. #30 Sand

- 1) Filter media shall be Grade #30, effective size .27 millimeter with a uniformity coefficient of 1.6 maximum.

MEDIA ANALYSIS

Sieve No. US Series	MM Opening	Percent Retained On Sieve (By Weight)
30	0.589 (0.023 in)	2
40	0.417 (0.016 in)	36
50	0.295 (0.012 in)	46
70	0.208 (0.008 in)	11
100	0.147 (0.006 in)	5

I. "HydroForce®" System:

1. The HydroForce® system shall consist of a stainless-steel centrifugal pump, hydro-pneumatic pressure sustaining tank, adjustable pressure switch, 50 feet of 3/8 inch Nylo Seal® tubing and all necessary tubing connectors.
2. Pump
 - a. The pump housing shall be made of stainless steel and the impeller shall be molded of Lexan®. A mechanical seal shall be provided and shall be a precision-lapped, highly- polished, carbon-ceramic stainless-steel shaft seal, ensuring drip-proof protection. The motor shall be a 1/2 HP, single phase, 60 cycle, 3450 RPM, suitable for service with filter control console. The motor shall be a NEMA 'C' face flange mounting with a drip-proof enclosure. The motor shall be equipped with sealed ball bearings. The pump shall be performance rated at 5 gallons per minute at 80 feet of head.

3. Tank
 - a. Pressurized water shall be contained in a hydro-pneumatic steel tank that shall be lined with an epoxy coating. The tank will employ a flexing diaphragm, separating wet and dry chambers. The steel tank shall be designed for a maximum working pressure of 100 psi. Tank connection shall be 3/4" NPTM.
4. Pressure Switch
 - a. A pressure switch shall be mounted directly to the pump motor and shall be rated for the operation of a 1-1/2 HP motor at 115 volts, single phase. The switch will allow for adjustment of cut-in and cut-out pressure.
5. Check Valve:
 - a. A half-inch, spring-loaded check valve shall be supplied as part of the assembly. The check valve shall be installed on the pump suction and shall be designed to retain water pressure accumulated within the amplification system.
6. Tubing and Fittings:
 - a. Fifty (50) feet of 1/2 inch Nylo Seal® tubing and all necessary tubing to pipe fittings shall be supplied for the connection of the HydroForce system to the filter system and the filter control.
7. Finish:
 - a. The system shall be coated with an industrial-grade polyurethane high-gloss protective finish.
- J. Packaging:
 1. To protect and safeguard filter vessel, it shall be skidded and supplied with a plastic wrapping to facilitate shipment, handling, and/or storage on job site. The plastic wrap shall also act as a protective barrier during installation. All other components shall be packaged in a manner that will ensure damage-free transportation and facilitate storage at job site.
- K. Instructions:
 1. Printed and bound operating, installation and service manual with exploded parts list shall be supplied with the system described herein.
- L. Certification:
 1. Certified/stamped engineering calculations and drawings will be required for the structural strength of filter vessel and seismic loading. The filter supplied must be listed by the National Sanitation Foundation (NSF) ANSI 50 for a flow rate of up to 20 gallons per minute, per square foot of filter area. Proof of National Sanitation Foundation (NSF) listings will be required.
- M. Startup, Training and Field Service:
 1. Local factory representation for the products contained herein is mandatory. A site specific/site local factory-authorized and trained service specialist shall provide eight hours (8) of startup and training service. The startup shall include adjustments to the filter system and all of its controlling components, calibration and setup of the control system, and instructions to the Owner/operator of the system's workings.
 2. Prior to the completion of one (1) years' service, the site specific/site local factory-authorized service specialist shall visit the filter system installation site. With the Owner/operator, the service specialist shall inspect all of the filter system components for signs of wear/malfunction at that time. Any and all worn or malfunctioning items shall be repaired or replaced at no expense to the Owner. The service specialist will thoroughly instruct the Owner/operator on annual service procedures for the filter system, all at no expense to the Owner.

N. Warranty:

1. A 15-year limited warranty shall be provided covering all components of the filter system specified herein. The first (1st) year of the warranty period shall be unconditional. The second (2nd) year through the fifteenth (15th) year may be limited and prorated.

2.8 POOL HEATER(S)

- A. Indirect fired pool heating package system; 'Aguas' with SmartTouch control condensing modulating boiler, titanium heat exchanger with CPVC connections, factory assembled skid mounted package, California Code controls, 1½" natural gas connection, 4" water connections, 8" ø flue to atmosphere, 1,500,000 BTU per hour input, 97% efficient, provide ¾" cold water to each unit. 'Lochinvar APN1500', weight = 3,500 lbs. Two (2) total.

2.9 CHLORINE FEED SYSTEM

- A. Provide 'Chem-Tainer' 500 Gallon #TC5971DC; dual storage/containment tank with lid seismically restrained; (4,165 lbs.). Complies with Fed. Reg. #40CFR-264-163. Feed pump shall be 'LMI' #SD43-88P-KSI; 288 GPD @ 150 PSI with FRP shelf bracket. Hard pipe to point of injection.

2.10 ACID STORAGE/FEED SYSTEM

- A. Provide 'Chem-Tainer' 150 Gallon #TC3448DC; dual storage/containment tank with lid seismically restrained; (1,250lbs). Complies with Fed. Reg. #40CFR-264-163. Feed pump shall part of the Carbon Dioxide alkalinity control system. Provide a complete acid vapor recovery system.

2.11 CARBON DIOXIDE STORAGE/FEED SYSTEM

- A. Provide one (1) 'Novo-600', 600 lb cryogenic storage tank with remote fill port. 594 liquid lbs., (5195 cubic feet of gaseous CO2 at NTP) one (1) total. Provide EKO PH-MTS CO2 high efficiency feed system with alkalinity control, 0 to 160 SCFH feed capacity booster pump, piping injector, flowmeter, relays and acid feed alkalinity control. One (1) system total. (92 lbs.each) Provide hard wired 'BRK' #SL177 CO2 detector with audible and visual alarms in each chemical room, UL 1971 standard listed, one (1) total.

2.12 SWIMMING POOL WATER CHEMISTRY CONTROLLER

The equipment room controller package shall be BECS Technology model CS-BECSYS7-BP-E packaged by Eko³ Systems.

A. General

1. The integrated equipment room control system shall provide continuous monitoring and control of sanitizers, oxidizers, pH, temperature, system flow rate monitoring, total dissolved solids (TDS), turbidity, chemical inventory levels, surge tank and backwash holding tank water levels, system pressures, and water chemistry balance calculations. The control system shall also provide automatic control of the filtration system including backwash operation. Installation of the system shall be per the manufacturer's specification and no exceptions shall be allowed. A factory trained/authorized representative shall provide system commissioning and training to the owner.

B. Certifications

1. The controller shall carry the following product certifications:
 - a. UL 61010-1
 - b. (CSA) C22.2 Number 61010-1
 - c. European Union Low Voltage Directive 73/23/EEC EN 61010-1

C. Sensors - The controller shall include pH, ORP, ppm and temperature sensors meeting the following requirements:

1. pH sensor

- a. The controller shall continuously monitor, display and data log pH with 0.1 or 0.01 resolution (programmable) and provide a measurement of pH by utilizing a sensor with the following characteristics:
 - 1) 0 – 14 sensing range;
 - 2) ABS body with ½" NPT process connection;
 - 3) Minimum of 32 milliliters of inorganic electrolyte gel; organic electrolytes, susceptible to breakdown in the presence of strong oxidants, shall not be considered equal;
 - 4) A porous Teflon liquid junction to provide a stable, low impedance reference contact, and to prevent fouling and clogging of the liquid junction;
 - 5) A silver/silver chloride (Ag/AgCl) reference element;
 - 6) A general-purpose glass membrane pH sensing element;
 - 7) Operating temperature range of 0 - 80 degrees C;
 - 8) Operating pressure range of 0 - 100 psiG.

2. ORP / HRR sensor

- a. The controller shall continuously monitor, display and data log ORP with 1mV resolution and provide a measurement of ORP by utilizing a sensor with the following characteristics:
 - 1) -1000 to +1000mV sensing range;
 - 2) ABS body with ½" NPT process connection;
 - 3) Minimum of 32 milliliters of inorganic electrolyte gel; organic electrolytes, susceptible to breakdown in the presence of strong oxidants, shall not be considered equal;
 - 4) A porous Teflon liquid junction to provide a stable, low impedance reference contact, and to prevent fouling and clogging of the liquid junction;
 - 5) A silver/silver chloride (Ag/AgCl) reference element;
 - 6) A solid platinum or solid gold ORP sensing element with a minimum of 1 cm² surface area; platinum-plated and gold-plated sensing elements, which are susceptible to abrasives, shall not be considered equal;
 - 7) Operating temperature range of 0 - 80 degrees C;
 - 8) Operating pressure range of 0 - 100 psig.

3. Amperometric (ppm) Sensor

- a. The optional Free Chlorine sensor shall be an amperometric probe system with a measuring range of 0.05 to 20 mg/l with a fully selectable scale and a temperature range of 36°-113° Fahrenheit. The amperometric probe shall come with a PVC body, replaceable PTFE membrane and electrolyte, gold cathode and silver/ silver chloride anode.

4. Temperature Sensor

- a. The controller shall continuously monitor, display and data log temperature with 1°F resolution and provide a measurement of water temperature by utilizing a sensor with the following characteristics:
 - 1) 32 – 212°F (0 – 100°C) sensing range;
 - 2) 2 wire, 100Ω resistive temperature detector (RTD) with an 0.00385 Alpha.

5. Flow Sensor

- a. The controller shall continuously monitor, display and data log flow rate with 0.1 gpm resolution and shall provide a measurement of pool circulation flow rate and volume by utilizing a flow sensor with the following characteristics:
 - 1) 0-8800 gpm (0-33265 liter/min) measuring range,
 - 2) Paddle wheel flow sensor with a frequency output,
 - 3) Dual O-ring seal,
 - 4) 25-foot cable,
 - 5) Iron pipe saddle,
 - 6) Flow volume: 999 trillion gallons, 1-gallon resolution; 999 trillion liters, 1 liter resolution.

6. 4-20mA Sensor

- a. The controller shall be capable of reading a total of eight (8) 4-20mA output sensors, including the following:
 - 1) Pressure Transducers (Quantity 2) - The controller shall continuously monitor, display and data log pressure(s) with 1 psiG resolution and provide measurement of filter influent and/or filter effluent pressure by utilizing pressure transducer(s) with the following characteristics:
 - a) 0 to 100 psiG measuring range,
 - b) $\pm 2\%$ span max @ 25° C which includes linearity, hysteresis and repeatability,
 - c) 0.25% static error band and 1.5% typical thermal error band,
 - d) Temperature compensated and fully calibrated,
 - e) Stainless steel wetted components with plumbing connections of 1/4".
 - 2) Vacuum Transducer (Quantity 1) The controller shall continuously monitor, display and data log vacuum(s) with 1 psiG resolution and provide measurement of strainer vacuum by utilizing a vacuum transducer with the following characteristics:
 - a) -15 to +85 psiG measuring range,
 - b) $\pm 2\%$ span max @ 25° C which includes linearity, hysteresis and repeatability,
 - c) 0.25% static error band and 1.5% typical thermal error band,
 - d) Temperature compensated and fully calibrated,
 - e) Stainless steel wetted components with plumbing connections of 1/4".
 - 3) Liquid Level Sensors - Three (3) total - The controller shall provide measurement of liquid levels for surge tanks, backwash holding tanks and/or liquid chemical inventory by utilizing liquid level sensor(s) with the following characteristics:
 - a) Field configurable sensing range from 3 ft to 16 ft,
 - b) Field calibration for various tank levels, shapes and sizes,
 - c) Non-contacting sensing elements enclosed in PVC.
 - 4) Conductivity/TDS Sensor - The controller shall continuously monitor, display and data log conductivity/TDS with 1 micromho/ppm resolution and provide a measurement of conductivity/TDS by utilizing a sensor with the following characteristics:
 - a) 0-20,000 micromhos (0-10,000 ppm TDS) measuring range
 - b) A 316 stainless steel electrode,
 - c) PTFE insulator as well as a dual EPR O-ring seals,
 - d) AC operation, which resists electrode plating.

D. User Interface

1. Standard Display - The standard display shall be a backlit transfective LCD with 14-line x 40 alpha/numeric graphical characters that will continuously display information related to the following:
 - a. All installed sensor readings,
 - b. Set points, with current control status,
 - c. All active alarms, including time activated,
 - d. Smart menus w/ integrated on-screen help.
2. Contrast adjustment of the backlit LCD shall be provided through clearly marked keys on the front-panel without the need for access to internal controller circuitry. After initial adjustment, controller shall monitor internal temperature and automatically adjust contrast to prevent LCD blackout in extreme ambient temperature conditions. Controllers that do not include front-panel contrast adjustment and automatic temperature compensation shall not be considered equal.
3. The standard user interface shall include single-touch access to Set Points, Relay Modes, Calibrations, Backwash status and settings, Menu access, and Reset Fail/Safes. An alphanumeric keypad shall be provided for ease of system configuration.

E. Control Functions

1. Water Chemistry

- a. pH Control: The controller shall continuously control pH. Chemical feed shall be configurable for feed-up, feed-down, or dual feed and either on/off or time-based proportional feed.
- b. Sanitizer Control: The controller shall continuously control sanitizer based upon the ORP reading, the amperometric sensor, or both with a bracketed control program. Chemical feed shall be configurable for either on/off or time-based proportional feed.
- c. Bracketed Sanitizer Control: With the amperometric ppm sensor, the controller shall be configurable for bracketed sanitizer control; The bracketed control algorithm shall allow either the ORP or ppm setpoint to be chosen as the primary control point, while using other parameter to create a secondary boundary (min and max settings) that must be maintained in addition to the primary control point.
- d. Sanitizer Booster Feed: The controller shall have a sanitizer booster program with selectable ORP and/or ppm set points with separate ending set points, allowing the option of the booster sanitizer to control to a lower set point while the primary system can recover.
- e. Ozone/UV Control: The controller shall provide feed-up control of an ozone or UV system based upon ORP and/or ppm set points. A Fireman Cycle feature shall turn off the Ozone/UV relay 0 to 60 minutes (settable) prior to backwash initiation or recirculation pump shutdown. The Ozone/UV control algorithm shall include an Energy Conservation mode, with on/off set time and secondary set point.
- f. Superchlorination: The controller shall have a programmable superchlorination function, based ORP or ppm superchlor setpoint, which is triggered manually.
- g. Dechlorination: The controller shall have a programmable dechlorination function, based upon ORP or ppm dechlor setpoint, which is triggered either manually or by the completion of the superchlorination function.
- h. LSI & RSI: The controller shall compute the Langelier Saturation Index and the Ryznar Saturation Index based upon current inputs and the Ca Hardness and Alkalinity entered by the operator.
- i. Flow Monitoring: The controller shall continuously monitor, display, and data log system flow, maintaining a total flow volume. A low flow alarm shall be operator settable, which can be programmed to disable chemical feeds.
- j. Heater Control: The controller shall perform on/off control of a heater based upon an operator settable temperature set point. A Fireman Cycle feature shall turn off the heater 0 to 60 minutes (settable) prior to recirculation pump shutdown. Heater control algorithm shall include an Energy Conservation mode, with on/off set time and secondary temperature set point.
- k. Chemical Inventory Monitoring: The controller shall continuously monitor, display, and data log liquid pH adjuster and sanitizer inventory levels. The controller shall include low chemical level alarm points for each chemical being monitored.
- l. Backwash tank Monitoring: The controller shall continuously monitor, display, and data log backwash holding tank levels.
- m. Surge tank Monitoring: The controller shall continuously monitor, display, and data log surge tank levels.
- n. Autofill: The controller shall automatically control a water makeup relay to add makeup water to maintain pool level set point, based upon surge tanks (or equivalent) level, with an overfill delay feature. The controller shall provide a programmable alternate set point (4 event 28 day timer). Use in conjunction with 3" valve specified in Section 131107 2.3G
- o. Sensor Wash: The controller shall include a programmable sensor wash with start and end time, feed duration, and number of cycle to allow multiple feed cycles per day.

F. Energy Conservation

1. Alternate Setpoints: The controller shall have alternate Sanitizer, Heater, and Autofill setpoints, based upon a 4 event 28 day timer.
2. Energy Conservation Mode: The controller shall have the capability to disable all mechanical and chemical functions during programmed conservation cycle. The Energy Conservation Mode shall include the ability to periodically monitor and satisfy all operation requirements based upon a programmed time schedule.

G. Automatic Backwash

1. Backwash Initiation: The controller shall be user configurable to initiate backwash upon any of the following conditions:
 - a. Time, based upon a 24 hour, 7 day programmable calendar,

- b. Pressure Differential, taken from either a pressure differential switch or an operator settable low pressure differential setpoint based upon the differential between two installed pressure transducers,
 - c. Low System Flow, an operator settable low flow set point based upon the installed system flow meter,
 - d. Totalized filter water volume, an operator settable totalized filter water volume set point based upon the total system flow maintained by the controller from the installed system flow meter,
 - e. High filter effluent turbidity, an operator settable turbidity set point based upon the installed turbidity sensor,
 - f. Manual, which only initiates backwash when manually activated by operator.
- 2. Normal Operation: The controller shall be capable of controlling the backwash operation of up to 16 filters, with the following backwash features included as part of normal programming.
 - a. Inhibit Period, Operator settable daily time period during which backwash is prevented from being triggered.
 - b. Backwash Frequency Fail Safe: Prevents an automatically triggered backwash from starting within this time period from the end of the previous backwash. Does not prevent a Manual initiation of backwash.
 - c. Fireman Cycles: The controller shall provide operator settable independent Fireman Cycle settings for the Heater and Ozone/UV controls. The controller shall automatically delay the start of the backwash operation until the Heater and Ozone/UV controls have been deactivated and the corresponding Fireman Cycles have expired.
 - d. Primary/Priority Valve Management: Primary/Priority valve control closes a Primary/Priority valve during backwash of a filter to increase the flow through the filter being backwashed.
 - e. Alternate Lead Filter, In multiple filter systems, the controller shall automatically alternate the lead filter in each successive backwash cycle, in order to assure an effective full backwash of all filters in the system.
 - f. Backwash duration: Operator settable length of time to backwash each filter.
 - g. Dwell Time: Operator settable length of time to delay after each filter is backwashed.
- 3. Backwash Holding Tank Management: The controller shall be capable of monitoring the backwash holding tank to prevent overflow, by adjusting the backwash cycle as follows:
 - a. Suspend backwash when the holding tank is full, allowing time for the holding tank to drain.
 - b. Automatically resume backwash when the holding tank is empty.
 - c. An operator settable timeout which monitors the amount of time the backwash holding tank takes to drain. If this timeout is exceeded, a limit timer alarm is activated and the backwash cycle cancelled.
- 4. Advanced Backwash Optimization: The controller shall be capable of the following advanced features as part of the normal backwash programming:
 - a. Backwash accessory: Turns on an additional relay before, during, and/or after backwash operations based upon operator settable parameters; useful for sites where application of a dechlorination agent to backwash water (holding tank) is required.
 - b. Water Saving (Turbidity): The controller shall be capable of monitoring backwash effluent turbidity and ending a filter backwash early upon reaching a desired turbidity set point.
 - c. Filter Isolation: During backwash suspension due to full backwash holding tank, allows suspended filter to be isolated from the system rather than being returned to filter mode. This prevents the filter bed from recompacting, making the resumed backwash rapidly effective. Requires properly equipped filters.

H. Main Recirculation Pump

- 1. On/Off Control with Relay:

Controller shall provide the capability to interface to and control a recirculation pump with a programmable relay. The controller shall include the following capabilities, available as appropriate based upon installed sensors and implemented features:

 - a. Fireman Switch: The following events shall satisfy Fireman Switch timing requirements prior to turning off recirculation pump:
 - 1) Backwash Operations
 - 2) Energy Conservation mode (24 hr, 7 day function)
 - 3) Manual off

- b. Immediate: The following events immediately turn off recirculation pump, regardless of Fireman Switch timing requirements:
 - 1) Surge Tank Level Low Alarm: Turn off pump immediately (surge tank is almost empty)
 - 2) Strainer Vacuum High Alarm: Turn off pump immediately (possible entrapment)
 - 3) Emergency shutdown, triggered by front-panel Emergency Off: Turn off pump immediately (per Operator)

I. Total Dynamic Head (TDH)

- 1. Controller shall provide the capability to continuously monitor the Total Dynamic Head (TDH) of the main recirculation pump, directly calculated by the controller from recirculation pump influent vacuum and filter influent pressure transducers. TDH shall be displayed on the user interface and recorded in data logs, with user-programmable High and Low TDH Alarm settings.

J. Control Outputs

- 1. Relay Outputs - Solid-State Relays: The controller shall come with a total of 4 integral line or dry contact 5A solid-state relay outputs capable of switching 3A under all normal operating conditions, accounting for the effects of the temperature gradient inside the NEMA 4X enclosure. Systems that utilize relays that are not de-rated must submit an engineering evaluation justifying the use of relays at their full, optimal-condition capacity.
- 2. Mechanical Relays - The controller shall come with a total of 3 mechanical relays:
 - a. 1 integral 8A dry contact mechanical relay, and
 - b. 4 integral 3A dry contact or line powered mechanical relays.
 - c. Since mechanical relays have the inherent risk of failing in the closed (active) position, as a safety measure the controller shall preclude the ability to assign any of the integral mechanical relays to chemical feed functions. Systems that do not preclude mechanical relays from being configured for chemical feeds shall not be considered equal.
- 3. Expansion Relay Outputs
 - a. The controller shall be capable of expanding the number of relay outputs available by adding up to 3 expansion modules in any combination.

L. Solid-State Relay Expansion Modules

- 1. Each Solid-State Relay Expansion Module provides 5 integral 5A solid state dry contact or line powered relays capable of switching 3A under all normal operating conditions. Systems that utilize relays that are not de-rated must submit an engineering evaluation justifying the use of relays at their full, optimal-condition capacity.

M. Mechanical Relay Expansion Modules

- 1. Each Mechanical Relay Expansion Module provides 5 integral mechanical relays:
 - a. 1 integral 8A dry contact mechanical relay, and
 - b. 4 integral 3A dry contact or line powered mechanical relays.
 - c. Since mechanical relays have the inherent risk of failing in the closed (active) position, as a safety measure the controller shall preclude the ability to assign any of the integral mechanical relays to chemical feed functions. Systems that do not preclude mechanical relays from being configured for chemical feeds shall not be considered equal.

N. Safety Features

- 1. Manual-On limit
 - a. The controller shall have built-in limits to the amount of time any relay control output may be forced on (i.e. in "Manual On" mode). This is an important safety feature to prevent control outputs from inadvertently being left forced on after service or diagnostics.

2. High/Low Alarm Settings & Control Lockouts

- a. The controller shall have programmable high and low alarm settings for pH, ORP, PPM, temperature, low flow & no flow and chemical overfeed, turbidity, pressure & vacuum, surge tank levels, chemical inventory.
- b. The controller shall have a programmable lockout of sanitizer feed upon pH high or low alarm.

3. No Flow Alarm & Flow Restored Delay

- a. The controller shall activate a No Flow alarm when the dedicated sample stream flow switch indicates there is insufficient flow through the sample stream. This No Flow alarm shall lockout all chemical feed control operations.
- b. The controller shall include a Flow Restored Delay, which shall extend the No Flow lockout user-programmable amount of time after the No Flow alarm ends (i.e. flow is restored). This feature is necessary to assure that the system has valid, stable sensor readings of circulating water prior to making chemical feed control decisions.
- a. Feed Limit Alarms
- b. The controller shall trigger a Failsafe alarm if a chemical feed relay remains on longer than the programmable Feed Limit Timer. Chemical feeds shall automatically be disabled if the corresponding reading goes into a Failsafe alarm condition.

4. Emergency Off

- a. The controller shall have a dedicated Emergency Off button on the front panel of the system, which immediately halts all chemical feeds and control outputs when pressed. This feature shall be password protectable, which shall require entry of one of the Security passwords.

5. Safety Shield

- a. The controller shall include a safety shield or other mechanism for allowing fuse replacement without access to high voltage circuitry or wiring.

O. Security

- 1. The controller shall have three security password levels: six for operators, two for managers and one for the distributor providing for a history of access identified by the user.

P. Data Logging

- 1. The controller shall have 512K battery backed-up RAM for input level recording and events. All input level shall be recorded for 10 to 56 days depending on sample rate (2to 10 minutes).
- 2. The controller shall record and maintain the latest 1100 events over a maximum of 14 days recording all alarms, parameter changes, user logins, and operational cycles related to all control features

Q. Local Alarms / Indicators

- 1. The controller shall signal all alarm conditions with the following indicators:
 - a. A bright red flashing LED on the front of the controller,
 - b. Activation of a master alarm signal provided as a dry contact relay enabling the use of 0-240 VAC alarms, and each active alarm listed on the LCD display along with time activated.

R. Remote Communication, Access and Alarm Notification

- 1. Ethernet
 - a. The controller shall come with a standard, integral 100BaseT Ethernet connection. The controller shall be capable of providing Remote Access via PC with Ethernet connection and Alarm Notification via email or text message via an Ethernet connection to the Internet.

S. Enclosure

1. The controller shall be housed in a NEMA 4X polycarbonate enclosure.

T. Flow Cell

1. PVC flow cell

- a. The flowcell shall have a PVC body with two ½" NPT ports for pH and ORP sensors, two ¼"NPT ports for temperature sensor and sensor wash acid injection, and a clear acrylic front viewing window. The flowcell design shall provide precise sample flow rate and water velocity regulation past the probes. The flowcell shall come provided with PVC ½" isolation ball valves, PVC ¼" wet test valve and standard reed or optional rotary flow switch.
- b. Each flowcell shall be equipped with a pressure-sensing device. The pressure sensor shall consist of a compound pressure/vacuum gauge manufactured in stainless steel, 2 ½" diameter, liquid filled with an operating pressure range of 0 to 60 psig and vacuum of 0 to -30 in./ Hg.

U. Packaged System Enclosure

1. The equipment room controller and flowcell with sensors shall be mounted onto a 3/8" thick PVC backplate. The flowcell shall be completely assembled and reading for integration into the plumbing.

V. AC Surge Suppression

1. An integrated solid state device shall be furnished to protect each mechanical room control system from excessive line voltage at controller.
2. Device shall be housed in a tamper proof enclosure provided with mounting tabs and have ½" NPT hardwire connection, with LED indicator light, UL listed.

W. Commissioning / Start-Up, Warranty and Manuals

1. Controller and sensing probes (ORP, pH, ppm) shall be covered by a standard manufacturer's 5-year warranty. Manufacturer's representative shall provide a complete set of new probes on the fifth year of operation.
2. The control system shall be provided with on-site start-up, on-site operator training, and 2 years on-site warranty service performed by a factory trained and certified representative of the controller manufacturer.
3. Manufacturer's representative shall supply an Operator's Manual describing system features and operating instructions.

3. PART 3 EXECUTION

3.1 SURFACE CONDITIONS

A. Inspection:

1. Prior to installing the items of this Section, carefully inspect the installed Work of other trades and verify that all such Work is complete to the point where this installation may properly commence.
2. Verify that the swimming pool equipment items may be installed in strict accordance with original design, pertinent codes and regulations, and the manufacturers' recommendations.

B. Discrepancies:

1. In the event of discrepancy, immediately notify the Owner's Representative's Representative.
2. Do not proceed with installation in areas of discrepancy until all such discrepancies are fully resolved.
3. Failure to notify the Owner's Representative's Representative and give written notice of discrepancies shall constitute acceptance by the Installer of existing conditions as fit and proper to receive its Work.

3.2 INSTALLATION

- A. Supply and install items of swimming pool equipment in strict accordance with applicable codes and regulations, the original design, and the manufacturer's published recommendations, anchoring firmly and securely for long life under hard use.

- B. Coordinate with other trades to insure all imbedded items are set plumb and flush. Railing ends must have anchor sockets and escutcheon plates. Be certain that deck equipment and railings are properly bonded prior to imbedding.
- C. All equipment shall be braced and/or anchored to resist a horizontal force acting in any direction using the criteria shown on the Drawings.

3.3 INSTRUCTION

- A. The Contractor shall provide a factory certified representative(s) to start-up and certify proper installation, operation and full warranty status of all swimming pool mechanical equipment. The Contractor shall provide not less than two 8-hour days of on-site training for facility staff in the operation and maintenance of the swimming pool mechanical equipment and systems. The two 8-hour days shall be separated by a minimum of seven calendar days and be completed within the 14-day start-up period.

3.4 EQUIPMENT ACTIVATION

- A. All water chemistry and filtration mechanical equipment shall be operational upon filling of pool after plaster. Chemicals and other related support items as supplied by Contractor, shall be in supply at start-up.
- B. For the first fourteen (14) calendar days after completion of the pool plaster, brush all plastered surfaces at least twice a day and coordinate with General Contractor to ensure that the plaster is carefully maintained after the initial fourteen-day period. In addition, coordinate with the Contractor to ensure that pool filtration equipment is continuously running during the initial fourteen-day period.
- C. Start-up and provide qualified personnel to operate pool equipment for a period not less than fourteen (14) days after the pool is placed in operation, or until the Owner takes occupancy of the facility or letter of substantial completion. During this time, Contractor shall instruct and supervise the Owner's personnel in the various operating and maintenance techniques involved. Contractor shall be responsible for supply of chemicals during this not less than fourteen (14) day period and at time of turnover to Owner, chemical storage tanks shall be full. (Owner's personnel shall be fully trained and capable of assuming swimming pool maintenance tasks, training may begin before Owner takes occupancy).

3.5 CLEAN-UP

- A. Upon completion of swimming pool equipment, remove all debris, materials and equipment occasioned by this Work to the approval of the Owner's Representative's Representative.

END OF SECTION

SECTION 13 11 07

SWIMMING POOL MECHANICAL

1. PART 1 - GENERAL

1.1 WORK INCLUDED

- A. Swimming pool mechanical piping as indicated on the Drawings for circulation and filtration systems, pool water heating systems, chemical control systems, booster pump systems and appurtenances.
- B. Domestic water system from points of connection within swimming pool mechanical equipment room to make-up water system.
- C. Filter backwash piping to point of connection with backwash retention pit as required.

1.2 QUALITY ASSURANCE

A. Qualifications of Workers:

- 1. The entity performing the work of this Section shall have been successfully engaged in the respective trade for at least five (5) years immediately prior to commencement of the Work.
- 2. For actual construction operations, use only trained and experienced workers with a minimum of three (3) years experience with the materials and methods specified.
- 3. Provide at least one person who shall be present at all times during execution of the work of this Section, with a minimum of five (5) years experience with the type of materials being installed, the referenced standards, and who shall direct all Work performed under this Section.

B. Standards:

- 1. All equipment supplied or work performed shall comply with Chapter 31B of California Building Code, latest edition.
- 2. Work shall be performed in accordance with the applicable editions of all National, State and local codes, laws, regulations and ordinances, including the following:
 - a. American National Standards Institute (ANSI).
 - b. American Society for Testing Materials (ASTM).
 - c. American Waterworks Association (AWWA).
 - d. American Welding Society (AWS).
- 3. Do not construe anything in the Drawings or Specifications to permit Work not conforming to these requirements.

1.3 SUBMITTALS AND SUBSTITUTIONS

A. Provide submittals in conformance with the requirements of Section 01 33 00.

B. Required submittals include:

- 1. Pipe and Fittings as specified in Article 2.2 of this Section.
- 2. Valves as specified in Article 2.3 of this Section.
- 3. Pressure / Vacuum Gauges as specified in Article 2.4 of this Section.
- 4. Pipe Hangers and Supports as specified in Article 2.5 of this Section.
- 5. Sleeves and Waterstops as specified in Article 2.6 of this Section.

C. Submit proof of qualifications as specified in Article 1.2.A of this Section.

1.4 PRODUCT HANDLING

- A. Delivery: Deliver all materials to the Project Site in the manufacturer's original unopened containers with all labels intact and legible.

- B. Storage: Store all materials under cover in a manner to prevent damage and contamination, and store only the specified materials at the Project site.
- C. Protection: Use all means necessary to protect swimming pool mechanical items before, during and after installation and to protect the installed Work specified in other Sections.
- D. Replacements: In the event of damage, immediately make all repairs and replacements necessary to the approval of the Owner's Representative and at no additional cost to the Owner.

1.5 JOB CONDITIONS

- A. Cooperate with entities performing Work specified in other Sections to so that no conflict of new construction or occupied space may occur. Should any installation Work be done without such craft coordination, that Work so installed shall be removed and re-installed.

2. PART 2 - PRODUCTS

2.1 PRODUCT QUALITY

- A. Materials and equipment shall be new, of the best quality for the purpose intended, and shall be clearly marked with the manufacturer's name and nameplate data or stamp and rating. As far as practicable, materials and equipment shall be of one manufacturer.

2.2 PIPE AND FITTINGS

- A. PVC Schedule 40: Type 1, normal impact, NSF approved for solvent welding applications, ASTM Specification D-1785, color shall be white. Dura, Lasco, or approved equal.
- B. PVC Schedule 80: Type 1, normal impact, NSF approved for solvent welding applications, ASTM Specification D-1785, color shall be gray. Dura, Lasco, or approved equal.
- C. CPVC Schedule 80 Influent/Effluent Piping: Type 1, normal impact, NSF approved for solvent welding applications, ASTM Specification D-1785, color shall be gray. Dura, Lasco, or approved equal.
- D. PVC DR25: Conforming to ASTM D-1784, use with epoxy coated bell and spigot-type fittings or epoxy coated mechanical joint by flange adapters with epoxy coated cast iron fittings as specified in Article 2.02 (F), below. Johns-Manville "Big Blue", Diamond Plastics, or approved equal.
- E. Copper Tubing: ASTM Specification B-88, hard drawn, with ANSI Standard B16.22 wrought copper fittings.
- F. Steel: ASTM Specification A-120, Schedule 40 black or galvanized pipe with ASTM A-47 150 lb. banded malleable iron threaded fittings.
- G. Cast Iron: ASTM Specification B16.1, cast iron flanged fittings, provide epoxy coating as required for use with chlorinated water.

2.3 VALVES

- A. Ball Valves:
 - 1. For pool system: True-Union design, PTFE seat material with FPM or FKM Double O-ring stem seals, locking handle, NSF certified. PVC schedule 80 body for below grade installation. CPVC Schedule 80 body for above grade installation. Furnish ball valves on all pipe diameters 2½" or less with a rating of at least 200psi at 73°F. Asahi, Iplex, or Nibco.
 - 2. For copper pipe system: 3-piece full-port Bronze body valve with Teflon seat, 'Apollo', 'Nibco' or approved equal.
- B. Butterfly Valves:
 - 1. Epoxy coated cast or ductile iron body, 316 stainless steel disc and stem, viton seat material, furnish hand wheel/gear operators on all valves 8" and larger. DeZurick, Keystone, Iplex or equal.
 - 2. PVC body, PVC disc and EPDM construction suitable for chlorinated water applications. Stem shall be

of 316 stainless steel and non-wetted. Valves shall be self-gasketed design with a convex sealing arrangement. Valves 1-1/2" – 10" shall be rated to 150 psi and 12" valves shall be rated to 100 psi at 70°F. Asahi Pool-Pro, no known equal.

- C. Check Valves: Wafer-type, epoxy coated cast or ductile iron body, 316 stainless steel plates and shaft, viton seat material. Centerline, Metraflex, or approved equal.
- D. Surge Chamber Float Valve: EPD #2-0020-230 Float Control Valve, 10" line size, as manufactured by Environmental Products Division of Doughboy Recreational, Rancho Cucamonga, CA, no known equal.
- E. Surge Chamber Isolation Valve: Butterfly valve, tapped lug style, bronze body, stainless steel stem, bronze disc, phenolic back-up ring, EPT seat material. Provide stainless steel shaft extension, shaft housing and tool operator located 2'-0" above floor level with deck access grate as required. DeZurick, Keystone, Asahi, Spears, or Ipex or approved equal.
- F. RP Backflow Preventer: Febco #835-B for 2" and smaller; #825 for 2-1/2" and larger. Febco, Watts, or approved equal.
- G. Make-up Water Control: 3" 'Cla-Val' fill system to include 3" 'Cla-Val' solenoid control valve #136-01BY, 3" ductile iron, epoxy coated body with cast iron disc retainer and diaphragm washer, bronze trim, flanged globe pattern, 120V at 60 Hz. Solenoid wiring shall be wired to water chemistry controller. Provide 6" air gap at fill point.

2.4 PRESSURE / VACUUM GAUGES

- A. Furnish and install pressure and vacuum gauges on the discharge and suction sides of all pumps. 2" or 2 1/2" dial, bottom connection, chrome ring, shut-off cock and snubber. Ranges shall be selected to indicate between mid-point and two-thirds of maximum range under design conditions. Marsh, Terice, or approved equal.

2.5 PIPE HANGERS AND SUPPORTS

A. General:

- 1. The requirements of this Section relates to various requirements of the Agreement, General and Supplementary Conditions, Specifications, Drawings, and modifying documents which are part of the Construction Contract. Responsibility for coordination of all such applicable requirements will be that of the Contractor.

B. Description:

- 1. This section provides guidelines and limitations for the support of all mechanical, electrical, plumbing or architectural items from the building structure, and for the seismic bracing of such items.
- 2. Design and install all support and bracing systems as required for the swimming pool systems. Provide for attachment to portions of the building structure capable of bearing the loads imposed. Design these systems to not overstress the building structure.

C. Quality Assurance:

- 1. Design and install all support systems to comply with the requirements of the 2016 California Building Code, Chapter 16A.
- 2. Seismic bracing is to be designed by a professional engineer licensed in the State of California.
- 3. For the seismic bracing of mechanical, electrical and plumbing system, refer to "Guidelines for Seismic Restraints of Mechanical Systems and Plumbing Piping Systems" by Sheet Metal and Air conditioning Contractors National Association, Inc., (SMACNA) for guidelines.

D. Submittals:

- 1. Submit shop drawings for all substructures and attachment methods.
- 2. Submit proposed alternative methods of attachment for review and approval by the Architects, prior to deviating from the requirements given below.
- 3. For all pipe hangers and support systems, submit structural calculations and details which include all

resultant forces applied to the building structure and are prepared and signed by the Contractor's licensed California professional engineer. Calculations will be reviewed for compliance with design criteria, not for arithmetic.

E. Materials:

1. Use Kin-Line, Grinnel, or approved equal.
2. Support all pipelines individually with hangers, each branch having at least one hanger. Lateral brace as noted and required.
3. Support piping near floor with steel stanchions welded to end plates secured to pipe and floor.
4. Support vertical piping at each floor level. Install coupling in piping at each support. Coupling shall rest on and transmit load to support. Isolate copper from steel supports with vinyl electrician's tape around pipe and coupling.
5. Use Stoneman "Trisolator," Unistrut, or approved equal, isolators at each hanger and other support points on bare copper tubing system.
6. For PVC pipe, space hangers four (4) feet apart for pipe sizes 1" and under, five (5) feet apart for pipe sizes 1-1/4" to 2", and six (6) feet apart for pipe sizes over 2". Space hangers for horizontal pipes at a maximum of six (6) feet for copper 2" and smaller and for steel 1-1/4" and smaller; ten (10) feet for copper 2-1/2" and larger and for steel 1-1/2" and larger.
7. Size hanger rods, screws, bolts, nuts, etc., according to manufacturer's sizing charts.
8. Trapeze hangers may be used for parallel lines.
9. Use galvanized or cadmium plated hangers, attachments, rods, nuts, bolts, and other accessories in pool mechanical room, high humidity areas, or where exposed to weather. Hot dip galvanize all items which are not factory furnished. Plating for hinged movements must be done at the factory.
10. Lateral Bracing: To prevent swaying of the piping systems, provide angle iron bracing and anchor into wall or overhead framing. Piping shall be braced or anchored in such a way as to resist a horizontal force of 50% of its operating weight in any direction.
11. Do not use wire or other makeshift devices for hangers.
12. Furnish all substructures and fasteners required to comply with the limitations given below. Use material as specified in the various sections and as appropriate to their use.

F. Guidelines & Limitations:

1. Each Contractor will coordinate the load requirements from all subcontractors so that no combination of loads overstresses the building structure or exceed the limitations given below.
2. Concrete Structure:
 - a. Support all loads hung from concrete structure with cast-in-place inserts, unless drilled-in anchors are specifically approved in writing prior to placing the concrete.
 - b. Concrete anchors must not penetrate into reinforcing bars. Where the anchors boring indicates the presence of reinforcing bar, patch hole with an epoxy type grout and relocate anchor 12 diameters away.
 - c. Individual expansion anchors cannot support any loads greater than 300 pounds or manufacturer's specified load capacity without approval.
3. Steel Structure:
 - a. Hang no more than 20 pounds per metal deck rib in any span.
 - b. At beams, hang all beam loads greater than 40 pounds concentric to beam, not off the flanges.
 - c. Attached no loads to the beams or girders greater than the following without specific approval from the architect;
 - 1) Roof beams and girders: 300 pound point load or 600 pound total load for a single span.

G. Seismic Bracing:

1. Design and install seismic bracing to not ground out vibration and sound isolation systems.
2. All items of mechanical and electrical equipment 60" or more in height are to be seismically braced whether such bracing is shown or not.

2.6 SLEEVES AND WATERSTOPS

- A. Provide sleeves where work of this Section passes through fire rated partitions, floors and ceilings, concrete slabs or exterior of structure. Caulk clearance space using sealant appropriate for application in conformance with manufacturer's recommendations and Title 24 of California Code of Regulations. 3m, Dow Corning, or approved equal. In lieu of sleeves and caulking, "Link Seal" products may be used.
- B. Provide prefabricated waterstops as indicated on the Drawings at all pipe penetrations through structures containing stored water (i.e., swimming pools, balance/surge tanks, etc.) to insure leak-proof seals.

3. PART 3 - EXECUTION

3.1 SURFACE CONDITIONS

- A. Inspection:
 - 1. Prior to Work of this Section, carefully inspect the installed Work of other trades and verify that such work is complete to the point where this installation may properly commence.
 - 2. Verify that items of this Section may be installed in accordance with the original design and referenced standards.
- B. Discrepancies:
 - 1. In the event of discrepancy, immediately notify the Owner's Representative.
 - 2. Do not proceed with installation in areas of discrepancy until all such discrepancies have been fully resolved.
 - 3. Failure to notify the Owner's Representative and give written notice of discrepancies shall constitute acceptance by the Contractor of existing conditions as fit and proper to receive his work.

3.2 ABBREVIATIONS AND SYMBOLS

- A. Abbreviations and symbols on the Drawings are those most commonly used. Obtain clarification from the Owner's Representative on any questionable items before bid.

3.3 GENERAL PIPING REQUIREMENTS

- A. Size any section of pipe for which size is not indicated or any intermediate section erroneously shown undersized the same size as the largest pipe connecting to it. Sizes listed are nominal.
- B. Cut pipe accurately to job measurements and install without springing or forcing, true to line and grade, generally square with building and/or structures and adequately supported to prevent undue stress on pipe, fittings and accessories.
- C. Make changes of direction with manufactured fittings. Street ells, bushings, reducing flanges, close nipples or bending of pipe is not allowed.
- D. Use great care to install piping in accordance with best practice. Plastic pipe shall be "snaked" in trenches to allow for thermal expansion.
- E. All above grade, below grade and buried or imbedded PVC shall be installed using solvent weld fittings. Also, each and every fitting and pipe end shall be prepared with solvent primer. Fittings shall be joined individually and with enough time between assembly of adjacent joints to allow them to seal solidly. After joining, an even ring of primer must be visible around the entire fitting. If any fittings are installed without visible primer, the fitting shall be removed and discarded and piping recut, rechamfered and joint made up again using a new fitting. All procedures, methods and techniques used to make up solvent weld joints shall be in strict accordance with manufacturer's recommendations.
- F. Arrange pipe and hangers to allow for expansion, contraction and structural settlement. No pipe shall contact structure except penetrations as shown on the Drawings.
- G. Provide dielectric connections between copper and dissimilar metals. In copper systems, threaded piping including connections to equipment shall be brass pipe and fittings. Install dielectric connections in vertical sections of piping only.
- H. Run pipe full size through shut-off valves, balancing valves, etc. Change pipe size within three (3) pipe

diameters of final connection to control valves, fixtures and other equipment.

- I. Provide unions or flanges at connections to equipment, on service side of valves and elsewhere as required to facilitate ease of maintenance.
- J. Locate equipment shut-off valves as close to equipment as possible maintaining easy valve access.
- K. Make all connections between domestic water systems and equipment or face piping with approved backflow prevention devices as required.
- L. All PVC pipe exposed to direct sunlight shall be painted with two coats of Exterior Acrylic Semi-gloss Paint, Sherwin Williams or equal. Color to be selected by the Architect. Prior to painting the PVC pipes, the exterior of all PVC pipes shall be wiped with Methyl Ethyl Ketone, or an approved equal, to remove the glaze from the pipes.
- M. The Main Drain pipe must run either level or uphill from the main drain sump, through the surge pit (if applicable) and then to the circulation pump.

3.4 TRENCH EXCAVATION AND BACKFILL

A. Excavation:

- 1. Excavate and backfill trenches as required for the Work of this Section. Conform to requirements of Section 13 11 01.
- 2. The Contractor shall perform all excavation of every description and of whatever materials encountered, to the depths indicated on the Drawings or as necessary. The Contractor shall dispose of the excavated materials not required or suitable for backfill as directed, and shall perform such grading as may be necessary to prevent surface water from flowing into the trenches. The Contractor shall provide adequate equipment for the removal of storm or subsurface waters, which may accumulate in the excavated areas.

B. Trenching:

- 1. Excavate trenches to lines and grades as indicated on the Drawings and with banks as nearly vertical as practicable.
- 2. Bottoms of trenches shall be accurately graded to provide uniform bearing on undisturbed soil for the entire length of each section of pipe.
- 3. The width of the trench at and below the top of the pipe shall be such that the clear space between the barrel of the pipe and the trench wall shall not exceed 8" on either side of the pipe. The width of trench above the top of pipe may be wider if necessary.
- 4. Over-depth excavations shall be filled with tamped sand to required grades.
- 5. Excavations of five (5) feet or more in depth shall be shored or supported in conformance with rules, and regulations of State and Federal Governments. Shoring shall be constructed, maintained and removed in a manner to prevent caving of the excavation walls or other load on the pipe.

C. Backfilling:

- 1. Material for backfilling of pipes shall be approved granular material less than two (2) inches in diameter obtained from the excavation. No material of a perishable, spongy or otherwise unsuitable nature shall be used as backfill.
- 2. Backfilling of pipe trenches shall commence immediately after installation and testing to preclude damage to the installed pipe. Backfill around pipe shall be carefully placed so as not to displace or damage the pipe, and shall be carried up symmetrically on each side of the pipe to one foot above the top of the pipe. The material shall be carefully compacted or consolidated before additional backfill is placed.
- 3. Backfill above an elevation of one foot above the top of pipe in conformance with requirements of Section 13 11 01. Material for balance of backfill shall be approved granular material less than six (6) inches in diameter taken from the excavation.
- 4. Unless otherwise indicated on the Drawings, all pipe shall have a minimum of eighteen (18) inches of cover.

3.5 GENERAL EQUIPMENT REQUIREMENTS

- A. Position equipment to result in good appearance and easy access to all components for maintenance and repairs.
- B. Install piping, flues, breeching and ducts so that they do not interfere with equipment access.
- C. Install level, secure and out of moisture. Provide shims, anchors, support straps, angles, grouted bases, or other items as required to accomplish proper installation.
- D. All screws, nuts, bolts and washers shall be galvanized, cadmium plated or stainless steel. After fabrication, hot-dip galvanize unfinished ferrous items for outdoor, below grade or other use subject to moisture.
- E. Extend 1/2" Schedule 40 black steel pipe lubrication tubes from all hard to reach locations to front of equipment or to access points. Terminate with proper type of lubrication fitting.

3.6 VALVES AND STRAINERS

- A. If no shut-off is indicated, provide ball valves at inlet connections and balance valves at outlet connections to fixtures and equipment. Provide proper valve trim for service intended.
- B. Use no solder end valves unless noted otherwise; provide adapters in copper tubing systems.
- C. Locate valves with stems above horizontal plane of pipe. In general, locate valves within six (6) feet of floor, out from under equipment, in accessible locations with adequate clearance around hand wheels or levers for easy operation.
- D. Provide all valves, cocks and strainers, full pipe size unless indicated otherwise.
- E. Provide hand wheel operators on all valves 6" and larger, under 6" lever operators may be used.
- F. Provide tool operated valve with stainless steel shaft extension and 'on deck' tool operation for surge chamber butterfly isolation valve.

3.7 IDENTIFICATION OF PIPING

- A. Identify each valve by a numbered brass tag with hole and brass chain mounted on valve stem or handle. Tag to be a minimum of 1" in diameter and numbers at least 1/4" high stamped into tag. Valves and plumbing lines shall be labeled clearly with the source or destination descriptions.
- B. Install an identification chart in a plastic or glass framed enclosure, which schematically illustrates the proper operation of all piping systems and indicates number and location of all valves and control devices within the system.
- C. The direction of flow for the recirculation equipment shall be labeled clearly with directional symbols such as arrows on all piping in the equipment area. Where the recirculation equipment for more than one pool is located on site, the equipment shall be marked as to which pool the equipment serves.

3.8 TESTS

- A. Perform tests in presence of Owner's Representative with no pressure loss or noticeable leaks.
- B. Do not include valves and equipment in tests. Include connection to previously tested sections if systems are tested in sections.
- C. Perform tests as follows:

System	Test Pressure	Test Medium	Duration
Skimmer Lines and Lawson Main Drain sump lines	20psig	Water*	4 hours
Pool Piping	50 psig	Water*	4 hours
Pool Main Drains	30 psig	Water*	4 hours
Domestic Water	150 psig	Water*	4 hours

*Never test PVC pipe or fittings with air or other gases, always use water.

3.9 PIPE MATERIAL APPLICATION

- A. PVC Schedule 40: Below grade swimming pool piping and domestic water piping up to 12" line size; use standard solvent weld fittings.
- B. PVC Schedule 80: Above grade swimming pool piping up to 12" line size; use solvent weld Schedule 80 or epoxy coated cast iron fittings.
- C. Type L Hard Copper: Above grade domestic water piping.
- D. CPVC Schedule 80; Pool Heater Piping.
- E. Schedule 40 Steel: Natural gas piping.

3.10 CUTTING AND DRILLING

- A. Cutting or drilling necessary for installation of Work of this Section shall be done only with approval of Owner's Representative.

3.11 CLOSING-IN OF UNINSPECTED WORK

- A. Do not cover or enclose Work before testing and inspection. Re-open Work prematurely closed and restore all Work damaged.

3.12 QUIETNESS

- A. Quietness is a requirement. Eliminate noise, other than that caused by specified equipment operating at optimum conditions, as directed by Owner's Representative.

3.13 FLUSHING OF LINES

- A. Flush or blow out pipes free from foreign substances before installing valves, stops or making final connections. Clean piping systems of dirt and dust prior to initial start-up.
- B. Just prior to plastering the pool, under the observations of the IOR, the pool mechanical system shall be flushed using the pool circulation pump. Circulate water through the mechanical system until the effluent water from the pool return heads runs clean.

3.14 CLEAN-UP

- A. After all Work has been tested and approved, the Swimming Pool Subcontractor shall thoroughly clean all parts of the equipment installations, including all pool pipe and fittings in the pool mechanical room. Exposed parts shall be cleaned of cement, plaster and other materials and all grease and oil spots removed with solvent.
- B. The Swimming Pool Subcontractor shall remove debris from the Project site. Cartons, boxes, packing crates and excess materials not used, occasioned by this work shall be disposed of to the satisfaction of the Owner's Representative.
- C. If the above requirements of clean up are not performed to the satisfaction of the Owner's Representative, the Owner reserves the right to order the work done, the cost of which shall be borne by the Swimming Pool Subcontractor.

END OF SECTION

SECTION 13 11 08

SWIMMING POOL ELECTRICAL

1. PART 1 GENERAL

1.1 WORK INCLUDED

- A. Provide labor, materials and equipment as required to install the swimming pool electrical system including but not limited to:
1. A complete and operable system of service equipment, switchboards, panelboards, conduits, switches, time clocks and wiring for power and lighting, motor control centers.
 2. Junction and/or pull boxes, conduits, disconnects, starters, contactors, wiring and connection of all motors and mechanical equipment, including connection and wiring of line voltage controls associated with the mechanical systems.
 3. Swimming pool underwater lighting systems.
 4. Swimming pool timing system.
 5. Complete grounding system as required and shown on the Drawings.
 6. Adjusting and preliminary operation of the completed electrical system as described in Article 3.06, A of this Section.
 7. Cleaning of all completed Work and installation adjustment of all trim and decorative items.

1.2 QUALITY ASSURANCE

- A. Qualifications of Workers:
1. The entity performing the work of this Section shall have been successfully engaged in the respective trade for at least five (5) years immediately prior to commencement of the Work.
 2. For actual construction operations, use only trained and experienced workers with a minimum of three (3) years experience with the materials and methods specified.
 3. Provide at least one person who shall be present at all times during execution of the work of this Section, with a minimum of five (5) years experience with the type of materials being installed, the referenced standards, and who shall direct all Work performed under this Section.
- B. Ordinances and Codes: Materials and construction shall conform with all applicable code requirements, including:
1. National Electrical Code; Electrical Safety Orders of the State of California; Department of Industrial Relations; regulations of the State Fire Marshal; rules and regulations of the Board of Underwriters of the Pacific.
 2. Chapter 31 of California Building Code, latest edition.
- C. Verification of Conditions:
1. The locations shown on the Drawings are diagrammatic only and the exact finish location of equipment and materials cannot be indicated. Therefore, locations of all Work and equipment shall be verified to avoid interferences, preserve head room and keep openings and passageways clear. Changes shall be made in locations of equipment and materials which may be necessary to accomplish these purposes.
- D. Preliminary Operations and Testing:
1. Motor driven equipment shall be tested for correct rotation and completion of all connections.

1.3 SUBMITTALS AND SUBSTITUTIONS

- A. Provide submittals in conformance with the requirements of Section 01 33 00.
- B. Required submittals include:
1. Conduit and Fittings as specified in Article 2.2 of this Section.
 2. Panelboards as specified in Article 2.6 of this Section.
 3. Circuit Breakers as specified in Article 2.7 of this Section.
 4. Motor Starters as specified in Article 2.10 and 2.11 of this Section.
 5. Fuses as specified in Article 2.13 of this Section.
 6. Time Clocks as specified in Article 2.14 of this Section.
 7. Ground Fault Circuit Interrupters as specified in Article 2.15 of this Section.
- C. Submit proof of qualifications as specified in Article 1.2.A of this Section.

1.4 PRODUCT HANDLING

- A. Delivery: Deliver all materials to the Project Site in the manufacturer's original unopened containers with all labels intact and legible.
- B. Storage: Store all materials under cover in a manner to prevent damage and contamination, and store only the specified materials at the Project site.
- C. Protection: Use all means necessary to protect swimming pool electrical materials before, during, and after installation and to protect the installed Work specified in other Sections.

2. PART 2 PRODUCTS

2.1 MATERIALS, GENERAL

- A. Materials shall be new, in unbroken packages and bear the U.L. label of approval.
- B. Equipment of one type shall be by same manufacturer. One type of equipment for classifications such as:
 - 1. Switchboards, panels, buss duct, disconnect switches and allied items.
 - 2. Conduit.
 - 3. Wire.
 - 4. Conduit fittings.
 - 5. Fixtures of the same general type.
 - 6. Wiring devices.

2.2 CONDUIT AND FITTINGS

- A. Conduit within or under buildings or where exposed outdoors shall be rigid threaded, hot dipped, galvanized, or U.L. approved plastic except where noted otherwise on the Drawings. Metallic conduit shall be of the same metal between outlets or terminals.
- B. Use flexible metallic conduit only for short connections of motors and where specifically called for on Drawings. Maximum length shall be 40". Use only liquid tight flexible metal conduit. Install an unbroken #12 AWG insulated copper grounding conductor in each liquid tight flexible conduit with permanent connection at motor junction box and service panel ground.
- C. Protect, before installation, metallic conduit runs in all slabs laid on grade or in contact with the earth or exposed in damp locations, with two (2) heavy coats of asphaltum rust-resisting compound.
- D. Encase conduits 2-1/2" or larger run underground, outside, or under buildings, in concrete envelopes a minimum of 3" thick, except as indicated otherwise on Drawings or stubouts. Conduits 2 and smaller laid 18" below finish surface in soil.
- E. Low voltage runs underground outside buildings, 1-1/4" or smaller, may be G.I. or sherardized steel conduit, with machine applied wrapping equal to double wrap or Scotch-Wrap #50 tape, half lapped and quadrupled at joints in lieu of concrete encasement.
- F. Service conduits through foundations or concrete members shall run through metal sleeves with adequate clearances for full movement of the conduit. Do not run conduits through footings.
- G. Secure conduits run exposed on surfaces with one-hole heavy-duty straps or fasten with matching fittings to inserts or trapezes, parallel to building walls and ceilings.
- H. Cap all conduit or duct stub-outs with standard factory caps; except cap threaded steel conduit with B.I. water pipe caps in outdoor locations.
- I. Use conduit fittings as manufactured by Crouse-Hinds Company, Appleton Electric Co., or approved equal.
- J. Employ U.L. liquid tight fittings for use with liquid tight flexible metal conduit.
- K. Use unions as manufactured by Appleton, O-Z/Gedney, or approved equal. The use of running threads will not be permitted.
- L. Exposed conduit in chemical rooms shall be rigid, non-metallic corrosion resistant NEMA 3R Type suitable for installation in corrosive atmospheres.

2.3 GROUNDING

- A. Bond together and ground to a common ground at a single point all metallic conduit, piping systems, pool reinforcing steel, metal parts of ladders, lifeguard stands, handrails and their supports and the like. The bonding conductor shall not be smaller than #8 copper.

2.4 WIRING CONNECTIONS

- A. Make connections without strain on conductors, allowing the conductors to take a natural position after connections or taps are made. Include all strand of wire in making the connection.
- B. Make connections for wiring by one of the following means:
 1. Make all taps or connections to conductors with compression type connectors except those smaller than #8 B&S gauge may have soldered connections. Solderless connections for #10 AWG or smaller may be used and shall be "Scotchlok", Buchanan, or approved equal. For #8 AWG or larger, they shall be T&B "LockTite", Burndy "Versitaps", or approved equal.
 2. All cable or conductor terminal lugs shall be Burndy "Quicklug", IlSCO, or approved equal. Two piece stamped lugs and solder lugs will not be approved.
 3. Paint taped splices in damp or outdoor locations with two (2) coats of insulating paint.
 4. Tag all branch circuit wires with circuit number at the panelboard and at each point of use with linen or plastic tags.

2.5 CONDUCTORS

- A. Copper RHW or THW. Do not make splices between boxes.

2.6 COLOR CODING

- A. Neutrals (identified conductors shall be white).
- B. Phase conductors shall be red for phase B; blue for phase C.
- C. Green shall be used for mechanical equipment and receptacle grounds only.

2.7 MOTOR WIRING

- A. Make final connections to motors with the required AWG (Minimum #12), Flamenol machine tool wire, 19 strand. Control wiring for equipment shall be Flamenol machine tool wire, 19 strand of required AWG. Provide junction boxes at each item of equipment to change from standard building wiring to machine tool wire.
- B. Phase motors as proper in direction of rotation.

2.8 PANELBOARDS

- A. Panelboards shall be flush or surface mounting as indicated with circuit breakers as shown on panel schedule, hinged lockable doors, index card holders and proper bussing.
- B. Where indicated on the drawings, panelboards shall be furnished with subfeed breakers and/or lugs, split bussing, contractors, time switches, relays, etc., as required.
- C. All panelboards shall be keyed alike.
- D. All panelboards shall be finished with one coat of zinc chromate and coat of primer sealer after a thorough cleaning where exposed to public view (e.g., corridors, covered passages, offices, etc.) and gray in switchboard, janitor's heater and storage rooms. Prime coated panelboard shall be painted to match surroundings after installation. Panelboards shall be fabricated of sheet steel of the following minimum gauges: Doors and trim #12; enclosure - code gauge steel.
- E. Furnish all panelboards and terminal cabinets with Yale 46515 flush locks and LL806 keys except where indicated otherwise herein. Fasten the trim to panel boards and terminal cabinet by means of concealed, bolted or screwed fasteners accessible only when the door is open.
- F. Panelboards 208/120 volt, three phase, 4 wire, S/N or 120/240 volt, single phase, 3 wire, S/N.

Panelboard types as manufactured by:

Westinghouse
General Electric
Square D

Type B10B
Type NLAB
Type NQOB

- G. Panelboards for 480/277 volt, three panes, 4 wire, S/N.

Panelboard types as manufactured by:

Westinghouse
General Electric
Square D
Sylvania
I.T.E.

Type Pow-R-Line 2
Type AE
Type NEHB
Type NH1B
Type Approved Equal

- H. Panelboard for bussing sizes thru 400 amp shall be 20" wide surface mounted type. Recess mounted type shall have a 20" wide (maximum) recess metal enclosure with trim plate cover extending 1" on all sides of enclosure. Depth shall be 5-3/4" nominal. Height of panel as required for devices.
- I. Provide 6" additional gutter space in all panels where double lugs are required, or where cable size exceeds bus size. Minimum bottom gutter space shall be 6" high. 12" additional gutter space may be required for aluminum feeders where used.
- J. Panelboards shown on the drawings with relays, time clocks or other control devices shall have a separate metal barriered compartment mounted above panel with separate hinged locking door to match panelboard. Provide mounting sub-base in cabinet for control devices and wiring terminal strips.
- K. Panelboard shall have a circuit index card holder removable type, with clear plastic cover. Index card shall have numbers imprinted to match circuit breaker numbers.

2.9 CIRCUIT BREAKERS

- A. Breakers shall have a minimum short circuit interrupting rating of 10,000A symmetrical for panelboard voltage thru 240 volt and 14000A for panelboards thru 600 volts or as specified on the drawings. In no case shall the interrupting rating be less than the bus withstand rating unless noted otherwise on the drawings.
- B. Circuit breakers as manufactured by the following companies only are acceptable:
 - 1. General Electric Company
 - 2. Square D Company
 - 3. Westinghouse Company
 - 4. I.T.E. Company
- C. Circuit breakers shall be arranged in the panels so that the breakers of the proper trip settings and numbers correspond to the numbering in the panel schedules on the drawings. Circuit numbers of breakers shall be black-on-white micarta tabs or other previously approved method. Circuit number tabs which can readily be changed from front of panel will not be accepted. Circuit number tabs shall not be attached to or be a part of the breaker.
- D. Where two or three pole breakers occur in the panels, they shall be common trip units. Single pole breakers with tie-bar between handles will not be accepted.
- E. All circuit breakers shall be padlockable in the "off" position. Locking facilities shall be riveted or mechanically attached to the circuit breaker (submit sample for approval). Other means of attachment shall not be accepted without prior written approval of Architect.
- F. Where branch circuit breakers supply the power to motors and signal systems, the breakers shall be furnished with lockout clips, mounted in the "on" position. The breakers shall be able to trip automatically with lockout clips in place.
- G. Panelboard circuit breakers shall be bolt-on type.

2.10 BUSSING

- A. Bussing shall be rectangular cross section copper, or full length silver or tin-plated aluminum.
- B. Bussing shall be braces to withstand symmetrical short circuit ratings as follows or as noted on drawings. In no case shall bus short circuit bracing be less than specified circuit breakers.
- C. Each panelboard shall be equipped with a ground bus secured to the interior of the enclosure. The bus shall have a separate lug for each ground conductor. No more than one conductor shall be installed per lug.

2.11 TERMINAL CABINETS

- A. Terminal cabinets shall be fabricated of code gauge sheet steel for flush mounting (except where noted a surface) of size indicated on the drawings, and complete with hinged lockable doors and the number of 2-way screw terminals required for termination of all conductors. Terminal cabinet locks to operated form same key used for panelboards. The trim to terminal cabinets shall be fastened by means of concealed bolted or screwed fasteners accessible behind door to terminal cabinets. Terminal cabinets shall have 5/8" plywood backing. Cabinets shall be finished with one coat of zinc chromate and one coat of primer sealer after a thorough cleaning where exposed to public view Prime coated cabinets shall be painted to match

surroundings after installation.

- B. Provide engraved nameplate on each cabinet indicating its designation and system (i.e., Swimming Pool - Panel 'SP').

2.12 MOTOR CONTROL INDIVIDUAL STARTERS

A. Manual Motor Starters:

1. Provide flush or surface mounting manual motor starters with number of poles and size of thermal overload heaters as required for the motor being controlled (equipped with overload heaters, one for each motor lead). Back boxes shall be supplied with all flush mounting starters whether they are toggle type requiring only a 4" square outlet box or the larger type requiring a special box and cover designed to accept the particular unit.
2. Unless otherwise noted on the drawings, all manual starters for single phase motors, smaller than 1 h.p., shall be the compact toggle type. Manual starters for all single-phase motors, 1 to 5 h.p., and all three phase motors up to 5 h.p. shall be the heavy duty type.
3. Where manual motor starter is shown with pilot light, the pilot light shall be installed in a separate outlet box adjacent to the starter outlet, and engraved nameplate in indicate function of pilot light.
4. The following motor starters as manufactured by:

Manufacturer	Single Phase 1HP and Below	Others
Arrow Hart	Type RL	Type LL
General Electric	CR 101	Class CR 1062
I.T.E.	Class C10, C11 or C12	Class C20
Square D Company	Class 2510, Type A	Class 2510, Type B & C
Westinghouse	Type MS	Type A100
Allen Bradley	Approved Equal	Approved Equal.

B. Individual Magnetic Motor Starters:

1. Magnetic motor starters shall be A.C. line voltage, across-the-line units in NEMA Type I enclosure, unless other types of enclosures are indicated.
2. All starters located outside of a building whether or not indicated shall be W.P. (weatherproof), and all starters noted W.P. shall be furnished in NEMA type 4 cast or stainless-steel enclosures.
3. Starter shall be horsepower rated for the motor controlled, and shall be equipped with properly sized overload elements. Every pole shall be with overload element.
4. Verify the exact motor current and voltage characteristics with the Contractor supplying the motor before installation of a starter.
5. Each starter shall be equipped with "Hand-Off-Auto" switch or stop-start pushbutton as required.
6. Coils shall be designed to operate on voltage indicated on control diagrams and have built-in under the voltage release for coil circuit to drop motor starter off the line when the line voltage drops below normal operating voltage.
7. The coil control circuit shall be independently fused, sized to protect coil.
8. Starters to be equipped with running pilot light indication with a "Push-to-Test" feature.
9. Magnetic starters shall have a minimum of two auxiliary contacts. Additional auxiliary contacts shall be provided as required to comply with the requirements of the wiring diagrams on the electrical and mechanical drawings and the description of the function in the Mechanical Section of the Specifications.
10. Minimum starter size shall be NEMA size I unless indicated otherwise.
11. The following types of magnetic motor starters as manufactured by:

Manufacturer	Type
General Electric	Class CR 106
I.T.E.	Class A20
Square D Company	Class 8536
Westinghouse	Type A200 (Size 4 Max.) or Class II-200 (Sizes 5-8)

2.13 INDIVIDUAL COMBINATION MOTOR STARTERS

- A. Combination starter shall incorporate fused disconnect switch and individual magnetic motor starter in a common enclosure. Combination starters shall be mounted in general purpose enclosures unless otherwise indicated on the plans. Starters shall comply with NEMA standards, size and horsepower as indicated on drawings General Electric, Square D, Westinghouse or I.T.E.
- B. The disconnect handle used on combination starters shall control the disconnect device with the door opened or closed. The disconnect handle shall be clearly marked as to whether the disconnect device is "ON" or "OFF", and shall include a two-color handle grip, the black side visible in the "OFF" position indicating a safe condition, and the red side visible in the "ON" position indicating an unsafe or danger condition.

- C. All starters used in combination starters shall be manufactured in accordance with the latest published NEMA standards, sizes, and horsepower ratings. These starters shall be furnished with three melting alloy type thermal overload relays.
- D. Thermal units shall be of one-piece construction and interchangeable. The starter shall be inoperative if a thermal unit is removed.

2.14 MOTOR CONTROL INTERLOCKS AND CONTROL DEVICES

- A. Refer to mechanical and plumbing drawings and specifications and provide all control devices including timeswitches, relays and interconnection of starters of required.
- B. Mount all relays and timeswitches in a separate compartment in motor control center unless otherwise indicated.
- C. Whether shown on mechanical and plumbing drawings or control center schedules or not, where motors are controlled by external devices (i.e., thermostats, relays, float or pressure switches, etc.) or interlocked with other motors, each motor starter to be equipped with a "Hand-Off-Auto" selector switch in starter cover. Other starters equipped with a "Start/Stop" pushbutton station in starter cover.

2.15 FUSES

- A. Fuses shall be dual element, current limiting type, U.L. Class RK5 unless otherwise indicated on the drawings. Provide one spare set of fuses of each size and type in each motor control center.

2.16 TIME CLOCKS

- A. Time clocks shall be provided for all underwater lighting systems and swimming pool circulation pumps not controlled by filter microprocessors.
- B. Contacts shall have a minimum rating of 40 amperes at 277V.
- C. Timing motor shall be heavy duty synchronous, self starting, high torque type, and shall be rated at 120, 208, 240, 277 volt 60 Hz.
- D. Motor shall operate normally at temperature range of -60 degrees Fahrenheit to +120 degrees Fahrenheit.
- E. Dial shall be 3" diameter, clearly calibrated with day/night zones and 24 hour rotation, with gear to provide one revolution yearly which automatically varies the on/off settings each day according to seasonal changes. Day and month of the year shall show clearly through calendar window on the dial.
- F. Time clocks shall be equipped with 7-spoke omitting wheel marked with days of the week.
- G. Time clocks shall be housed in a flush enclosure where supply circuits emanate from a flush mounted panelboard and surface enclosure when supply circuits are from a surface mounted panel.
- H. Acceptable manufacturers are Tork, Paragon, or approved equal.

2.17 GROUND FAULT CIRCUIT INTERRUPTERS

- A. Minimum rating shall be 20 amperes, 125V, 5 milliampere trip setting, Class A per UL943.
- B. Manufacturer to be Crouse-Hinds, Leviton, or approved equal.

2.18 BOXES

- A. Boxes shall be of the size required by ordinances or larger, and of pressed galvanized code gauge steel where concealed or exposed on ceilings. Exposed boxes on walls below 7'6" shall be cast steel similar to "FA" condulets.
- B. Outlets to be surface where wiring is exposed and flush in areas where conduit is concealed.
- C. Provide surface outlets with proper galvanized steel surface cover. Box and cover shall be deep enough to provide at least 1/4" clearance between back of device and back of box. Where box contains more than one device, use proper gang box with proper cover. Surface outlet boxes shall be of the threaded hub type wherever below 8'0".
- D. Provide exposed junction boxes with proper flat blank galvanized cover. If necessary, for cable installation, additional pull boxes or junction boxes may be installed in accessible locations.
- E. Where pull boxes larger than outlet boxes are required, galvanized code gauge sheet steel boxes may be used with covers

attached by brass machine screws. Boxes exposed to the weather shall be approved for the purpose, and conduit entrances shall be on the bottom made by means of an interchangeable hub with gasket and adapter nut. Pull boxes not shown on Drawings may be added only after approval of size and location is obtained.

- F. For outlets exposed to weather or where noted, cast outlet boxes shall be Crouse-Hinds, Appleton, or approved equal. Boxes shall have proper number and size hubs. Device plates, covers, adapters and boxes shall be as manufactured by Crouse-Hinds, Appleton, or approved equal.
- G. Exposed junction boxes, outlet boxes and pull boxes for pool chemical rooms shall be NEMA 3R type suitable for corrosive atmosphere, non-metallic.

2.19 IDENTIFICATION MARKINGS

- A. Plainly mark all motor and electrical appliance control equipment indicating the equipment controlled with engraved metal tags.
- B. Provide laminated plastic nameplates on panelboards on the outside of the door at the top indicating panel designation and feeder source.
- C. Provide laminated plastic nameplates on distribution switchboards and motor control centers at the top center indicating panel designation and feeder source.
- D. Identify each distribution switchboard and motor control center circuit breaker with a laminated plastic nameplate indicating its' use.
- E. Type panelboard directories on the forms provided with the equipment, indicating the use of each branch circuit breaker.
- F. Fasten all laminated plastic nameplates to surfaces with two (2) or more screws.

3. PART 3 EXECUTION

3.1 INSPECTION

- A. Verify conditions at the Project site before submitting bid. Be responsible for providing all necessary wiring for the new electrical systems. Wherever wiring is being disrupted due to remodeling or changes, reconnect existing and provide new wiring circuits to accomplish a fully operable system at no additional cost to the Owner.

3.2 COORDINATION

- A. The Drawings are essentially diagrammatic and indicate the desired location, size, routes, connection points, etc., and are to followed as closely as possible. Proper judgment must be exercised in executing the Work so as to provide the best possible installation in the available space and to overcome difficulties, limitations or interference wherever encountered. Be responsible for the correct placement of this Work, the proper location and connection in relation to Work of other trades, for determining the exact location of all conduits, outlets and equipment, and for installing the conduits in such a manner as to conform to the structure, avoid obstruction, preserve headroom and keep openings and passageways clear. Particular attention is directed to the close coordination required on exposed Work. Locations shown on Architectural or Mechanical Drawings if different than those shown on Electrical Drawings should be communicated to the Owner's Representative in writing for clarification.

3.3 INSTALLATION

- A. Trenching and Backfill: Conform with requirements of Section 13 11 01. Provide minimum cover as required by Code.
- B. Conduit Installation:
 - 1. Conduit and metallic raceway systems shall be mechanically and electrically continuous from sources of current to all outlets in a manner to provide a continuous grounding path. Close ends of conduit during construction to prevent entrance of dirt or moisture.
 - 2. Securely fasten conduit to the building construction within three feet of each outlet and within every ten feet thereafter. Secure it to boxes, cabinets, pull boxes, terminals with two locknuts and ends equipped with bushings or a terminal fitting. Cut square with ends carefully reamed.
 - 3. Make bends or elbows so that the conduit will not be injured or flattened.
 - 4. Use insulated metallic bushings in all places where bushings are required.
 - 5. Run exposed conduits level or plumb and parallel to the construction members of the building. No cutting across or diagonal runs will be permitted. Neatly surmount structural obstructions encountered on conduit runs by the use of fittings or pull boxes.
 - 6. Identify feeder conduits by stamped metal tags secured to exposed section of conduit in main or sub-panels.
 - 7. Make up all threaded conduit joints gas and watertight with conductive sealer except conduit above ground in dry

indoor locations.

8. Rigidly support all boxes independently of the conduit system.

C. Connections to Equipment:

1. Fully connect, in an approved manner, all electrical outlets, apparatus, motors, equipment, fixtures, wiring devices and appliances whether they are installed under the Electrical Contract or not, which require electrical connections, to the corresponding electrical system outlet.
2. Where the Work of this Section requires connections to be made to equipment that is furnished and set-in-place under other Sections, obtain such roughing-in dimensions from the manufacturer or supplier of each item as required and assume full responsibility for the installation of the connections thereto.

3.4 ADJUSTMENT AND CLEAN-UP

- A. Preliminary Operation: Should the Owner's Representative deem it necessary to operate the electrical installation or any part thereof prior to Substantial Completion of the Work, consent to such preliminary operation and supervise conduction of same. Subcontractor shall pay all costs occasioned by such operation. Preliminary operation shall not be construed as an acceptance of any Work installed under this Contract.
- B. Clean-up: Upon completion of the Work of this Section, immediately remove all swimming pool electrical materials, debris and rubbish occasioned by this Work to the approval of the Owner's Representative.

END OF SECTION

SECTION 13 34 16

PERMANENT GRANDSTANDS AND PRESS BOX-FOOTBALL AND AQUATICS

PART 1 - GENERAL

1.01 SYSTEM DESCRIPTION

- A. Provide labor, material, equipment and supervision necessary to complete installation of permanent steel grandstand, including the following:
 - 1. Steel Substructure
 - 2. Decking System
 - 3. Concrete Foundation
 - 4. Press Box Support Structure
 - 5. Press Box

1.02 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Manufacturers must have ten years of experience in the manufacture of bleachers and grandstands; manufacturer must exhibit proof of business existence for past five years with documentation; welders must be AWS certified.
- B. Installer Qualifications: Experienced in the proper installation of grandstands.
- C. Source Quality Control: Mill Test Certification.

1.03 SUBMITTALS

- A. Manufacturer's Product Data: Submit manufacturer's descriptive product data for project.
- B. Shop Drawings: Manufacturer to submit shop drawings sealed by a California registered engineer and shall be of sufficient clarity to indicate the location, nature and extent of the work proposed and show in detail that it will conform to the applicable code and relevant laws.
- C. Product Sample: Submit one 18-inch seat sample.
- D. Color Sample: If applicable, submit sample.

1.04 SITE CONDITIONS

- A. Field Site:
 - 1. Owner to make site accessible.
 - 2. Owner to verify site locations, benchmarks.
- B. Underground Utility Line: Owner to clearly mark all underground utilities and obstructions and Owner to relocate all that conflict with grandstand.
- C. Soil Test: Furnished by Owner.

1.05 BUILDING CODES

- A. Must meet or exceed all State and Local applicable codes and in compliance with the California Building Code, Title 24 and ICC 300.

1.06 WARRANTY

- A. Permanent Grandstand shall be under warranty for a period of one (1) year beginning at date of substantial completion for projects installed by manufacturer. The warranty will provide for repair or replacement of failed components due to defect in materials and workmanship of installation for the specified period. This warranty excludes any other defects resulting from abnormal use in service, vandalism, weathering, oxidation, accidental or intentional damage or any occurrences beyond manufacturer's control.

1.07 MAINTENANCE

- A. Owner is to conduct annual inspection and required maintenance of grandstand to assure safe conditions. It is also recommended that a professional engineer or registered architect perform inspections biennially.

PART 2 - PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

- A. Southern Bleacher Company (800) 433-0912. Horizontal Beam Grandstands.
 - 1. Alternate manufacturers seeking to be pre-approved must submit product literature and references (with contact names/numbers) to the Owner 14 days prior to bid date for five similar size DSA approved projects completed within the past two years.
 - 2. Southern Bleacher Company's DSA approved drawings are specifically for their usage. Each manufacturer must provide their own DSA approved drawings and structural calculations.
 - 2. No time extensions to the schedule will be granted awaiting DSA approval of
 - 3. Contractors submitting plans and calculations from alternate manufacturers are responsible for all costs incurred of re-obtaining DSA approval.

2.02 PERMANENT STEEL GRANDSTAND

- A. Product Description
 - 1. **Home:** Horizontal Beam Design
Gross seating capacity of 3,114, net seating capacity of 2,501 plus 27 wheel chair spaces, 18 rows, and 259' 6" long
Press Box Support Structure: 42' x 8'.
Press Box: 30' x 8' Sloped front pre-fabricated press box.

Visitors: Horizontal Beam Design
Gross seating capacity of 1,890, net seating capacity of 1,546 plus 17 wheel chair spaces, 18 rows, and 157' 6" long.

Aquatics: Non-elevated Leg-Truss Design
Gross seating capacity of 345, net seating capacity of 273 plus 6 wheel chair spaces, 5 rows, and 103' 6" long with integral fully cantilevered roof structure
 - 2. Vertical columns are placed 18 feet 0 inches on center laterally and as required on center front to back for football. 6 feet 0 inches on center laterally and as required on center front to back for aquatics.
 - 3. Wide-flange construction.
 - 4. Traverse bays are free of cross-bracing the total length of the grandstand.
 - 5. Stringers are wide flange with steel angle rise and depth fabrication and are placed 6 feet on center.

6. Front Walkway:
 - a. Width: 6' 5" on home side, 7' 7" on visitor side.
 - b. Elevated: 5' 0" on home, 4' 6" on visitors side, above grade at the benchmark.
7. Entry stairs to be firmly anchored to uniformly poured concrete bases.
 - a. Stair rise: 7 inches with aluminum closure and contrasting aluminum stair nose.
 - b. Stair tread depth: 11 inches.
 - c. Guardrails: As required by code.
 - d. Stairs to have handrail extension. The handgrip portion of handrails shall not be less than 1 1/2 inches or more than 2 inches in cross-sectional dimension or the shape shall provide an equivalent gripping surface. The handgrip portion of handrails shall have a smooth surface with no sharp corners. The top of handrails and handrail extensions shall be placed not less than 34 inches or more than 38 inches above the nosing of treads and landings. Where handrails are not continuous between flights, the handrails shall extend horizontally at least 12 inches beyond the top riser and continue to slope for the depth of one tread beyond the bottom riser. Ends shall be returned or shall terminate in newel posts or safety terminals.
8. Aisles:
 - a. Aisles with seating on both sides to have discontinuous mid-aisle handrails. The handrails shall be discontinuous with breaks at intervals not to exceed five rows. These breaks shall have a clear width of at least 22 inches and not greater than 36 inches horizontally.
 - b. Anodized aluminum handrails with rounded ends to be provided with an intermediate handrail below the main handrail.
 - c. Aluminum tread nosing of contrasting color on aisle steps.
 - d. Half-steps shall be provided for riser heights above 8 inches.
 - e. Half-steps shall provide equal rise and run throughout aisle. Each shall have aisle nosing with non-skid black powder coated finish or other paint system meeting AAMA 603.8-92 specifications with a hardness rating of 2H and riser closure with clear anodized finish.
 - f. Aisles with a riser height of non-uniformity shall be indicated with distinctive markings as required by code.
9. Decking:
 - a. Rise and Tread Depth:
 1. Home- 8 and 14 inches with tread depths of 26"
 2. Visitors- 8 and 11 inches with tread depths of 26"
 3. Aquatics- 12 inches with tread depths of 26"
 - b. Each seat 17 inches above its respective tread.
 - c. Mill Aluminum Decking Arrangement
 - (1) Tongue & Groove Deck System for Football Grandstands
 - (2) Interlocking Deck System for Aquatics Grandstand
 - d. Seating Selection
 - (1) Anodized Aluminum Bench Seat
 - (a) 2 x 10 (standard), Die #7758 with height of 1 1/2".
10. Guard railing: To be at all sides of bleacher, entry stairs and ramps, portals, and landings. Railing to be anodized aluminum with end plugs at ends of straight runs and/or elbows at corner. All guardrails shall be secured to angle rail risers by galvanized fasteners. Railing shall be at heights as required by code for its location on the grandstand. Guard railing shall include intermediate railing, or galvanized chain link fencing fastened in place with galvanized fasteners and aluminum ties.

11. Ramps:
 - a. Slope: 1 in 12.5.
 - b. Guardrails: As required by code plus toe board.
 - c. Handrail: Ramps to have handrail extension. The handgrip portion of handrails shall not be less than 1 1/2 inches or more than 2 inches in cross-sectional dimension or the shape shall provide an equivalent gripping surface. The handgrip portion of handrails shall have a smooth surface with no sharp corners. The top of handrails and handrail extensions shall be placed not less than 34 inches or more than 38 inches above the ramp surface. Where handrails are not continuous between runs, the handrail shall extend horizontally above the landing 12 inches minimum beyond the top and bottom ramps. Ends shall be returned or shall terminate in newel posts or safety terminals.
12. Handicap provision:
 - a. Quantity of wheelchair spaces: Per above and drawings
 - b. Riser area adjacent to wheelchair spaces to have closed intermediate construction.
13. Front Facades:
 - a. Flat Dur-kyn finish riser board façade on front of home and visitor grandstand.
14. Integral Roof System:
 - a. Rear grandstand columns to be spaced approximately 6' o.c. and roof columns extend up every 12' o.c. to support of roof beams.
 - b. Fully cantilevered roof beam system to be provided.
 - c. All roof beams supported at rear by back row columns.
 - d. Galvalume Zee purlins installed at spacing required for support of design loading at this location. All zeos to be hot dipped galvanized finish.
 - e. 26 gauge R panel as manufactured by MBCI provided for roof. Colors to be selected from Signature 200 colors or Galvalume finish.
 - f. Standard trim around roof perimeter to be finished in MBCI Signature 200 standard colors.
 - h. No gutters or downspouts from roof are to be provided. Roof slope shall be 1:12, with loading per local building code requirements
 - i. Roof safety anchors are not included, but can be added at the Owner's request at an additional cost.

B. Materials/Finishes

1. Substructures: Structural shapes meet one of the following ASTM specifications: A36, A36/A572 grade 50, A572 grade 50, A529-50, or A500 grade B.
 - b. Shop connections are seal welds.
 - c. After fabrication, all steel is hot-dipped galvanized to ASTM-A-123 specifications.
 - d. Painted steel finish is unacceptable.
2. Extruded Aluminum:
 - a. Seat Planks, Backrests, Stanchions, Riser Planks, and Railing are extruded aluminum alloy, 6063-T6.
 - (1) Clear anodized 204R1, AA-M10C22A31, Class II finish for seat plank
 - (2) Factory applied, baked-on Kynar or Hylar/acrylic resin based paint coating, Dur-Kyn, as manufactured by the Valspar Corporation for all riser boards and aisle half-steps. Dur-Kyn meets or exceeds the physical and performance properties of AAMA 2603. (Specify color).
 - b. Tread planks are extruded aluminum alloy 6063-T6 mill finish.
 - c. Railing: Extruded aluminum alloy, 6063-T6 clear anodized 204R1, AA-M10C22A31, Class II.

3. Accessories:
 - a. Channel End Caps: Aluminum alloy 6063-T6, clear anodized 204R1, AA-M10C22A31, Class II.
 - b. Hardware:
 - (1) Bolts, Nuts: Hot-dipped galvanized or mechanically galvanized.
 - (2) Hold-down Clip Assembly: Aluminum alloy 6005A-T6, mill finish.
 - (3) Structural Hardware: Equal to or greater than hot-dipped galvanized ASTM-A307. No connections utilizing high strength bolts are classed as slip critical.
 - d. Aisle Nose and Stair Nose: Aluminum alloy, 6063-T6, non-skid black powder coated finish or other paint system meeting AAMA 603.8-92 specifications with a hardness rating of 2H.
- C. Fabrication:
 1. Design Load:
 - a. Tread and Seat Area: 100 psf uniform live load.
 - b. Seat (Vertical): 120 lbs/lf.
 - c. Seat (Horizontal Sway): 24 lbs/lf parallel and 10 lbs/lf perpendicular to seat.
 - d. Handrail and Guardrail: 50 lbs/lf in any direction.
 - e. Handrail and Guardrail: 200 lbs concentrated in any direction.
 - f. Snow Loads: As per State adopted code.
 - g. Wind Loads: As per State adopted code.
 - h. Seismic Loads: As per State adopted code.
 2. All manufactured connections to be shop welded.
 - a. Manufactured by certified welders conforming to AWS Standards.

2.03 PRESS BOX WITH METAL STRUCTURE

- A. Product Description: Type II Construction
 1. Press Box Support Structure: Support Structure to be 42 feet wide x 8' feet deep
 2. Press Box Dimensions: 30 feet wide x 8 feet long, sloped front design
 3. Filming Area/Observation Deck located on Press Box roof.
 4. Press Box to be of open construction, allowing inspection of electrical wiring, switches, and other components without destructive disassembly.
- B. Materials/Finishes
 1. Press Box Support Structure:
 - a. Structural shapes meet one of the following ASTM specifications: A36, A36/A572 grade 50, A572 grade 50, A529-50, or A500 grade B.
 - b. Shop connections are seal welds.
 - c. After fabrication, all steel is hot-dipped galvanized to ASTM-A-123 specifications.
 2. Press Box: All materials shall be new and shall comply with ASTM specifications.
 - a. Floor
 - (1) Main support to be a galvanized steel floor frame sized to support structure and metal belly pan for support of insulation.
 - (2) Floor to be INTERLOCK Aluminum Decking System, extruded aluminum alloy 6063-T6, mill finish. Attach Decking System to steel floor frame with mechanical fasteners at end of plank and at intermediate supports. (Tongue & Groove or Standard extrusion is not acceptable.)
 - (3) Insulation: Poly-encapsulated Formaldehyde-free fiberglass building insulation R-13, 3 1/2 inches thick. Batt or roll as manufactured by Johns Manville, or equal.

- b. Wall Structure
 - (1) 4 inch x 4 inch x 11 gauge square tubing with maximum span of 14 feet on front wall and 6 feet on back wall. 4 inch x 2 1/2 inch x 14 gauge steel "cees" with maximum spacing of 5 feet for all walls with siding. Spans greater than those called out require engineered calculations for design.
Steel framing shapes to meet one of the following ASTM's, A500 Grade A or B 45 ksi, A36 50ksi, A1011 CS Type B.
 - (2) Insulation: Poly-encapsulated Formaldehyde-free fiberglass building insulation R-13, 3 1/2 inches thick. Batt or roll as manufactured by Johns Manville or equal.
 - (3) Interior Finish
 - (a) 1/2 or 5/8 inch vinyl coated gypsum panels (as required), Gold Bond vinyl-surfaced Durasan.
 - (b) Cove Base: Vinyl 4 inches x .080.
 - (4) Exterior Finish
 - (a) 26 gauge prefinished R-Panel paneling as manufactured by MBCI, Signature 200 color series, or equal.
 - (b) Wall panels are attached with #12 TEK screws - 6" O.C. at the top, midpoint and bottom of the panels.
 - (c) Lap screws are placed at each end of the panels, at the intermediate supports, and at the mid point between supports (TEK #14).
 - (d) All fasteners to be painted same color as exterior paneling.
- c. Roof Structure
 - (1) 4 inch x 4 inch x 11 gauge square tubing with maximum spacing of 6 feet on center and 4 inches x 2 1/2 inches x 14 gauge steel "cees" with maximum spacing of 2 feet on center.
 - (2) Roof: 1/8 inch four way steel plate roof, continuous welded seams coated with acrylic metal primer as manufactured by Coronado and 36 mils of acrylink roof coating as manufactured by Isothermal Protective Coatings, or equal. Plate is welded on both sides of rafters with 1-1/2 inch long 1/8 inch fillet welds on 12 inch centers.
 - (3) Insulation: Poly-encapsulated Formaldehyde-free fiberglass building insulation, R-19 (minimum) 6 inches thick. Batt or roll as manufactured by Johns Manville or equal.
 - (4) Cornice: 26 gauge steel prefinished to match metal siding.
 - (5) Ceiling: 24 inch x 24 inch x 5/8 inch acoustical lay in ceiling tile with removable tiles, per 2006 IBC or local code, applicable category per seismic zone, (in California per 2007 CBC, applicable category per seismic zone, ref. DSA IR 25-5).
- d. Exterior Doors
 - (1) Full flush steel construction with hollow or polystyrene core. 18 gauge skin sheets. Dimensions: 3 feet 0 inches x 6 feet 8 inches. Color: Coordinated with press box siding color.
 - (2) Steel door frame (16 gauge) complete with 1/2 inch threshold and weather-stripping.
 - (3) Exterior Hardware: Yale 546F Exterior Trim, or equal. Handles shall be lever type that allows operation without tight grasping or twisting of the wrist. Keyed alike locks.
 - (4) Interior Hardware: Yale 2100 Exit Device, or equal. Handle shall be panic bar that allows for opening without any grasping, twisting or turning.
- e. Interior Doors
 - (1) Interior Hollow Core Birch Unit. Dimensions: 3 feet 0 inches x 6 feet 8 inches.
 - (2) Hardware: Handles shall be lever type that allows operation without tight grasping or twisting of the wrist.

- f. Interior Walls
 - (1) Framing to be steel galvanized studs (25 gauge) 1 1/4 inch x 3 5/8 inch or 4 inch at maximum 2 feet on center.
 - (2) Finishes are to be consistent with all other interior finishes.
- g. Windows
 - (1) Frame: Extruded aluminum single hung, vertical sliding unit, thermal break.
 - (2) Sash: Tilt toward inside for easy cleaning.
 - (3) Glazing: Clear tempered panes.
 - (4) Dimensions of each unit: Dependent on compartment size. At interior wall locations or structural support locations the dimension between windows shall be no greater than 6 inches.
 - (5) Finish: Electrostatically applied acrylic enamel.
- h. Work Bench
 - (1) 1 inch thick x 19 inch (minimum) wide clear anodized aluminum work bench supported by 4 inch x 2 1/2 inch x 14 gauge steel. Countertops heights shall be constructed to allow wheelchair usage at all locations.
- i. Caulking: Sonneborn NP1 – Polyurethane sealant, all temperature, UV resistant, or equal. Silicone products are not acceptable.
- j. Electrical
 - (1) Submittal drawing shall indicate devices and circuitry.
 - (2) LED\Fixtures: Indy, low profile, lay-in fixtures shall be located above countertop and be maximized to full length of compartment space.
 - (3) Wiring to be in EMT, flexible metal conduit or surface raceway. N.E.C. breaker panel to be 100 amp flush or surface mounted on wall with 1 1/4 inch conduit stubbed out bottom of press box or 2 inch rigid conduit to be stubbed out at back wall of press box ready for service line to be connected. (Service line to Press Box is responsibility of Owner).
 - (4) Electrical outlet(s) installed per NEC shall be standard duty. All outlets shall be surface or flush mounted.
 - (5) Sound, Telephone, Clock, and Field Communication: Empty single or double outlet boxes (as required) per N.E.C. with 3/4 inch conduit stubbed out bottom of Press Box for use of Owner. Outlet boxes to be flush mounted into wall. Any wiring completed on-site will be responsibility of such contractor for inspections. A quantity of two will be provided. Owner shall indicate additional boxes needed.
 - (6) Filming Area/Observation Deck: Weathertight outlet box for cameras. Quantity: One. Owner shall indicate additional outlets needed.
- k. Filming Area/Observation Deck
 - (1) Access
 - (a) Interior: Roof hatch with OSHA-rated aluminum ladder mounted to an interior back wall.
 - (2) Roof guard railing to be 42" above walking surface around perimeter of deck attached to 5/8 inch galvanized studs to be welded to roof support structure. The guard railing to include anodized aluminum with 9 gauge galvanized chain link fencing fastened in place with galvanized fasteners and aluminum ties.

2.04 WARRANTY

- A. The Press Box shall be under warranty for a period of one year beginning at date of substantial completion for projects installed by manufacturer. The press box is warranted to be free from defect in materials and workmanship in the course of manufacture. This warranty excludes any other defects resulting from abnormal use in service, accidental or intentional damage or any occurrences beyond manufacturer's control.

PART 3 - EXECUTION

3.01 INSTALLATION

- A. All work performed by technicians experienced in bleacher seating installation.
- B. Project as per approved shop drawings.

3.02 FIELD QUALITY CONTROL

- A. Foundation: Footings for the grandstand shall provide sufficient bearing area at bottom to support all loads of the grandstand. Depth and design of footings shall be determined by Owner supplied soil test. Hot-dipped galvanized anchor bolts shall be secured in the concrete footings. Concrete shall attain working strength of 3,000 psi.

3.03 CLEAN-UP

- A. Clean up all debris caused by work of this section.
- B. The Owner, Architect and Contractor acknowledge and accept that mill finish aluminum as specified will have water stains present from transportation and storage during installation. Removal of these stains is not part of this contract.
- C. Stand to be broom cleaned at completion.

END OF SECTION

SECTION 14 21 23

ELECTRIC TRACTION ELEVATORS - PASSENGER

1. PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Two types of gearless, machine room-less operating elevator systems, traction.
- B. Simplex collective automatic operation.
- C. Motor, controllers, hoistway accessories, equipment and fittings.
- D. Passenger cab, doors, threshold, and accessories.

1.2 REFERENCES

- A. 2010 Americans with Disabilities Act (ADA) Standards for Accessible Design.
- B. CBC - California Building Code, (CCR) California Code of Regulations, Title 24, Part 2.
- C. California Elevator Safety Code, California Code of Regulations (CCR), Title 8.
- D. APA - American Plywood Association.
- E. ASME A17.1 - Safety Code for Elevators and Escalators.
- F. ASTM A36 - Structural Steel.
- G. ASTM A139 - Electric-Fusion (Arc)-Welded Steel Pipe (Sizes 4 inches and Over).
- H. ASTM A167 - Stainless and Heat-Resisting Chromium-Nickel Steel Plate, Sheet, and Strip.
- I. ASTM A500 - Cold -Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes.
- J. ASTM A1008 - Standard Specification for Steel, Sheet, Cold-Rolled, Carbon, Structural, High Strength, Low-Alloy and High -Strength, Low-Alloy with Improved Formability.
- K. ASTM B221 - Aluminum and Aluminum-Alloy Extruded Bar, Rod, Wire, Shape, and Tube.
- L. AWS D1.1 - Structural Welding Code, Steel.
- M. FS TT-P-641 - Primer Coating, Zinc Dust/Zinc Oxide (for Galvanized Surfaces).
- N. FS TT-P-645 - Primer, Paint, Zinc Chromate, Alkyd Type.
- O. IEEE C2 - National Electrical Safety Code.
- P. NEMA LD-3 - High Pressure Decorative Laminates.
- Q. NFPA 80 - Fire Doors and Windows.
- R. UL 10B - Fire Tests of Door Assemblies.

1.3 SYSTEM DESCRIPTION

A. This Section includes two elevator systems; gearless electric traction type.

B. Characteristics of elevator Type 1 (Building B) as follows:

1. Rated Net Capacity : 3,500 lbs
2. Rated Speed : 200 ft/min
3. Travel Distance (nominal) : 24 ft
4. No. of Stops : 4
5. No. of Openings : 3 front 1 rear
6. Nominal Hoistway Size : 8 feet 9 inches x 7 feet 6 inches
7. Hoistway and Cab Entrance Frame Opening Sizes : 3 feet 6 inches x 7 feet 0 inches
8. Cab Size (Clear, Minimum) : 6 feet 8 inches x 5 feet 7 inches
9. Cab Height : 8 feet 0 inches
10. Door Type : Single leaf
11. Door Operation : Side opening; single speed
12. Control Space Location : Remote Closet

C. Characteristics of each elevator Type 2 as follows:

1. Rated Net Capacity : 3,500 lbs
2. Rated Speed : 200 ft/min
3. Travel Distance (nominal) : 15 ft
4. No. of Stops : 2
5. No. of Openings : 2 front
6. Nominal Hoistway Size : 8 feet 9 inches x 7 feet 1 inches
7. Hoistway and Cab Entrance Frame Opening Sizes : 3 feet 6 inches x 7 feet 0 inches
8. Cab Size (Clear, Minimum) : 6 feet 8 inches x 5 feet 7 inches
9. Cab Height : 8 feet 0 inches
10. Door Type : Single leaf
11. Door Operation : Side opening; single speed
12. Control Space Location : Remote Closet

D. Program doors to open automatically when car arrives at floor.

E. Include door protective devices consisting of movable, retractable safety edges, noiseless in operation and two photo-electric light rays which operate within invisible infrared light range.

F. Photo-electric lights to be at a height of 5 inches and 29 inches above floor line.

G. Program door operating sequence to minimize car and hall door open and close times. Provide independently adjustable door open times.

H. The minimum acceptable time from notification that a car is answering a call (lantern and audible signal) until the door of the car starts to close shall be calculated according to CBC Section 11B-407.3.4.

I. The minimum acceptable time for elevator doors to remain open shall be not less than 5 seconds.

- J. Door-reopening device shall remain effective for no less than 20 seconds.
- K. Program controls to minimize delays and the return of car to service, should doors be prevented from closing for a predetermined time.
- L. If doors are prevented from closing for approximately ten seconds because of an activated obstruction safety device, automatically disconnect door control device, allow doors to close more slowly, and recycle until obstruction is cleared. Sound alarm.
- M. Render "Door Close" signal inoperative when car is standing at dispatching terminal with doors open unless that elevator is operating on independent service.
- N. Special Operational Features:
 - 1. Independent operation; with key operated fire fighter's operation.
 - 2. Interconnect with fire alarm system.
 - 3. Seismic Design: In accordance with CBC, California Building Code, (CCR), Title 24, Part 2.
 - 4. Emergency Signal System:
 - (a) Mount an electrical alarm bell, not less than 6 inches in diameter, operable from inside the car, in a weatherproof enclosure on the outside of the building near the main entrance.
 - (b) Mount graphic sign adjacent to bell with 2 inch high letters stating "Elevator Emergency, Call Police."
 - (c) Provide emergency power source connection for alarm signal device capable of providing for operation of the bell for one hour.
 - (d) Provide a sign, having lettering not less than 3/16 inch high, in passenger elevators adjacent to the car emergency alarm giving instructions as to the use of the device for summoning assistance.
 - 5. Loaded-Car Bypass: When car load exceeds 80 percent of rated capacity, car to respond only to car calls, not hall calls.
 - 6. Elevator Pit Stop Switch: Locate an electrical lockout switch at entry to elevator pit which is interconnected to main disconnect.
 - 7. Top-of-Car Guardrail: Manufacturer's standard tubular steel guard rail at top of elevator cab. Size as required for proper clearance and headroom clearance required.
 - 8. Hoistway Tube Steel Life Line Support: 4 x 4 x 3/8 inch thick x length required HSS capable of supporting a vertical force of 5,000 pounds.

1.4 SIMPLEX AUTOMATIC OPERATION

- A. Start car upon momentary pressure of one or more car landing buttons, other than those for landing at which car is standing. Cause car to stop at first landing for which car or landing button is pressed, corresponding to direction in which car is traveling.
- B. Stop car at landings for which calls are registered. Make stops in order in which landings are reached, regardless of sequence in which buttons are pressed, provided button for given landing is pressed sufficiently in advance of arrival of car at that landing to permit stop to be made.
- C. If no car buttons are pressed and car starts up in response to several down calls, proceed first to highest down call and reverse to collect other down calls. Collect up calls similarly when car starts down in response to such calls.

- D. If car stops for landing call and car button is pressed within predetermined interval after stop for landing corresponding to direction car was travelling, proceed in same direction regardless of other landing calls registered.
- E. If DOWN landing buttons are pressed while car is travelling up, do not stop car at these landings, but allow calls to remain registered.
- F. After highest car and landing calls have been answered, reverse car automatically and respond to down car and landing calls.
- G. When travelling down, do not permit car to respond to up landing calls, but allow these calls to remain registered to be answered on next up trip.
- H. At each stop in response to either car or corridor call, hold car at landing for adjustable time interval to permit passengers to enter or exit. Cancel interval upon registration of car call or pressure on DOOR CLOSE button.

1.5 FIREFIGHTER'S OPERATION

- A. Provide automatic firefighter's operation in accordance with ASME A17.1 initiated by building fire alarm.
- B. Locate keyed switch, with pilot light, illuminated when this operation is in effect, marked ON-OFF AUTOMATIC/RESET with key removable in AUTOMATIC position only, marked FIREFIGHTER'S OPERATION - ELEVATORS, at street level of building in designated location.
- C. Do not permit sensing devices to restore normal service.
- D. Furnish two position keyed switch with key removable in OFF position only, marked FIREFIGHTER'S OPERATION in each car, located in or adjacent to operating panel marked ON and OFF/CANCEL calls.

1.6 SYSTEM POWER REQUIREMENTS

- A. Elevator Motor and Pump Unit Power: Refer to Division 26.
- B. Provide protection for elevator equipment in the event of a loss of electrical power.
- C. Protect elevator equipment against damage or malfunction due to change, to or from, normal power supply and emergency power supply.
- D. Installation of electrical wiring and equipment for elevator shall comply with provisions of the California Electrical Code, Title 24, Part 3, Article 620.
- E. Lighting Power: Refer to Division 26.

1.7 QUALITY ASSURANCE

- A. Quality Assurance: Under the provisions of Section 01 43 00.
- B. Manufacturer: Company specializing in manufacturing elevator equipment with ten years minimum documented experience.
- C. Installer: Employees and supervisor on payroll of elevator equipment manufacturer.
- D. Conform to ASME A17.1 and IEEE C2 and as supplemented in this Section.
- E. Door and Frame Assemblies: NFPA 80 and UL 10B.
- F. Perform welding in accordance with AWS D1.1.

1.8 REGULATORY REQUIREMENTS

- A. Conform to CBC, California Building Code, (CCR), Title 24, Part 2, and the 2010 ADA Standards for Accessible Design for accessibility requirements.
- B. Conform to CBC, California Building Code, (CCR) Title 8, and Title 24, Part 2 for manufacture and installation of elevator system.
- C. Do not install elevator until detailed plans, specifications, and engineering calculations have been accepted and signed by the Architect or Structural Engineer in general charge of design and signed by a California registered Architect or Professional Engineer who has been delegated responsibility covering the work shown on a particular plan or specification, and approved by the Division of the State Architect.

1.9 TESTS

- A. Provide inspection and testing of each elevator system under provisions of Section 01 45 29.
- B. Obtain required permits to perform tests.
- C. Perform tests required by regulatory agencies.
- D. Perform load testing in compliance with California Code of Regulations (CCR) Title 8, Section 3071.
- E. Schedule tests with authority having jurisdiction and require Architect and/or Engineer, Owner, and Contractor presence.

1.10 SUBMITTALS

- A. Submit shop drawings and product data under provisions of Section 01 33 00.
- B. Indicate the following minimum information on shop drawings:
 - 1. Motor controller, motor generator, selector, governor, and other component locations.
 - 2. Car, guide rails, buffers, and other components in hoistway.
 - 3. Rail bracket spacing and maximum loads on guide rails.
 - 4. Reactions at points of support.
 - 5. Weights of principal components.
 - 6. Location of circuit breaker, switchboard panel or disconnect switch, light switch, and feeder extension points.
 - 7. Locations in hoistway of travelling cables and connections for car light and telephone.
 - 8. Location and size of trap doors and access doors.
 - 9. Expected heat dissipation of elevator equipment.
 - 10. Seismic design data certified by a California Registered Professional Engineer.
 - 11. Elevator control functions and operational description.
 - 12. Hoist beam requirements.
- C. Provide product data on the following items:
 - 1. Signal and operating fixtures, operating panels, indicators.

2. Cab design and components.
 3. Door and frame details.
 4. Electronic equipment to control and monitor elevator control functions.
- D. Submit samples under provisions of Section 01 33 00.
 - E. Submit two samples 12 x 12 inch in size illustrating floor material, cab interior, cab ceiling, cab door, hoistway entrance door and frame finishes.

1.11 OPERATION AND MAINTENANCE DATA

- A. Submit operation and maintenance data under provisions of Section 01 77 00.
- B. Include description of elevator system's method of operation and control including motor unit, door operation, signals, firefighter's service, and special or non-standard features provided.
- C. Provide parts catalogs with complete list of equipment replacement parts with equipment description and identifying numbers.
- D. Provide legible schematic wiring diagrams covering electrical equipment installed, including changes made in final work, with symbols listed corresponding to identity or markings on both machine room and hoistway apparatus.
- E. Provide one copy of master electric schematic, behind plastic or glass glazing, in metal frame, mounted on wall of control closet.
- F. Provide one copy of lubrication chart, behind plastic or glass glazing, in metal frame, mounted on wall of control closet.

1.12 PREINSTALLATION CONFERENCE

- A. Convene a preinstallation conference two weeks prior to commencing work of this Section, under provisions of Section 01 31 00.
- B. Require attendance of persons directly involved with the work of this Section.
- C. Review schedule of installation, installation procedures and conditions, and coordination with related work.

1.13 WARRANTY

- A. Provide one year manufacturer's warranty under provisions of Section 01 77 00.
- B. Warranty: Include coverage of elevator system controller, operating equipment and devices.

1.14 MAINTENANCE SERVICE

- A. Furnish complete service and maintenance of elevator system and components for a period of twelve months after final completion.
- B. Examine periodically; clean, adjust, and lubricate all equipment.
- C. Repair or replace parts whenever required. Use parts produced by the manufacturer of the original equipment.
- D. Perform work without removing car from service during peak traffic periods.
- E. Provide 24 hour emergency call back service during the maintenance period.
- F. Maintenance service shall be performed during regular working hours of regular working days.

- G. Maintain locally, near the place of the work, an adequate stock of parts for replacement or emergency purposes, and have qualified installation personnel available to ensure the fulfillment of this maintenance service without unreasonable loss of time.
- H. Perform maintenance work using competent personnel, under the supervision of the elevator manufacturer.
- I. Maintenance service shall not be assigned or transferred to any agent or subcontractor without prior written consent of the Owner.
- J. Inspect operation of elevator with Owner's personnel present not more than one month prior to end of warranty and service period to determine that elevator and devices are functioning properly.

2. PART 2 PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

- A. Basis of Design: Kone, Inc., MonoSpace 500, www.us.kone.com.
- B. Other Acceptable Manufacturers:
 - 1. Otis Elevator Co., Gen 2, www.otis.com.
 - 2. Mitsubishi Electric, Inc., Diamond Trac, www.mitsubishielectric.com.
 - 3. Schindler Elevator Corp., 400A, www.us.schindler.com.
- C. Substitutions: Under provisions of Section 01 25 13.

2.2 MATERIALS

- A. Rolled Steel Sections, Shapes, Rods: ASTM A36.
- B. Structural Tubing: ASTM A500, Grade B.
- C. Sheet Steel: ASTM A1008; CS Type B; with matte finish.
- D. Stainless Steel: ASTM A167; Type 304; No. 4 finish.
- E. Aluminum: ASTM B221, extruded 6063 alloy with T6 temper; anodized finish.
- F. Plywood: APA rated sheathing, span rating 32/16, Exposure 1, sanded.
- G. Plastic Laminate: NEMA LD-3; high pressure type, 0105 inch thick; color/pattern selected by Architect.
- H. Primer for Galvanized Surfaces: FS TT-P-641.
- I. Primer for Plain Steel Surfaces: FS TT-P-645.
- J. Primer for Wood Surfaces: Alkyd primer sealer.
- K. Finish Paint (for Metal Surfaces): Two coats of factory applied enamel, semi- gloss, color to be selected.
- L. Finish Paint (for Wood Surfaces): Enamel, semi-gloss, color to be selected
- M. Finish (transparent) Stain (for wood surfaces): Semi-Gloss Lacquer.

2.3 EQUIPMENT

- A. Elevator: Equivalent to Kone, Inc. Model No. MonoSpace 500 with KCM831 equipment control.

- B. Machine: AC, gearless, with permanent magnet synchronous motor. Direct current electro-mechanical disc brake. Integral traction drive sheave. Mounted to car guide rail at top of hoistway.
- C. Drive: Variable voltage and frequency drive system that develops high starting torque with low starting current.
- D. Governor: Friction type over-speed governor rated for model of elevator specified.
- E. Positioning System: Consisting of magnets and proximity switches.
- F. Controller, Controls, Buttons, Wiring and Devices, Indicators: UL approved.
- G. Spring Buffers, Attachment Brackets and Anchors: Purpose designed, sized according to code with safety factors.

2.4 ELECTRICAL COMPONENTS

- A. Fittings: Steel compression type for electrical metallic tubing. Fittings with set screws are not acceptable.
- B. Spare Conductors: Include 10 percent extra conductors and two pairs of shielded audio cables in traveling cables.
- C. Do not use armored flexible metal conduit as grounding conductor.
- D. Include wiring and connections to elevator devices remote from hoistway and between elevator machine rooms.

2.5 LUBRICATION

- A. Grease Fittings: For lubricating bearings requiring periodic lubrication.
- B. Grease Cups: Automatic feed compression type.
- C. Lubrication Points: Visible and easily accessible.

2.6 CAR FABRICATION

- A. Frame: Rigid rolled steel sections, braced; mounted on resilient isolators.
- B. Enclosure: Sheet steel panels attached to steel frame; sheet plywood inner liner.
- C. Guides: Provide and mount to top and bottom of both car and counterweight system. Roller guide assembly to maintain constant contact on rail surface. Provide retainers on guides.
- D. Canopy: Reinforced 0.0538 inch thick milled steel, white baked enamel finish.
- E. Platform: Heavy loading type rated to accommodate point loads of 25 percent of total rated loading capacity.

2.7 CAB FABRICATION

- A. Cab: 0.058 milled steel.
- B. Floor: Two layers of 3/4 inch plywood, fire retardant treated surfaces and edges. Attach with flush mechanical fasteners.
- C. Finish Flooring: Vinyl composition tile as specified under Section 09 65 00.
- D. Finish Walls: Fixed decorative plastic laminate to manufacturer's standard details.
- E. Base: Resilient rubber as specified under Section 09 65 00.

- F. Finish Ceiling: White diffuser panels suspended in painted steel frame with fluorescent tube lights above.
- G. Control Panel and Face Plate: Brushed stainless steel with illuminating call buttons.
- H. Indicator Panel: Above control panel with illuminating position indicators.
- I. Handrail: 1-1/2 inch diameter x 1/4 inch thick handrail on 3 sides of cab with ends returned to wall. Mount 1-1/2 inch from wall at height of 32 inches above floor line to top of rail.
- J. Pad Hooks: Stainless steel type.
- K. Wall Mats: One set canvas covered, padded with sponge fill material, sewn with piping edges; brass grommets spaced to match pad hook spacing, covering side and rear walls.
- L. License Frame and Glass: Attached with tamper proof screws.
- M. Cab Doors: Baked enamel on steel; 0.0598 inch thick of insulated sandwich panel construction, flush design, rolled profiles, rigid construction.
- N. Cab Door Frames: Baked enamel on steel; 0.0598 inch thick, of rolled profiles, welded corner design, smooth invisible joints.
- O. Thresholds: Extruded aluminum type.
- P. Ventilation: Fan.

2.8 HOISTWAY ENTRANCES

- A. Hoistway Doors: Baked enamel on steel; 0.0598 inch thick, of insulated sandwich panel construction, flush design, rolled profiles, rigid construction.
- B. Hoistway Door Frames: Baked enamel on steel; 0.0598 inch thick, of rolled profiles, welded corner design, smooth invisible joints.
- C. Door and Frame Construction: UL rated, with applicable 1-1/2 hour fire rating; insulated sandwich panel construction, 1-1/4 inch thick.
- D. Door Jamb Markings: At each landing provide the following:
 - 1. At each floor landing provide 2 inch high Arabic numerals indicating floor level. Numerals shall be raised a minimum of 1/8 inch plus or minus 1/32 inch above surrounding surface. Numerals to be of a 70 percent contrasting color to surrounding jamb surface.
 - 2. Identification of floor level shall be by raised numerals and by California Contracted Grade 2 Round Top Braille located 3/8 inch below numerical floor level indicator.
 - 3. Located numerals and Braille indications on both sides of each jamb at a height of 5'-0" above landing level to the centerline of the numeral.
 - 4. At grade level a 1/8 inch raised 2 inch outside diameter 5 point star shall be placed 3/8 inch to the left of the numerical character.
 - 5. At each floor landing on both sides of each jamb at a height of 6'-6" above landing level to the centerline of the symbol provide a 3 inch high international star of life symbol indicating that the elevator is a medical emergency elevator.

2.9 FINISHES

- A. Structural Metal Surfaces: Clean surfaces of rust, oil or grease; wipe clean with solvent; prime two coats.
- B. Galvanized Surfaces: Clean with neutralizing solvent; prime one coat.

- C. Baked Enamel on Steel: Clean and degrease metal surface; apply one coat of zinc oxide primer sprayed and baked; two coats of semi-gloss enamel sprayed and baked; color as selected.

2.10 CAR OPERATING PANEL

- A. Provide one flush mounted operating panel per car; with front return panels containing illuminated call buttons corresponding to floors served, emergency stop switch, alarm button, door open, door close and telephone buttons; key operated light switch.
- B. Position emergency stop switch and alarm button where they are unlikely to be accidentally actuated and not more than 48 inches above car floor to centerline of switch or button.
- C. Locate centerline of uppermost button in elevator cab panel not more than 48 inches above car floor.
- D. Except for photoelectric tube bypass switches, emergency controls, including the emergency stop and alarm, shall be grouped in or adjacent to the bottom of the panel and shall be no lower than 2'-11" from the floor level.
- E. Floor buttons shall be provided with visual indicators to show when each call is registered. Visual indicators shall be extinguished when each call is answered.
- F. Car controls shall have a minimum dimension of 3/4 inch and shall be raised 1/8 inch plus or minus 1/32 inch above the surrounding surface.
- G. Control buttons shall be illuminated, shall have square shoulders, and shall be activated by a mechanical motion that is detectable.
- H. Control buttons shall be designated by a 5/8 inch minimum Arabic numeral, standard alphabet character, or standard symbol to the left of the control button.
- I. California Contracted Grade 2 round top Braille shall be located immediately below the numeral, character, or symbol.
- J. A minimum clear space of 3/8 inch shall be provided between rows of control buttons.
- K. Raised characters shall be white on a black background.
- L. The call button for the main floor shall be designated by a raised star located to the left of the floor designation.
- M. Minimum illumination at control panel when doors are open shall be 5 foot candles.
- N. In elevator cars, a visual car position indicator shall be provided above the car control panel to show the position of the elevator in the hoistway. As the car passes or stops at a floor served by the elevators, the corresponding numerals shall illuminate, and an audible signal shall sound. Numerals shall be a minimum of 1/2 inch high. The audible signal shall be no less than 20 decibels with a frequency no higher than 1,500 Hz. An automatic verbal announcement of the floor number at which a car stops or which a car passes may be substituted for the audible signal.
- O. Include matching service cabinet with hinged door and lock in each car containing:
 - 1. Independent service switch.
 - 2. Inspection switch.
 - 3. Fan or blower switch.
 - 4. Light switch.
 - 5. Necessary additional operating switches.

- P. Locate a 110 V, 15 A receptacle below service cabinet.

2.11 HALL CONTROLS

- A. Hall Buttons: Stainless steel internally illuminating type, Model KSS 140 vandal resistant, conforming to the following:
1. One hall button for originating up call and one button for originating down call. One button only at terminating landing.
 2. Visual indication shall be provided to show each call registered and extinguished when the call is answered.
 3. Identification of call direction shall be by directional arrow and by California Contracted Grade 2 Round Top Braille located 3/8 inch below visual direction indicator.
 4. Hall buttons, exclusive of border, shall be a minimum of 3/4 inch size and shall be raised 1/8 inch plus or minus 1/32 inch above surrounding surface.
 5. Mount hall call buttons at 42 inches above the floor to the centerline of the button.
 6. Objects adjacent to and below call buttons shall not project more than 4 inches from the wall.
- B. Hall Lanterns: Visual and audible signals conforming to the following:
1. Visual arrows shall be a minimum of 2-1/2 inches square and be visible from the hall call button.
 2. Visual arrows shall be white for up and green for down.
 3. Visual arrows shall be mounted a minimum of 6'-0" from the center of the lantern to the lobby floor.
 4. Hall lanterns shall have gongs. Sound gongs once for up stops and twice for down stops.
 5. Sound an audible soft-tone signal in car when car is stopping or stopped at a floor.
- C. Provide accessible key switch at each floor.

2.12 EMERGENCY SIGNS

- A. Except at the main entrance level, install a pictorial sign of standardized design adjacent to each elevator call station which will indicate that, in case of fire, the elevator will not operate and that exit stairways should be used.

2.13 EMERGENCY TELEPHONE

- A. Provide "hands free" telephone to a pre-programmed 24-hour emergency telephone number.
- B. Mount centerline of telephone at no more than 4'-0" above floor line.

2.14 SEISMIC CRITERIA

- A. Design and assemble elevator equipment and components to withstand earthquake forces in accordance with CBC - California Building Code, (CCR), Title 24, Part 2.

2.15 DESIGN FOR ACCESSIBILITY

- A. Conform to CBC - California Building Code, (CCR), Title 24, Part 2, and the 2010 ADA Standards for Accessible Design for accessibility requirements.
- B. Conform to accessibility features specified in this section.

3. PART 3 EXECUTION

3.1 INSPECTION

- A. Verify that hoistway is ready for work of this Section.
- B. Verify shaft and openings are of correct size and within tolerances.
- C. Confirm electrical power is available and of correct characteristics.
- D. Report defects or deficiencies in writing.
- E. Beginning of installation means acceptance of conditions.

3.2 INSTALLATION

- A. Install in accordance with ASME A17.1.
- B. Install hoistway components. Connect equipment to building utilities.
- C. Provide conduit, boxes, wiring, and accessories within hoistway and signal outlets.
- D. Install guide rails using threaded bolts with metal shims and lockwashers under nuts. Compensate for expansion and contraction movement of guide rails.
- E. Accurately machine and align guide rails. Form smooth joints with machined splice plates.
- F. Bolt or weld brackets directly to structural steel hoistway framing.
- G. Field Welds: Chip and clean away oxidation and residue; wire brush weld; prime two coats.
- H. Coordinate installation of hoistway wall construction.
- I. Install hoistway door sills, frames and headers in hoistway walls. Grout sills in place. Set entrances in vertical alignment with car openings and aligned with plumb hoistway lines.
- J. Fill hoistway door frames solid with grout at masonry walls.
- K. Locate hall signal equipment and signage as indicated.
- L. Adjust equipment for smooth and quiet operation.

3.3 TOLERANCES

- A. Guide Rail Alignment: Plumb and parallel to each other in accordance with ASME A17.1.
- B. Cab Movement on Aligned Guide Rails: Smooth movement, with no perceptible lateral or oscillating movement or vibration.

3.4 FIELD QUALITY CONTROL

- A. Field inspection and testing will be performed under provisions of Section 01 45 29.
- B. Perform and meet tests required by ASME A17.1 and by California Code of Regulations, (CCR), Title 8.
- C. Supply instruments and execute specific tests.
- D. Furnish test and approval certificates issued by jurisdictional authorities.
- E. Provide two weeks written notice of date and time of tests.

3.5 CLEANING

- A. Remove protective coverings from finished surfaces.
- B. Clean surfaces and components ready for inspection.

3.6 ADJUSTING

- A. Adjust for smooth acceleration and deceleration of car provide passenger comfort.
- B. Adjust doors to open only at the landing where the car is stopping or at rest. The opening sequence may begin only when the car is at rest. The car must be at rest before the hoistway door is fully open.
- C. Adjust automatic floor levelling feature at each floor to achieve 1/4 inch from flush.
- D. Adjust car platform sill and the edge of the hoistway landing to achieve a maximum 1-1/4 inch clearance.

3.7 PROTECTION

- A. Protect finished installation under provisions of Section 01 61 00.

3.8 DEMONSTRATION

- A. Provide demonstration and instruction under provisions of Section 01 77 00.
- B. Inspect operation of elevator with Owner's personnel present prior to date of Substantial Completion and verify that elevator is functioning properly.
- C. Engage a factory-authorized service representative to train Owner's maintenance personnel to operate, adjust, and maintain elevator(s).

3.9 SCHEDULE

- A. Type 1 - Building B.
- B. Type 2 - Buildings A, D, E, and J.

END OF SECTION

SECTION 14 42 00

WHEELCHAIR LIFTS

1. PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Machine and Housing.
- B. Platform, gates, doors, door frames.
- C. Controls, signals, and accessories.

1.2 REFERENCES

- A. 2010 Americans with Disabilities Act (ADA) Standards for Accessible Design.
- B. CBC - California Building Code, (CCR) California Code of Regulations, Title 24, Part 2.
- C. California Elevator Safety Code, California Code of Regulations (CCR), Title 8.
- D. ASME A18.1 - Safety Code for Platform Lifts and Stairway Chairlifts.

1.3 SYSTEM DESCRIPTION

A. Characteristics as follows:

- | | | |
|------------------------------|---|--|
| 1. Capacity | : | 750 pounds with static load safety factor of five |
| 2. Rated Speed | : | Twelve feet/minute |
| 3. Travel Distance (nominal) | : | 3 feet 0 inch |
| 4. Number of Stops | : | Two |
| 5. Nominal Platform Size | : | 36 inch x 54 inch 90 Degree Entry/Exit Configuration |
| 6. Mounting | : | Recessed |
| 7. Color | : | Standard paint color as selected by the Architect |

1.4 SUBMITTALS

- A. Submit shop drawings and product data under provisions of Section 01 33 00.
- B. Submit samples under provisions of Section 01 33 00.
- C. Submit two samples 12 x 12 inch in size illustrating panel finishes for Architect's selection.

1.5 OPERATION AND MAINTENANCE DATA

- A. Submit operation and maintenance data under provisions of Section 01 77 00.
- B. Include description of wheelchair lift systems method of operation and control, including motor and drive unit, brake, controls, switches and sensors.
- C. Provide parts catalogs with complete list of equipment replacement parts.

1.6 QUALITY ASSURANCE

- A. Manufacturer: Company specializing in manufacturing wheelchair lifts with five years minimum documented experience.

- B. Installer: Company specializing in installing similar equipment with five years minimum documented experience, approved by manufacturer.
- C. Comply with ASME A18.1 requirements for vertical rising wheelchair lift.

1.7 REGULATORY REQUIREMENTS

- A. Conform to CBC - California Building Code (CCR), Title 8 and Title 24, Part 2, and the 2010 ADA Standards for Accessible Design for accessibility requirements.
- B. Conform to CCR, California Code of Regulations, Title 8, Sections 3093 and 3094.
- C. Lifts with a runway enclosure shall comply with ASME A18.1, Section 2.1.1.
- D. Lifts without a runway enclosure shall comply with ASME A18.1, Section 2.1.3.
- E. Obtain final inspection of installation from the Department of Industrial Relations; Division of Occupational Safety and Health; Elevator, Ride, and Tramway Unit.

1.8 WARRANTY

- A. Provide one year manufacturer's warranty under provisions of Section 01 77 00.
- B. Warranty: Include coverage of wheelchair lift controller, operating equipment and devices.

1.9 MAINTENANCE SERVICE

- A. Furnish complete service and maintenance of wheelchair lift and components for a period of twelve months after final completion.
- B. Examine periodically; clean, adjust, and lubricate all equipment.
- C. Repair or replace parts whenever required. Use parts produced by the manufacturer of the original equipment.
- D. Provide emergency call back service during working hours for this maintenance period.
- E. Maintain locally, near the place of the work, an adequate stock of parts for replacement or emergency purposes, and have qualified installation personnel available to ensure the fulfillment of this maintenance service without unreasonable loss of time.
- F. Perform maintenance work using competent personnel, under the supervision of the wheelchair lift manufacturer.
- G. Maintenance service shall not be assigned or transferred to any agent or subcontractor without prior written consent of the Owner.

2. PART 2 PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

- A. Savaria, Model; Multi-Lift, www.savaria.com.
- B. Garaventa Accessibility, Model; Opal, www.garaventalift.com.
- C. Substitutions: Under provisions of Section 01 25 13.

2.2 COMPONENTS

- A. Drive: Recirculating ball screw with rotating screw.

- B. Ball Nut Safety: Integral backup system to prevent uncontrolled descent in event of ball nut failure.
- C. Motor: 1/2 HP, 1750 RPM instant reversing, 120 volt, 9.8 amps, single phase.
- D. Brake: Spring actuated electrically released brake mounted on ball screw shaft. Automatic braking upon release of any control switches.
- E. Platform Enclosure: Manufacturer's standard 42 inch high side walls, smooth finish.
- F. Platform Floor: 0.1196 inch thick galvanized steel plate with non-slip finish.
- G. Platform Gates: Manufacturer's standard 42 inch high landing gates. Bottom 10 inches of gate to have a smooth uninterrupted surface. Gate shall be power operated and shall remain open for 20 seconds minimum. End gates shall provide 32 inches clear width, side gates shall provide 42 inches clear width. Lift side of door shall present a smooth surface.
- H. Gate Hardware: Latching or locking hardware to be operable with a single effort by push pull activating device or other hardware designed so as not to require the ability to grasp the opening hardware.
- I. Controls: Locate on inside face of cars. Include keyless control paddle switch, emergency alarm, and stop switches. Force to activate controls shall not exceed 5 lbs.
- J. Provide a wand or other reaching device attached to a chain on the side opposite the controls.
- K. Call Send Station: Illuminated tactile constant pressure keyless elevator type buttons with courtesy and safety light. Wall mounted at 48 inches to top of station maximum.
- L. Auxiliary Threshold Lighting: Battery operated light fixtures with minimum 5fc lighting level. Rechargeable with an automatic recharging system.
- M. Platform Restriction Signage: As specified in Section 10 14 00.
- N. Grab Bar: 1-1/2 inch outside diameter metal grab bar, wall mounted with 1-1/2-inch clearance between grab bar and wall. Mount on control side of platform below controls. Top of bar to be between 2'-10" and 3'-2" above finished platform floor.
- O. Emergency Operation: Manual hand crank device to raise and lower platform. Device shall be secured against unauthorized use.
- P. Bottom Guard: Underside of platform shall be guarded in accordance with Section 2.1.7.6 of ASME A18.1.
- Q. Pit Switch: Locate lock out switch on bottom of mast for use by service personnel.
- R. Platform Safety Sensors: Equip underpanel of platform with sensors to prevent downward travel if obstruction is encountered.
- S. Limit Switch: Final limit switch to cut off power if control limit switch fails.
- T. Battery Backup: Complete battery operated backup system to operate lift should main power supply fail. Power supply shall be sufficient to operate lift a minimum of five times in the upward and downward direction.
- U. Transfer between normal and standby power system shall be automatic.

3. PART 3 EXECUTION

3.1 EXAMINATION

- A. Verify field measurements are as shown on shop drawings.
- B. Verify that required utilities are available, in proper locations, and ready for use.

- C. Beginning of installation means installer accepts existing conditions.

3.2 FIELD QUALITY CONTROL

- A. Perform acceptance testing in compliance with ASME A18.1, Section 10.4.

3.3 INSTALLATION

- A. Install in accordance with manufacturer's instructions and applicable codes and regulations.
- B. Outline lift landing area with 4 inch wide painted yellow stripe.
- C. Clearance between platform enclosure walls and machine housing or any other rigid surface shall be 2 inch minimum.
- D. When an obstruction or surface less than 42 inches above the top landing, other than the machine housing, is within 12 inches of platform enclosure walls, a smooth continuous surface shall be provided extending from the lower landing to a height of 42 inches minimum above top landing.
- E. Where an obstruction or surface is between 42 inches and 80 inches above top landing, a smooth continuous surface shall be provided extending from lower landing to a height of 3 inches minimum above obstruction.
- F. The clearance between platform floor and upper landing sill shall be 3/8 inch minimum to 3/4 inch maximum.
- G. Adjust lift for proper operation and clean unit thoroughly.
- H. Instruct Owner in proper operation and maintenance procedures.

END OF SECTION

SECTION 21 05 00

BASIC FIRE SUPPRESSION REQUIREMENTS

1. PART GENERAL

1.1 SECTION INCLUDES

- A. Requirements applicable to all Division 21 Sections. Also refer to Division 1 - General Requirements.
- B. All materials and installation methods shall conform to the applicable standards, guidelines and codes referenced herein and within each specification section.

1.2 REFERENCES

- A. CCR California Code of Regulation
- B. CBC California Building Code
- C. CFC California Fire Code
- D. CEC California Electric Code
- E. CMC California Mechanical Code
- F. CPC California Plumbing Code
- G. California Title 24 - Building Energy Efficiency Standards
- H. SCAQMD Southern California Air Quality Management Division

1.3 COORDINATION DRAWINGS

A. Definitions:

- 1. Coordination Drawings: A compilation of the pertinent layout and system drawings that show the sizes and locations, including elevations, of system components and required access areas to ensure that no two objects will occupy the same space.
 - a. Mechanical trades shall include, but are not limited to, mechanical equipment, ductwork, fire protection systems, plumbing piping, and any item that may impact coordination with other disciplines.
 - b. Maintenance clearances and code-required dedicated space shall be included.
 - c. The coordination drawings shall include all underground, underfloor, in-floor, in ceiling, in chase, and vertical trade items.
- 2. The contractors shall use the coordination process to identify the proper sequence of installation of all utilities above ceilings and in other congested areas, to ensure an orderly and coordinated end result, and to provide adequate access for service and maintenance.

B. Participation:

- 1. The contractors and subcontractors responsible for work defined above shall participate in the coordination drawing process.
- 2. One contractor shall be designated as the Coordinating Contractor for purposes of preparing a complete set of composite electronic CAD coordination drawings that include all applicable trades, and for coordinating the activities related to this process. The Coordinating Contractor for this project shall be the Mechanical Contractor.
 - a. The Coordinating Contractor shall utilize personnel familiar with requirements of this project and skilled as draftspersons/CAD operators, competent to prepare the required coordination drawings.

3. Electronic CAD drawings shall be submitted to the Coordinating Contractor for addition of work by other trades. IMEG will provide electronic file copies of mechanical drawings for contractor's use if the contractor signs and returns an "Electronic File Transfer" waiver provided by IMEG. IMEG will not consider blatant reproductions of original file copies an acceptable alternative for coordination drawings.

C. Drawing Requirements:

1. The file format and file naming convention shall be coordinated with and agreed to by all contractors participating in the coordination process and the Owner.
 - a. Scale of drawings:
 - 1) General plans: 1/4 Inch = 1'-0" (minimum).
 - 2) Mechanical, electrical, communication rooms, and including the surrounding areas within 10 feet: 1/2 Inch = 1'-0" (minimum).
 - 3) Shafts and risers: 1/2 Inch = 1'-0" (minimum).
 - 4) Sections of shafts and mechanical and electrical equipment rooms: 1/4 Inch = 1'-0" (minimum).
 - 5) Sections of congested areas: 1/2 Inch = 1'-0" (minimum).
2. Ductwork layout drawings shall be the baseline system for other components. Ductwork layout drawings shall be modified to accommodate other components as the coordination process progresses.
3. There may be more drawings required for risers, top and bottom levels of mechanical rooms, and shafts.
4. The minimum quantity of drawings will be established at the first coordination meeting and sent to the A/E for review. Additional drawings may be required if other areas of congestion are discovered during the coordination process.

D. General:

1. Coordination drawing files shall be made available to the A/E and Owner's Representative. The A/E will only review identified conflicts and give an opinion, but will not perform as a coordinator.
2. A plotted set of coordination drawings shall be available at the project site.
3. Coordination drawings are not shop drawings and shall not be submitted as such.
4. The contract drawings are schematic in nature and do not show every fitting and appurtenance for each utility. Each contractor is expected to have included in his/her bid sufficient fittings, material, and labor to allow for adjustments in routing of utilities made necessary by the coordination process and to provide a complete and functional system.
5. The contractors will not be allowed additional costs or time extensions due to participation in the coordination process.
6. The contractors will not be allowed additional costs or time extensions for additional fittings, reroutings or changes of duct size, that are essentially equivalent sizes to those shown on the drawings and determined necessary through the coordination process.

7. The A/E reserves the right to determine space priority of equipment in the event of spatial conflicts or interference between equipment, piping, conduit, ducts, and equipment provided by the trades.
8. Changes to the contract documents that are necessary for systems installation and coordination shall be brought to the attention of the A/E.
9. Access panels shall preferably occur only in gypsum board walls or plaster ceilings where indicated on the drawings.
 - a. Access to mechanical, electrical, technology, and other items located above the ceiling shall be through accessible lay-in ceiling tile areas.
 - b. Potential layout changes shall be made to avoid additional access panels.
 - c. Additional access panels shall not be allowed without written approval from the A/E at the coordination drawing stage.
 - d. Providing additional access panels shall be considered after other alternatives are reviewed and discarded by the A/E and the Owner's Representative.
 - e. When additional access panels are required, they shall be provided without additional cost to the Owner.
10. Complete the coordination drawing process and obtain sign off of the drawings by all contractors prior to installing any of the components.
11. Conflicts that result after the coordination drawings are signed off shall be the responsibility of the contractor or subcontractor who did not properly identify their work requirements, or installed their work without proper coordination.
12. Updated coordination drawings that reflect as-built conditions may be used as record documents.

1.4 QUALITY ASSURANCE

A. Contractor's Responsibility Prior to Submitting Pricing Data:

1. The Contractor is responsible for constructing complete and operating systems. The Contractor acknowledges and understands that the Contract Documents are a two-dimensional representation of a three-dimensional object, subject to human interpretation. This representation may include imperfect data, interpreted codes, utility guidelines, three-dimensional conflicts, and required field coordination items. Such deficiencies can be corrected when identified prior to ordering material and starting installation. The Contractor agrees to carefully study and compare the individual Contract Documents and report at once in writing to the Design Team any deficiencies the Contractor may discover. The Contractor further agrees to require each subcontractor to likewise study the documents and report at once any deficiencies discovered.
2. The Contractor shall resolve all reported deficiencies with the Architect/Engineer prior to awarding any subcontracts, ordering material, or starting any work with the Contractor's own employees. Any work performed prior to receipt of instructions from the Design Team will be done at the Contractor's risk.

B. Qualifications:

1. Only products of reputable manufacturers are acceptable.
2. All Contractors and subcontractors shall employ only workers skilled in their trades.

C. Compliance with Codes, Laws, Ordinances:

1. Conform to all requirements of the Division of The State Architect (DSA) of California Codes, Laws, Ordinances and other regulations having jurisdiction.
2. Conform to all published standards of Chino Valley Unified School District.
3. Conform to all State Codes.
4. If there is a discrepancy between the codes and regulations and these specifications, the Architect/Engineer shall determine the method or equipment used.
5. If the Contractor notes, at the time of bidding, any parts of the drawings or specifications that do not comply with the codes or regulations, he shall inform the Architect/Engineer in writing, requesting a clarification. If there is insufficient time for this procedure, he shall submit with his proposal a separate price to make the system comply with the codes and regulations.
6. All changes to the system made after letting of the contract, to comply with codes or requirements of Inspectors, shall be made by the Contractor without cost to the Owner.
7. If there is a discrepancy between manufacturer's recommendations and these specifications, the manufacturer's recommendations shall govern.
8. All rotating shafts and/or equipment shall be completely guarded from all contact. Partial guards and/or guards that do not meet all applicable OSHA standards are not acceptable. Contractor is responsible for providing this guarding if it is not provided with the equipment supplied.

D. Permits, Fees, Taxes, Inspections:

1. Procure all applicable permits and licenses.
2. Abide by all laws, regulations, ordinances, and other rules of the State or Political Subdivision where the work is done, or as required by any duly constituted public authority.
3. Pay all charges for permits or licenses.
4. Pay all fees and taxes imposed by the State, Municipal and/or other regulatory bodies.
5. Pay all charges arising out of required inspections by an authorized body.
6. Pay all charges arising out of required contract document reviews associated with the project and as initiated by the Owner or authorized agency/consultant.
7. Where applicable, all fixtures, equipment and materials shall be listed by Underwriters' Laboratories, Inc.

E. Utility Company Requirements:

1. Secure from the appropriate private or public utility company all applicable requirements.
2. Comply with all utility company requirements.
3. Make application for and pay for fire protection water service connection.

F. Examination of Drawings:

1. The drawings for the fire protection work are completely diagrammatic, intended to convey the scope of the work and to indicate the general arrangements and locations of equipment, outlets, etc., and the approximate sizes of equipment.

2. Contractor shall determine the exact locations of equipment and rough-ins, and the exact routing of pipes and ducts to best fit the layout of the job.
3. Scaling of the drawings is not sufficient or accurate for determining these locations.
4. Where job conditions require reasonable changes in indicated arrangements and locations, such changes shall be made by the Contractor at no additional cost to the Owner.
5. Because of the scale of the drawings, certain basic items, such as fittings, boxes, valves, unions, etc., may not be shown, but where required by other sections of the specifications or required for proper installation of the work, such items shall be furnished and installed.
6. If an item is either on the drawings or in the specifications, it shall be included in this contract.
7. Determination of quantities of material and equipment required shall be made by the Contractor from the documents. Where discrepancies arise between drawings, schedules and/or specifications, the greater number shall govern.
8. Where used in fire protection documents, the word "furnish" shall mean supply for use, the word "install" shall mean connect complete and ready for operation, and the word "provide" shall mean to supply for use and connect complete and ready for operation.
 - a. Any item listed as furnished shall also be installed, unless otherwise noted.
 - b. Any item listed as installed shall also be furnished, unless otherwise noted.

G. Field Measurements:

1. Verify all pertinent dimensions at the job site before ordering any materials or fabricating any supports, pipes or ducts.

H. Electronic Media/Files:

1. Construction drawings for this project have been prepared utilizing MEP Revit.
2. Contractors and Subcontractors may request electronic media files of the contract drawings and/or copies of the specifications. Specifications will be provided in PDF format.
3. Upon request for electronic media, the Contractor shall complete and return a signed "Electronic File Transmittal" form provided by IMEG.
4. If the information requested includes floor plans prepared by others, the Contractor will be responsible for obtaining approval from the appropriate Design Professional for use of that part of the document.
5. The electronic contract documents can be used for preparation of shop drawings and as-built drawings only. The information may not be used in whole or in part for any other project.
6. The drawings prepared by IMEG for bidding purposes may not be used directly for ductwork layout drawings or coordination drawings.
7. The use of these CAD documents by the Contractor does not relieve them from their responsibility for coordination of work with other trades and verification of space available for the installation.
8. The information is provided to expedite the project and assist the Contractor with no guarantee by IMEG as to the accuracy or correctness of the information provided. IMEG accepts no responsibility or liability for the Contractor's use of these documents.

1.5 SUBMITTALS

- A. Submittals shall be required for the following items, and for additional items where required elsewhere in the specifications or on the drawings.

1. Submittals list:

<u>Referenced Specification Section</u>	<u>Submittal Item</u>
21 05 00	Owner Training Agenda
21 05 29	Hangers and Supports
21 05 50	Seismic Restraint Systems
21 05 53	Mechanical Identification
21 13 00	Sprinkler Systems

- B. General Submittal Procedures: In addition to the provisions of Division 1, the following are required:

1. Transmittal: Each transmittal shall include the following:

- a. Date
- b. Project title and number
- c. Contractor's name and address
- d. Division of work (e.g., plumbing, heating, ventilating, etc.)
- e. Description of items submitted and relevant specification number
- f. Notations of deviations from the contract documents
- g. Other pertinent data

2. Submittal Cover Sheet: Each submittal shall include a cover sheet containing:

- a. Date
- b. Project title and number
- c. Architect/Engineer
- d. Contractor and subcontractors' names and addresses
- e. Supplier and manufacturer's names and addresses
- f. Division of work (e.g., plumbing, heating, ventilating, etc.)
- g. Description of item submitted (using project nomenclature) and relevant specification number
- h. Notations of deviations from the contract documents
- i. Other pertinent data
- j. Provide space for Contractor's review stamps

3. Composition:

- a. Submittals shall be submitted using specification sections and the project nomenclature for each item.
- b. Individual submittal packages shall be prepared for items in each specification section. All items within a single specification section shall be packaged together where possible. An individual submittal may contain items from multiple specifications sections if the items are intimately linked (e.g., pumps and motors).
- c. All sets shall contain an index of the items enclosed with a general topic description on the cover.

4. Content: Submittals shall include all fabrication, erection, layout, and setting drawings; manufacturers' standard drawings; schedules; descriptive literature, catalogs and brochures; performance and test data; electrical power wiring and control diagrams; dimensions; shipping and operating weights; shipping splits; service clearances; and all other drawings and descriptive data of materials of construction as may be required to show that the materials, equipment or systems and the location thereof conform to the requirements of the contract documents.
5. Contractor's Approval Stamp:
 - a. The Contractor shall thoroughly review and approve all shop drawings before submitting them to the Architect/Engineer. The Contractor shall stamp, date and sign each submittal certifying it has been reviewed.
 - b. Unstamped submittals will be rejected.
 - c. The Contractor's review shall include, but not be limited to, verification of the following:
 - 1) Only approved manufacturers are used.
 - 2) Addenda items have been incorporated.
 - 3) Catalog numbers and options match those specified.
 - 4) Performance data matches that specified.
 - 5) Electrical characteristics and loads match those specified.
 - 6) Equipment connection locations, sizes, capacities, etc. have been coordinated with other affected trades.
 - 7) Dimensions and service clearances are suitable for the intended location.
 - 8) Equipment dimensions are coordinated with support steel, housekeeping pads, openings, etc.
 - 9) Constructability issues are resolved (e.g., weights and dimensions are suitable for getting the item into the building and into place, sinks fit into countertops, etc.).
 - d. The Contractor shall review, stamp and approve all subcontractors' submittals as described above.
 - e. **The Contractor's approval stamp is required on all submittals. Approval will indicate the Contractor's review of all material and a complete understanding of exactly what is to be furnished. Contractor shall clearly mark all deviations from the contract documents on all submittals. If deviations are not marked by the Contractor, then the item shall be required to meet all drawing and specification requirements.**
6. Submittal Identification and Markings:
 - a. The Contractor shall clearly mark each item with the same nomenclature applied on the drawings or in the specifications.
 - b. The Contractor shall clearly indicate the size, finish, material, etc.
 - c. Where more than one model is shown on a manufacturer's sheet, the Contractor shall clearly indicate exactly which item and which data is intended.
 - d. All marks and identifications on the submittals shall be unambiguous.
7. Schedule submittals to expedite the project. Coordinate submission of related items.
8. Identify variations from the contract documents and product or system limitations that may be detrimental to the successful performance of the completed work.
9. Reproduction of contract documents alone is not acceptable for submittals.

10. Incomplete submittals will be rejected without review. Partial submittals will only be reviewed with prior approval from the Architect/Engineer.
11. Submittals not required by the contract documents may be returned without review.
12. The Architect/Engineer's responsibility shall be to review one set of shop drawing submittals for each product. If the first submittal is incomplete or does not comply with the drawings and/or specifications, the Contractor shall be responsible to bear the cost for the Architect/Engineer to recheck and handle the additional shop drawing submittals.
13. Submittals shall be reviewed and approved by the Architect/Engineer **before** releasing any equipment for manufacture or shipment.
14. Contractor's responsibility for errors, omissions or deviation from the contract documents in submittals is not relieved by the Architect/Engineer's approval.

C. Electronic Submittal Procedures:

1. Distribution: Email submittals as attachments to all parties designated by the Architect/Engineer, unless a web-based submittal program is used.
2. Transmittals: Each submittal shall include an individual electronic letter of transmittal.
3. Format: Electronic submittals shall be in PDF format only. Scanned copies, in PDF format, of paper originals are acceptable. Submittals that are not legible will be rejected. Do not set any permission restrictions on files; protected, locked, or secured documents will be rejected.
4. File Names: Electronic submittal file names shall include the relevant specification section number followed by a description of the item submitted, as follows. Where possible, include the transmittal as the first page of the PDF instead of using multiple electronic files.
 - a. Submittal file name: 21 XX XX.description.YYYYMMDD
 - b. Transmittal file name: 21 XX XX.description.YYYYMMDD
5. File Size: Electronic file size shall be limited to a maximum of 4MB. Larger files shall be transmitted via a pre-approved method.

1.6 SCHEDULE OF VALUES

- A. The requirements herein are in addition to the provisions of Division 1.
- B. Format:
 1. Use AIA Document Continuation Sheets G703 or another similar form approved by the Owner and Architect/Engineer.
 2. Submit in Excel format.
 3. Support values given with substantiating data.
- C. Preparation:
 1. Itemize work required by each specification section and list all providers. All work provided by subcontractors and major suppliers shall be listed on the Schedule of Values. List each subcontractor and supplier by company name.
 2. Break down all costs into:
 - a. Material: Delivered cost of product with taxes paid.
 - b. Labor: Labor cost, excluding overhead and profit.

- D. Update Schedule of Values when:
 - 1. Indicated by Architect/Engineer.
 - 2. Change of subcontractor or supplier occurs.
 - 3. Change of product or equipment occurs.

1.7 CHANGE ORDERS

- A. A detailed material and labor takeoff shall be prepared for each change order, along with labor rates and markup percentages. Change orders with inadequate breakdown will be rejected.
- B. Change order work shall not proceed until authorized.

1.8 EQUIPMENT SUPPLIERS' INSPECTION

- A. The following equipment shall not be placed in operation until a competent installation and service representative of the manufacturer has inspected the installation and certified that the equipment is properly installed, adjusted and lubricated; that preliminary operating instructions have been given; and that the equipment is ready for operation:
 - 1. Fire Seal Systems
- B. Contractor shall arrange for and obtain supplier's on-site inspection(s) at proper time(s) to assure each phase of equipment installation and/or connection is in accordance with the manufacturer's instructions.
- C. Submit copies of start-up reports to the Architect/Engineer and include copies of Owner's Operation and Maintenance Manuals.

1.9 PRODUCT DELIVERY, STORAGE, HANDLING & MAINTENANCE

- A. Exercise care in transporting and handling to avoid damage to materials. Store materials on the site to prevent damage. Keep materials clean, dry and free from harmful conditions. Immediately remove any materials that become wet or that are suspected of becoming contaminated with mold or other organisms.
- B. Keep all bearings properly lubricated and all belts properly tensioned and aligned.
- C. Coordinate the installation of heavy and large equipment with the General Contractor and/or Owner. If the Mechanical Contractor does not have prior documented experience in rigging and lifting similar equipment, he/she shall contract with a qualified lifting and rigging service that has similar documented experience. Follow all equipment lifting and support guidelines for handling and moving.
- D. Contractor is responsible for moving equipment into the building and/or site. Contractor shall review site prior to bid for path locations and any required building modifications to allow movement of equipment. Contractor shall coordinate his/her work with other trades.

1.10 NETWORK / INTERNET CONNECTED EQUIPMENT

- A. These specifications may require certain equipment or systems to have network, Internet and/or remote access capability ("Network Capability"). Any requirement for Network Capability shall be interpreted only as a functional capability and is not to be construed as authority to connect or enable any Network Capability. Network Capability may only be connected or enabled with the express written consent of the Owner.

1.11 WARRANTY

- A. Provide one-year warranty, unless otherwise noted, to the Owner for all fixtures, equipment, materials, and workmanship.

- B. The warranty period for all work in this Division of the specifications shall commence on the date of final acceptance, unless a whole or partial system or any separate piece of equipment or component is put into use for the benefit of any party other than the installing contractor with prior written authorization. In this instance, the warranty period shall commence on the date when such whole system, partial system or separate piece of equipment or component is placed in operation and accepted in writing by the Owner.
- C. Warranty requirements shall extend to correction, without cost to the Owner, of all Work found to be defective or nonconforming to the contract documents. The Contractor shall bear the cost of correcting all damage resulting from defects or nonconformance with contract documents.

1.12 INSURANCE

- A. Contractor shall maintain insurance coverage as set forth in Division 0 of these specifications.

1.13 CONTINGENCY

- A. The Fire Protection Contractor shall include in the Base Bid a contingency of one percent (1%) to be used only by change orders issued by the Architect/Engineer. The unused portion of the contingency shall be deducted from the Contract price before final payment is made.

1.14 MATERIAL SUBSTITUTION

- A. Where several manufacturers' names are given, the manufacturer for which a catalog number is given is the basis for job design and establishes the quality required.
- B. Equivalent equipment manufactured by the other named manufacturers may be used. Contractor shall ensure that all items submitted by these other manufacturers meet all requirements of the drawings and specifications, and fits in the allocated space.
- C. Any material, article or equipment of other unnamed manufacturers which will adequately perform the services and duties imposed by the design and is of a quality equal to or better than the material, article or equipment identified by the drawings and specifications may be used if approval is secured in writing from the Architect/Engineer not later than ten days prior to the bid opening.
- D. This Contractor assumes all costs incurred as a result of using the offered material, article or equipment, on his part or on the part of other Contractors whose work is affected.
- E. This Contractor may list voluntary add or deduct prices for alternate materials on the bid form. These items will not be used in determining the low bidder.
- F. All material substitutions requested later than ten (10) days prior to bid opening must be listed as voluntary changes on the bid form.
- G. 01 91 00 and 21 08 00, and provide all services as described in the Commissioning Plan.

1.15 PROJECT COMMISSIONING

- A. The Contractor shall work with the Commissioning Agent (CxA) as described in Section 01 91 00 and 21 08 00, and provide all services as described in the Commissioning Plan.

2. PART PRODUCTS

NOT APPLICABLE

3. PART EXECUTION

3.1 JOBSITE SAFETY

- A. Neither the professional activities of the Architect/Engineer, nor the presence of the Architect/Engineer or his or her employee and subconsultants at a construction site, shall relieve the Contractor and other entity of their obligations, duties and responsibilities including, but not limited to, construction means, methods, sequence, techniques or procedures necessary for performing, superintending or coordinating all portions of the work of construction in accordance with the contract documents and any health or safety precautions required by any regulatory agencies. The Architect/Engineer and his or her personnel have no authority to exercise any control over any construction contractor or other entity or their employees in connection with their work or any health or safety precautions. The Contractor is solely responsible for jobsite safety. The Architect/Engineer and the Architect/Engineer's consultants shall be indemnified and shall be made additional insureds under the Contractor's general liability insurance policy.

3.2 ARCHITECT/ENGINEER OBSERVATION OF WORK

- A. The Contractor shall provide seven (7) calendar days' notice to the Architect/Engineer prior to:
 - 1. Placing fill over underground and underslab utilities.
 - 2. Covering exterior walls, interior partitions and chases.
 - 3. Installing hard or suspended ceilings and soffits.
- B. The Architect/Engineer will have the opportunity to review the installation and provide a written report noting deficiencies requiring correction. The Contractor's schedule shall account for these reviews and show them as line items in the approved schedule.
- C. Above-Ceiling Final Observation
 - 1. All work above the ceilings must be complete prior to the Architect/Engineer's review. This includes, but is not limited to:
 - a. Pipe wall penetrations are sealed.
 - b. Pipe identification is installed.
 - c. Branch piping in the location of sprinklers shall be dropped to the ceiling.
 - 2. In order to prevent the Above-Ceiling Final Observation from occurring too early, the Contractor shall review the status of the work and certify, in writing, that the work is ready for the Above-Ceiling Final Observation.
 - 3. It is understood that if the Architect/Engineer finds the ceilings have been installed prior to this review and prior to 7 days elapsing, the Architect/Engineer may not recommend further payments to the contractor until such time as full access has been provided.

3.3 PROJECT CLOSEOUT

- A. The following paragraphs supplement the requirements of Division 1.
- B. IDPH Final Occupancy Checklist for Request of Inspection:
 - 1. Each Contractor must submit all forms and certifications required by IDPH relating to their work at 85% completion of the project or when directed by the Owner/Architect/Engineer.
- C. Final Jobsite Observation:
 - 1. In order to prevent the Final Jobsite Observation from occurring too early, the Contractor is required to review the completion status of the project and certify that the job is ready for the final jobsite observation.

2. Attached to the end of this section is a typical list of items that represent the degree of job completeness expected prior to requesting a review.
 3. Upon Contractor certification that the project is complete and ready for a final observation, the Contractor shall sign the attached certification and return it to the Architect/Engineer so that the final observation can be scheduled.
 4. It is understood that if the Architect/Engineer finds the job not ready for the final observation and that additional trips and observations are required to bring the project to completion, the costs incurred by the Architect/Engineer's additional time and expenses will be deducted from the Contractor's contract retainage prior to final payment at the completion of the job.
- D. Before final payment is authorized, this Contractor must submit the following:
1. Operation and maintenance manuals with copies of approved shop drawings.
 2. Record documents including marked-up or reproducible drawings and specifications.
 3. A report documenting the instructions given to the Owner's representatives complete with the number of hours spent in the instruction. The report shall bear the signature of an authorized agent of This Contractor and shall be signed by the Owner's representatives.
 4. Inspection report by the State Fire Marshal of the fire protection system.
 5. Start-up reports on all equipment requiring a factory installation inspection or start-up.
 6. Provide spare parts, maintenance, and extra materials in quantities specified in individual specification sections. Deliver to project site and place in location as directed; receipt by Architect/Engineer required prior to final payment approval.

3.4 OPERATION AND MAINTENANCE MANUALS

A. General:

1. Provide an electronic copy of the O&M manuals as described below for Architect/Engineer's review and approval. The electronic copy shall be corrected as required to address the Architect/Engineer's comments. Once corrected, electronic copies and paper copies shall be distributed as directed by the Architect/Engineer.
2. Approved O&M manuals shall be completed and in the Owner's possession prior to Owner's acceptance and at least 10 days prior to instruction of operating personnel.

B. Electronic Submittal Procedures:

1. Distribution: Email the O&M manual as attachments to all parties designated by the Architect/Engineer.
2. Transmittals: Each submittal shall include an individual electronic letter of transmittal.
3. Format: Electronic submittals shall be in PDF format only. Scanned copies, in PDF format, of paper originals are acceptable. Submittals that are not legible will be rejected. Do not set any permission restrictions on files; protected, locked, or secured documents will be rejected.
4. File Names: Electronic submittal file names shall include the relevant specification section number followed by a description of the item submitted, as follows. Where possible, include the transmittal as the first page of the PDF instead of using multiple electronic files.
 - a. O&M file name: O&M.div21.contractor.YYYYMMDD
 - b. Transmittal file name: O&Mtransmittal.div21.contractor.YYYYMMDD

5. File Size: Electronic file size shall be limited to a maximum of 4MB. Larger files shall be divided into files that are clearly labeled as "1 of 2", "2 of 2", etc.
6. Provide the Owner with an approved copy of the O&M manual on compact discs (CD), digital video discs (DVD), or flash drives with a permanently affixed label, printed with the title "Operation and Maintenance Instructions", title of the project and subject matter of disc/flash drive when multiple disc/flash drives are required.
7. All text shall be searchable.
8. Bookmarks shall be used, dividing information first by specification section, then systems, major equipment and finally individual items. All bookmark titles shall include the nomenclature used in the construction documents and shall be an active link to the first page of the section being referenced.

C. Operation and Maintenance Instructions shall include:

1. Title Page: Include title page with project title, Architect, Engineer, Contractor, all subcontractors, and major equipment suppliers, with addresses, telephone numbers, website addresses, email addresses and point of contacts. Website URLs and email addresses shall be active links in the electronic submittal.
2. Table of Contents: Include a table of contents describing specification section, systems, major equipment, and individual items.
3. Copies of all final approved shop drawings and submittals. Include Architect's/Engineer's shop drawing review comments. Insert the individual shop drawing directly after the Operation and Maintenance information for the item(s) in the review form.
4. Copy of final approved test and balance reports.
5. Copies of all factory inspections and/or equipment startup reports.
6. Copies of warranties.
7. Schematic electrical power/controls wiring diagrams of the equipment that have been updated for field conditions. Field wiring shall have label numbers to match drawings.
8. Dimensional drawings of equipment.
9. Capacities and utility consumption of equipment.
10. Detailed parts lists with lists of suppliers.
11. Operating procedures for each system.
12. Maintenance schedule and procedures. Include a chart listing maintenance requirements and frequency.
13. Repair procedures for major components.
14. List of lubricants in all equipment and recommended frequency of lubrication.
15. Instruction books, cards, and manuals furnished with the equipment.

3.5 INSTRUCTING THE OWNER'S REPRESENTATIVES

- A. Adequately instruct the Owner's designated representatives in the maintenance, care, and operation of all systems installed under this contract.

- B. Provide verbal and written instructions to the Owner's representatives by FACTORY PERSONNEL in the care, maintenance, and operation of the equipment and systems.
- C. The Owner has the option to make a video recording of all instructions. Coordinate schedule of instructions to facilitate this recording.
- D. The instructions shall include:
 - 1. Explanation of all system flow diagrams.
 - 2. Maintenance of equipment.
 - 3. Start-up procedures for all major equipment.
 - 4. Explanation of seasonal system changes.
 - 5. Description of emergency system operation.
- E. The Architect/Engineer shall be notified of the time and place instructions will be given to the Owner's representatives so he or his representative can attend if desired.
- F. Minimum hours of instruction for each item shall be:
 - 1. Sprinkler System(s) - 2 hours.
- G. The Contractor shall prepare a detailed, written training agenda and submit it to the Architect/Engineer a minimum of two weeks prior to the formal training for approval. The written agenda shall include specific training points within the items described above. For example: how to adjust setpoints, troubleshooting, proper start-up, proper shut-down, seasonal changes, draining, venting, changing filters, changing belts, etc. Failure to provide and follow an approved training agenda may result in additional training required at the expense of the Contractor.
- H. Operating Instructions:
 - 1. Contractor is responsible for all instructions to the Owner's representatives for the fire protection and control systems.
 - 2. If the Contractor does not have staff that can adequately provide the required instructions he shall include in his bid an adequate amount to reimburse the Owner for the Architect/Engineer to perform these services.

3.6 SYSTEM STARTING AND ADJUSTING

- A. The fire protection systems shall be complete and operating. System startup, testing, adjusting, and balancing to obtain satisfactory system performance is the responsibility of the Contractor. This includes calibration and adjustments of all controls, noise level adjustments and final comfort adjustments as required.
- B. Complete all manufacturer-recommended startup procedures and checklists to verify proper motor rotation, electrical power voltage is within equipment limitations, equipment controls maintain pressures and temperatures within acceptable ranges, all filters and protective guards are in-place, acceptable access is provided for maintenance and servicing, and equipment operation does not pose a danger to personnel or property.
- C. All operating conditions and control sequences shall be tested during the start-up period. Test all interlocks, safety shutdowns, controls, and alarms.

- D. The Contractor, subcontractors, and equipment suppliers shall have skilled technicians to ensure that all systems perform properly. If the Architect/Engineer is requested to visit the job site for trouble shooting, assisting in start-up, obtaining satisfactory equipment operation, resolving installation and/or workmanship problems, equipment substitution issues or unsatisfactory system performance, including call backs during the warranty period, through no fault of the design; the Contractor shall reimburse the Owner on a time and materials basis for services rendered at the Architect/Engineer's standard hourly rates in effect when the services are requested. The Contractor shall pay the Owner for services required that are product, installation or workmanship related. Payment is due within 30 days after services are rendered.

3.7 RECORD DOCUMENTS

- A. The following paragraph supplements Division 1 requirements:

Contractor shall maintain at the job site a separate and complete set of fire protection drawings and specifications on which he shall clearly and permanently mark in complete detail all changes made to the fire protection systems.

- B. Mark drawings to indicate revisions to piping size and location, both exterior and interior; including locations of other control devices, and other units requiring periodic maintenance or repair; actual equipment locations, dimensioned from column lines; actual inverts and locations of underground piping; concealed equipment, dimensioned from column lines; mains and branches of piping systems, with valves and control devices located and numbered, concealed unions located, and with items requiring maintenance located; Change Orders; concealed control system devices.
- C. Before completion of the project, a set of reproducible fire protection drawings will be given to the Contractor for transfer of all as-built conditions from the paper set maintained at the job site. All marks on reproducibles shall be clear and permanent.
- D. Mark specifications to show approved substitutions; Change Orders, and actual equipment and materials used.
- E. Record changes daily and keep the marked drawings available for the Architect/Engineer's examination at any normal work time.
- F. Upon completing the job, and before final payment is made, give the marked-up drawings to the Architect/Engineer.

3.8 PAINTING

- A. This Contractor shall paint the following items:
- B. Paint all equipment that is marred or damaged prior to the Owner's acceptance. Paint and color shall match original equipment paint and shall be obtained from the equipment supplier if available.
- C. Equipment in finished areas that will be painted to match the room decor will be painted by others. Should this Contractor install equipment in a finished area after the area has been painted, he shall have the equipment and all its supports, hangers, etc., painted to match the room decor.
- D. Equipment cabinets, casings, covers, metal jackets, etc., in equipment rooms or concealed spaces, shall be furnished in standard or prime finish, free from scratches, abrasions, chips, etc.
- E. Equipment in occupied spaces, or if standard to the unit, shall have a baked primer with baked enamel finish coat free from scratches, abrasions, chips, etc. If color option is specified or is standard to the unit, this Contractor shall, before ordering, verify with the Architect/Engineer his color preference and furnish this color.
- F. Paint all equipment in unfinished areas such as boiler room, mechanical spaces, storage room, etc., furnished by this Contractor. Equipment furnished with a factory coat of paint and enamel need not be painted, provided the factory applied finish is not marred or spattered. If so, equipment shall be refinished with the same paint as was factory applied.

- G. Paint all outdoor uninsulated steel piping the color selected by Owner or Architect/Engineer.
- H. After surfaces have been thoroughly cleaned and are free of oil, dirt, and other foreign matter; paint all pipes and equipment with the following:
 - 1. Bare Metal Surfaces - Apply one coat of primer suitable for the metal being painted. Finish with two coats of Alkyd base enamel paint.
 - 2. Insulated Surfaces - Paint insulation jackets with two coats of semi-gloss acrylic latex paint.

3.9 ADJUST AND CLEAN

- A. Thoroughly clean all equipment and systems prior to the Owner's final acceptance of the project. Clean all foreign paint, grease, oil, dirt, labels, stickers, and other foreign material from all equipment.
- B. Clean all areas where moisture is present. Immediately report any mold, biological growth, or water damage.
- C. Remove all rubbish, debris, etc., accumulated during construction from the premises.

3.10 SPECIAL REQUIREMENTS

- A. Contractor shall coordinate the installation of all equipment, valves, etc., with other trades to maintain clear access area for servicing.
- B. All equipment shall be installed in such a way to maximize access to parts needing service or maintenance. Review the final field location, placement, and orientation of equipment with the Owner's designated representative prior to setting equipment.
- C. Installation of equipment or devices without regard to coordination of access requirements and confirmation with the Owner's designated representative will result in removal and reinstallation of the equipment at the Contractor's expense.
- D. In accordance with LEED EQc4.1, Low-Emitting Materials - Adhesives and Sealants, all adhesives and sealants used on the interior of the building must comply with the following requirements:
 - 1. Adhesives, sealants, and sealant primers must comply with South Coast Air Quality Management District (SCAQMD) Rule #1168.
 - 2. Aerosol adhesives must comply with Green Seal Standard for Commercial Adhesives GS-36 requirements in effect on October 19, 2000.

3.11 IAQ MAINTENANCE FOR OCCUPIED FACILITIES UNDER CONSTRUCTION

- A. Contractors shall make all reasonable efforts to prevent construction activities from affecting the air quality of the occupied areas of the building or outdoor areas near the building. These measures shall include, but not be limited to:
 - 1. All contractors shall endeavor to minimize the amount of contaminants generated during construction. Methods to be employed shall include, but not be limited to:
 - a. Minimizing the amount of dust generated.
 - b. Reducing solvent fumes and VOC emissions.
 - c. Maintain good housekeeping practices, including sweeping and periodic dust and debris removal. There should be no visible haze in the air.
 - 2. Request that the Owner designate an IAQ representative.
 - 3. Review and receive approval from the Owner's IAQ representative for all IAQ-related construction activities and negative pressure containment plans.

4. Inform the IAQ representative of all conditions that could adversely impact IAQ, including operations that will produce higher than normal dust production or odors.
5. Schedule activities that may cause IAQ conditions that are not acceptable to the Owner's IAQ representative during unoccupied periods.
6. Request copies of and follow all of the Owner's IAQ and infection control policies.
7. Unless no other access is possible, the entrance to construction site shall not be through the existing facility.
8. To minimize growth of infectious organisms, do not permit damp areas in or near the construction area to remain for over 24 hours.
9. In addition to the criteria above, provide measures as recommended in the SMACNA "IAQ Guidelines for Occupied Buildings Under Construction".

3.12 CONSTRUCTION WASTE MANAGEMENT

- A. This Contractor shall comply with all construction and demolition waste disposal and recycling requirements outlined in LEED MRc2: Construction Waste Management (follow latest edition at the time of bidding or as referenced in these specifications).
 1. This Contractor shall coordinate with the Construction Manager to develop and implement a construction waste management plan that, at a minimum, identifies the materials to be diverted from disposal and whether the materials will be sorted on-site or co-mingled.
 2. The Contractor shall track waste disposal and recycling efforts throughout the construction process for all materials associated with this Contractor's scope of work. The Contractor shall provide this information to the Construction Manager so that it can be incorporated with similar information from all other contractors for the project.
 - a. Calculations for waste and recycled material can be done by weight or volume, but they must be consistent throughout the project. The Contractor shall coordinate with the Construction Manager to establish the preferred calculation method and report the results accordingly.
 - b. Excavated soil and land-clearing debris do not count towards the waste disposal or recycled material.
 3. At a minimum, 50% of the construction and demolition debris for this project must be recycled or salvaged.

END OF SECTION

READINESS CERTIFICATION PRIOR TO FINAL JOBSITE OBSERVATION

To prevent the final job observation from occurring too early, we require that the Contractor review the completion status of the project and, by copy of this document, certify that the job is indeed ready for the final job observation. The following is a typical list of items that represent the degree of job completeness expected prior to your requesting a final job observation.

1. Penetrations fire sealed and labeled in accordance with specifications.
2. All pumps operating and balanced.
3. Fire protection system operational.
4. Pipes labeled.

Accepted by:

Prime Contractor _____

By _____ Date _____

Upon Contractor certification that the project is complete and ready for a final job observation, we require the Contractor to sign this agreement and return it to the Architect/Engineer so that the final observation can be scheduled.

It is understood that if the Architect/Engineer finds the job not ready for the final observation and that additional trips and observations are required to bring the project to completion, the costs incurred by the Architect/Engineers for additional time and expenses will be deducted from the Contractor's contract retainage prior to final payment at the completion of the job.

* * * * *

SECTION 21 05 29

FIRE SUPPRESSION SUPPORTS AND ANCHORS

1. PART GENERAL

1.1 SECTION INCLUDES

- A. Hangers, Supports, and Associated Anchors.
- B. Sleeves and Seals.
- C. Flashing and Sealing of Equipment and Pipe Stacks.
- D. Cutting of Openings.
- E. Escutcheon Plates and Trim.

1.2 QUALITY ASSURANCE

- A. Support Sprinkler Piping in conformance with NFPA 13.
- B. Support Standpipes in conformance with NFPA 14.

1.3 REFERENCES

- A. MSS SP-58 - Pipe Hangers and Supports - Materials, Design, Manufacture, Selection, Application, and Installation.
- B. MSS SP 69 - Pipe Hangers and Supports - Selection and Application.
- C. MSS SP 89 - Pipe Hangers and Supports - Fabrication and Installation Practices.
- D. MSS SP-127 – Bracing for Piping Systems Seismic-Wind-Dynamic Design, Selection, Application
- E. NFPA 13 - Standard for the Installation of Sprinkler Systems.
- F. NFPA 14 - Standard for the Installation of Standpipe and Hose Systems.

1.4 SUBMITTALS

- A. Submit shop drawings and product data under provisions of Section 21 05 00.

1.5 WORK FURNISHED BUT INSTALLED UNDER OTHER SECTIONS

- A. Furnish sleeves and hanger inserts to General Contractor for placement into formwork.

2. PART PRODUCTS

2.1 SEISMIC RESTRAINTS

- A. Refer to Section 21 05 50 for additional requirements for seismic restraints.

2.2 HANGER RODS

- A. Hanger rods for single rod hangers supporting steel, copper, and CPVC piping shall conform to the following:

<u>Pipe Size</u>	<u>Rod Size</u>
4" and smaller	3/8"
5", 6", 8"	1/2"
10" and 12"	5/8"

- B. Hanger rods and accessories used in mechanical spaces or otherwise dry areas shall have ASTM B633 electro-plated zinc finish.

- C. All hanger rods, nuts, washers, clevises, etc., in damp areas shall have ASTM A123 hot-dip galvanized finish applied after fabrication. This applies to the following areas:

1. Hot dipped galvanized is appropriate for outdoors very damp areas.

2.3 PIPE HANGERS AND SUPPORTS

A. General:

1. All pipe hangers, clamps, and supports shall conform to Manufacturers Standardization Society MSS-SP-58, 69, 89, and 127 (where applicable).

B. Vertical Supports:

1. Support and laterally brace vertical pipes at every floor level in multi-story structures, and more frequently when required by applicable codes, but never at intervals over 15 feet. Support vertical pipes with riser clamps installed below hubs, couplings or lugs. Provide sufficient flexibility to accommodate expansion and contraction without compromising fire barrier penetrations and other fixed takeoff locations.

Acceptable Products:

Anvil - Fig. CT121
 Cooper/B-Line - Fig. B3373CT
 Erico - Model 510
 Nibco/Tolco - Fig. 82

2. Wall supports shall be used where vertical height of structure exceeds minimum spacing requirements. Install wall supports at same spacing as hangers or strut supports along vertical length of pipe runs.
3. Masonry Anchors: Fasten to concrete masonry units with expansion anchors or self-tapping masonry screws. For expansion anchors into hollow concrete block, use sleeve-type anchors designed for the specific application. Do not fasten in masonry joints. Do not use powder actuated fasteners, wooden plugs, or plastic inserts.

C. Hangers and Clamps:

1. Hangers in direct contact with copper pipe shall be coated with plastic with appropriate temperature range.
2. Unless otherwise indicated, hangers shall be as follows:
 - a. Clevis Type: Bare Metal Pipe
 Service: Rigid Plastic Pipe

Acceptable Products:	Bare Steel, Plastic or Insulated Pipe	Bare Copper Pipe
Anvil	Fig. 260	Fig. CT65
Cooper/B-Line	Fig. 3100	Fig. B3104CT
Erico	Model 400	Model 402
Nibco/Tolco	Fig. 1	Fig. 81

- b. Adjustable Swivel Ring Type:
Service: Bare Metal Pipe - 100 mm and Smaller

Acceptable Products:	Bare Steel Pipe	Bare Copper Pipe
Anvil	Fig. 69	Fig. CT69
Cooper/B-Line	Fig. B3170NF	Fig. B170CT
Erico	Model FCN	
Nibco/Tolco	Fig. 200	Fig. 202

3. Support may be fabricated from U-channel strut or similar shapes. Piping less than 4" in diameter shall be secured to strut with clamps of proper design and capacity as required to maintain spacing and alignment. Strut shall be independently supported from hanger drops or building structure. Size and support shall be per manufacturer's installation requirements for structural support of piping. Clamps shall not interrupt piping insulation.
4. Strut used in mechanical spaces or otherwise dry areas shall have ASTM B633 electro-plated zinc finish.
5. Strut used in damp areas listed in hanger rods shall have ASTM A123 hot-dip galvanized finish applied after fabrication.
6. Unless otherwise indicated, pipe supports for use with struts shall be as follows:

- a. Clamp Type:
Service: Bare Metal Pipe
Rigid Plastic Pipe

- 1) Clamps in direct contact with copper pipe shall be plastic coated.
- 2) Pipes subject to expansion and contraction shall have clamps slightly oversized to allow limited pipe movement.

Acceptable Products:	Bare Steel, Plastic or Insulated Pipe	Bare Copper Pipe
Unistrut	Fig. P1100 or P2500	
Cooper/B-Line	Fig. B2000 or B2400	Fig. BVT
Nibco/Tolco	Fig. A-14 or 2STR	

D. Upper (Structural) Attachments:

1. Unless otherwise shown, upper attachments for hanger rods or support struts shall be as follows:

- a. Steel Structure Clamps:

- 1) C-Type Wide Flange Beam Clamps (for use on top and/or bottom of wide flanges. Not permitted for use with bar-joists.):

Acceptable Products:	
Anvil	Fig. 92
Cooper/B-Line	Fig. B3033/B3034
Erico	Model 300
Nibco/Tolco	68

2) Scissor Type Beam Clamps (for use with bar-joists and wide flange):

Acceptable Products:

Anvil	Fig. 228, 292
Cooper/B-Line	Fig. B3054
Erico	Model 360
Nibco/Tolco	Fig. 329

b. Concrete:

1) Concrete Inserts, Single Rod Galvanized:

Acceptable Products:

Anvil	Fig. 282
Cooper/B-Line	Fig. B3014
Erico	Model 355
Nibco/Tolco	Fig. 310

2) Concrete Inserts, Continuous Strip Galvanized:

Acceptable Products:

Unistrut Corp	P3200 Series
Cooper/B-Line	Fig. B22-J
Erico	CONCT

- c. Concrete Anchors: Fasten to concrete using cast-in or post-installed anchors designed per the requirements of Appendix D of ACI 318-05. Post-installed anchors shall be qualified for use in cracked concrete by ACI-355.2.

- d. Masonry Anchors: Fasten to concrete masonry units with expansion anchors or self-tapping masonry screws. For expansion anchors into hollow concrete block, use sleeve-type anchors designed for the specific application. Do not fasten in masonry joints. Do not use powder actuated fasteners, wooden plugs, or plastic inserts.

2. Steel Structure Welding:

- a. Unless otherwise noted, hangers, clips, and auxiliary support steel may be welded in lieu of bolting, clamping, or riveting to the building structural frame. Take adequate precautions during all welding operations for fire prevention and for protecting walls and ceilings from being damaged by smoke.

2.4 OPENINGS IN FLOORS, WALLS AND CEILINGS

- A. Exact locations of all openings for the installation of materials shall be determined by the Contractor and given to the General Contractor for installation or construction as the structure is built.
- B. Coordinate all openings with other Contractors.
- C. Hire the proper tradesman and furnish all labor, material and equipment to cut openings in or through existing structures, or openings in new structures that were not installed, or additional openings. Repair all spalling and damage to the satisfaction of the Architect/Engineer. Make saw cuts before breaking out concrete to ensure even and uniform opening edges.
- D. Said cutting shall be at the complete expense of each Contractor. Failure to coordinate openings with other Contractors shall not exempt the Contractor from providing openings at his expense.
- E. Do not cut structural members without written approval of the Architect or Structural Engineer.

2.5 PIPE SLEEVES AND LINTELS

- A. Each Contractor shall provide pipe sleeves and lintels for all openings required for the Contractor's work in masonry walls and floors, unless specifically shown as being by others.
- B. Fabricate all sleeves from standard weight black steel pipe or as indicated on the drawings. Provide continuous sleeve. Cut or split sleeves are not acceptable.
- C. Fabricate all lintels for masonry walls from structural steel shapes or as indicated on the drawings. Have all lintels approved by the Architect or Structural Engineer.
- D. Sleeves through the floors on exposed risers shall be flush with the ceiling, with planed squared ends extending 1" above the floor in unfinished areas, and flush with the floor in finished areas, to accept spring closing floor plates.
- E. Sleeves shall not penetrate structural members or masonry walls without approval from the Structural Engineer. Sleeves shall then comply with the Engineer's design.
- F. Openings through unexcavated floors and/or foundation walls below the floor shall have a smooth finish with sufficient annular space around material passing through opening so slight settling will not place stress on the material or building structure.
- G. Install all sleeves concentric with pipes. Secure sleeves in concrete to wood forms. This Contractor is responsible for sleeves dislodged or moved when pouring concrete.
- H. Where pipes rise through concrete floors that are on earthen grade, provide 20 mm resilient expansion joint material (asphalt and cork) wrapped around the pipe, the full depth of concrete, at the point of penetration. Secure to prevent shifting during concrete placement and finishing.
- I. Size sleeves large enough to allow expansion and contraction movement. Provide continuous insulation wrapping.
- J. Wall Seals ("Link-Seals"):
 - 1. Where shown on the drawings, pipes passing through walls, ceilings, or floors shall have their annular space (sleeve or drilled hole - not tapered hole made with knockout plug) sealed by properly sized sealing elements consisting of a synthetic rubber material compounded to resist aging, ozone, sunlight, water and chemical action.
 - 2. Sleeves, if used, shall be standard weight steel with primed finish and waterstop/anchor continuously welded to sleeve or thermoplastic with integral water seal and textured surface.
 - 3. Sleeves shall be at least 2 pipe sizes larger than the pipes.
 - 4. Pressure shall be maintained by stainless steel bolts and other parts. Pressure plates may be of composite material for Models S and OS.
 - 5. Sealing element shall be as follows:

Model	Service	Element Material	Temperature Range
S	Standard (Stainless)	EPDM	-40°F to 250°F
T	Fire Seals (1 hour)	Silicone	-67°F to 400°F
FS	Fire Seals (3 hours)	Silicone	-67°F to 400°F
OS	Oil Resistant/Stainless	Nitrile	-40°F to 210°F

- 6. Acceptable Manufacturers: Thunderline Corporation "Link-Seals", O-Z/Gedney Company, Calpico, Inc., Innerlynx, or Metraflex Company (cold service only).

2.6 ESCUTCHEON PLATES AND TRIM

- A. Fit escutcheons to all insulated or uninsulated exposed pipes passing through walls, floors, or ceilings of finished rooms.

- B. Escutcheons shall be heavy gauge, cold rolled steel, copper coated under a chromium plated finish, heavy spring clip, rigid hinge and latch.
- C. Install galvanized steel (unless otherwise indicated) trim strip to cover vacant space and raw construction edges of all rectangular openings in finished rooms. This includes duct and pipe openings.

2.7 PIPE PENETRATIONS

- A. Seal all pipe penetrations. Seal non-rated walls and floor penetrations with grout or caulk. Backing material may be used.
- B. Seal fire rated wall and floor penetrations with fire seal system as specified.

2.8 PIPE ANCHORS

- A. Provide all items needed to allow adequate expansion and contraction of all piping. All piping shall be supported, guided, aligned, and anchored as required.
- B. Repair all piping leaks and associated damage. Pipes shall not rub on any part of the building.

2.9 FINISH

- A. Prime coat exposed steel hangers and supports. Hangers and supports in crawl spaces, pipe shafts, and suspended ceiling spaces are not considered exposed.

3. PART EXECUTION

3.1 FIRE SUPPRESSION SUPPORTS AND ANCHORS

- A. General Installation Requirements:
 - 1. Install all items per manufacturer's instructions.
 - 2. Coordinate the location and method of support of piping systems with all installations under other Divisions and Sections of the Specifications.
 - 3. Where pipe support members are welded to structural building framing, scrape, brush clean, and apply one coat of zinc rich primer to welding.
- B. Supports Requirements:
 - 1. Where building structural steel is fireproofed, all hangers, clamps, auxiliary steel, etc., which attach to it shall be installed prior to application of fireproofing. Repair all fireproofing damaged during pipe installation.
 - 2. Set all concrete inserts in place before pouring concrete.
 - 3. Furnish, install and prime all auxiliary structural steel for support of piping systems that are not shown on the Drawings as being by others.
 - 4. Install hangers and supports complete with lock nuts, clamps, rods, bolts, couplings, swivels, inserts and required accessories.
 - 5. Hangers for horizontal piping shall have adequate means of vertical adjustment for alignment.

- C. Pipe Requirements:
1. Support all piping and equipment, including valves, strainers, and other specialties and accessories to avoid objectionable or excessive stress, deflection, swaying, sagging or vibration in the piping or building structure during erection, cleaning, testing and normal operation of the systems.
 2. Do not, however, restrain piping to cause it to snake or buckle between supports or to prevent proper movement due to expansion and contraction.
 3. Support piping at equipment and valves so they can be disconnected and removed without further supporting the piping.
 4. Piping shall not introduce strains or distortion to connected equipment.
 5. Parallel horizontal pipes may be supported on trapeze hangers made of structural shapes and hanger rods; otherwise, pipes shall be supported with individual hangers.
 6. Trapeze hangers may be used where ducts interfere with normal pipe hanging.
 7. Provide additional supports where pipe changes direction, adjacent to flanged valves and strainers, at equipment connections and heavy fittings.
 8. Provide at least one hanger adjacent to each joint in grooved end steel pipe with mechanical couplings.
- D. Provided the installation complies with all loading requirements of truss and joist manufacturers, the following practices are acceptable:
1. Loads of 100 lbs. or less may be attached anywhere along the top or bottom chords of trusses or joists with a minimum 915 mm spacing between loads.
 2. Loads greater than 100 lbs. must be hung concentrically and may be hung from top or bottom chord, provided one of the following conditions is met:
 - a. The hanger is attached within 6" from a web/chord joint.
 - b. Additional L2x2x1/4 web reinforcement is installed per manufacturer's requirements.
 3. It is prohibited to cantilever a load using an angle or other structural component that is attached to a truss or joist in such a fashion that a torsional force is applied to that structural member.
 4. If conditions cannot be met, coordinate installation with truss or joist manufacturer and contact Architect/Engineer.
- E. After piping and insulation installation are complete, cut hanger rods back at trapeze supports so they do not extend more than 3/4" below bottom face of lowest fastener and blunt any sharp edges.
- F. Do not exceed 25 lbs. per hanger and a minimum spacing of 2'-0" on center when attaching to metal roof decking (limitation not required with concrete on metal deck). This 25 lbs. load and 2'-0" spacing include adjacent electrical and architectural items hanging from deck. If the hanger restrictions cannot be achieved, supplemental framing off steel framing will need to be added.
- G. Do not exceed the manufacturer's recommended maximum load for any hanger or support.

H. Spacing of hangers shall in no case exceed the following:

	<u>Pipe Material</u>	<u>Maximum Spacing</u>
1.	Steel (All steel pipe unless otherwise noted):	
	1-1/4" & under	12'-0"
	1-1/2" & larger	15'-0"
2.	Steel (Schedule 40 lightweight alternative):	
	3" & under	12'-0"

I. Installation of hangers shall conform to MSS SP-58, 69, 89, and applicable NFPA standards.

END OF SECTION

SECTION 21 05 50

SEISMIC REQUIREMENTS FOR EQUIPMENT AND SUPPORTS

1. PART GENERAL

1.1 SECTION INCLUDES

- A. Seismic Requirements.

1.2 QUALITY ASSURANCE

A. General:

1. Items used for seismic restraint of equipment and systems shall be specifically manufactured for seismic restraint.
2. These requirements are beyond those listed in Section 21 05 29 of these specifications. Where a conflict arises between the seismic requirements of this section and any other section, the Architect/Engineer shall be immediately notified for direction to proceed.

B. Manufacturer:

1. System Supports/Restraints: Company specializing in the manufacture of products specified in this Section.
2. Equipment: Each company providing equipment that must meet seismic requirements shall provide certification included in project submittals the equipment supplied for the project meets or exceeds the seismic requirements of the project.

- C. Testing Agency: An independent testing agency, acceptable to Authorities Having Jurisdiction, with experience and capability to conduct the testing indicated.

- D. Installer: Company specializing in performing the work of this Section.

- E. Suppliers: Following is a partial list of manufacturer/supplier contact information for seismic restraints:

1. B-Line Systems, Inc. (800) 851-7415, www.b-line.com.
2. Unistrut Corporation <http://www.unistrut.us/>
3. Kinetics Noise Control (877) 457-2695, www.kineticsnoise.com.
4. Mason Industries, Inc. www.mason-ind.com.
5. Loos & Co., Inc. (800) 321-5667, www.loosnaples.com.
6. Tolco (909) 737-5599, www.tolco.com
7. ISAT 877.523.6060, www.isatsb.com
8. Vibro-Acoustics (416) 291-7371, <https://virs.vibro-acoustics.com/>

1.3 REFERENCES

- A. California Building Code (CBC)
- B. California Division of State Architect (DSA) Interpretation of Regulations
- C. ASHRAE - A Practical Guide to Seismic Restraint.
- D. ASCE 7-02, Chapter 9.
- E. ASCE 7-05, Chapter 13.
- F. ASCE 7-10, Chapter 13.
- G.
- H. NFPA 13 - Installation of Sprinkler Systems.
- I. NFPA 14 - Standpipe and Hose Systems.

1.4 SUBMITTALS

- A. Submit under provisions of Section 21 05 00.
- B. Submittal to Code Official:
 - 1. Contractor shall submit copies of the seismic shop drawings to the governing code authority for approval.
- C. Shop Drawings:
 - 1. Calculations, restraint selections, and installation details shall be designed and sealed by a Professional Structural Engineer licensed in the state where the project is located experienced in seismic restraint design and installation.
 - 2. Coordination Drawings: Plans and sections drawn to scale, coordinating seismic bracing of mechanical components with other systems and equipment in the vicinity, including other seismic restraints.
 - 3. Manufacturer's Certifications: Professional Structural Engineer licensed in the state where the project is located shall review and approve manufacturer's certifications of compliance.
 - 4. System Supports/Restraints - Submit for each condition requiring seismic bracing:
 - a. Calculations for each seismic brace and detail utilized on the project.
 - b. Plan drawings showing locations and types of seismic braces on contractor fabrication/installation drawings.
 - c. Cross-reference between details and plan drawings to indicate exactly which brace is being installed at each location. Details provided are to clearly indicate attachments to structure, correctly representing the fastening requirements of bracing.
 - d. Clear indication of brace design forces and maximum potential component forces at attachment points to building structure for confirmation of acceptability by the Structural Engineer of Record.
 - 5. Equipment - Submit for each piece of equipment supplied:
 - a. Certification that the equipment supplied for the project meets or exceeds the seismic requirements specified.
 - b. Specific details of seismic design features of equipment and maximum seismic loads imparted to the structural support.
 - c. Engineering calculations and details for equipment anchorage and support structure.

1.5 TESTING AND INSPECTION

- A. The Owner Contractor shall employ a DSA Inspection Agency to perform the duties as required by DSA.
- B. Work performed on the premises of a fabricator approved by the building official need not be tested and inspected. The fabricator shall submit a certificate of compliance that the work has been performed in accordance with the approved plans and specifications to the building official and the Architect and Engineer of Record.

- C. The Special Inspection Agency shall furnish inspection reports to the building official, the Owner, the Architect, the Engineer of Record, and the General Contractor. The reports shall be completed and furnished within 48 hours of inspected work. A final signed report stating whether the work requiring special inspection was, to the best of the Special Inspection Agency's knowledge, in conformance with the approved plans and specifications shall be submitted.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Deliver, store, protect and handle products to site. Accept material on site in factory containers and packing. Inspect for damage. Protect from damage and contamination by maintaining factory packaging until installation. Follow manufacturer's instructions for storage.

1.7 DESIGN REQUIREMENTS

- A. This project is subject to the seismic bracing requirements of California Building Code, Division of State Architect (DSA) Interpretation of Regulations.
- B. All seismic anchorage and bracing shall comply with FM Global Property Loss Prevention Data Sheet 1-11, Fire Following Earthquakes.

1.8 COORDINATION

- A. Coordinate layout and installation of seismic bracing with building structural systems and architectural features, and with mechanical, fire-protection, electrical and other building features in the vicinity.
- B. Coordinate concrete bases with building structural system.

1.9 WARRANTY

- A. Provide one-year warranty on parts and labor for manufacturer defects and installation workmanship.

2. PART PRODUCTS

2.1 SEISMIC DESIGN CRITERIA

- A. This section describes the requirements for seismic restraint of systems and equipment related to continued operation of the facility after a design seismic event.
- B. Definitions
 - 1. Stay in Place:
 - a. All systems and equipment shall be anchored and restrained such that the anchoring system is intended not to fail and equipment and/or system components will not fall.
 - 2. Remain Operational:
 - a. The following systems and associated equipment are intended not to fail externally or internally and are intended to remain operational.
 - 1) Fire Protection

2.2 SEISMIC BRACING AND SUPPORT OF SYSTEMS AND COMPONENTS

- A. General:
 - 1. Seismic restraint designer shall coordinate all attachments with the Structural Engineer of Record; refer to submittal requirements.

2. The seismic restraint design shall be based on actual equipment data obtained from manufacturer's submittals or the manufacturer. The equipment manufacturer shall verify and provide written certification the attachment points on the equipment can accept the combination of seismic, weight, and other imposed loads.
 3. Design analysis shall include calculated dead loads, static seismic loads, and capacity of materials utilized for the connection of the equipment or system to the structure.
 4. Analysis shall detail anchoring methods, bolt diameter, embedment, and weld length.
 5. All seismic restraint devices shall be designed to accept without failure the forces calculated per the applicable building code.
- B. Friction from gravity loads shall not be considered resistance to seismic forces.
- C. Fire protection systems shall meet the requirements of NFPA-13 and NFPA-14 for the building seismic requirements.

2.3 MATERIALS

- A. Use the following materials for restraints:
1. Indoor Dry Locations: Steel, zinc plated.
 2. Outdoors and Damp Locations: Galvanized steel.
 3. Corrosive Locations: Stainless steel.

2.4 ANCHORAGE AND STRUCTURAL ATTACHMENT COMPONENTS

- A. Strength: Defined in reports by ICC Evaluation Service or another agency acceptable to authorities having jurisdiction.
1. Structural Safety Factor: Strength in tension and shear of components used shall be at least two times the maximum seismic forces to which they will be subjected.
- B. Concrete and Masonry Anchor Bolts and Studs: Steel-expansion wedge type. Comply with IBC, ACI and ICC ES requirements for cracked concrete anchors.
- C. Concrete Inserts: Steel-channel type.
- D. Through Bolts: Structural type, hex head, high strength. Comply with ASTM F3125, Grade A 325.
- E. Welding Lugs: Comply with MSS SP-69, Type 57.
- F. Beam Clamps for Steel Beams and Joists: Double sided. Single-sided type is not acceptable.
- G. Bushings for Floor-Mounted Equipment Anchors: Neoprene units designed for seismically rated rigid equipment mountings, and matched to the type and size of anchor bolts and studs used.
- H. Bushing Assemblies for Wall-Mounted Equipment Anchorage: Assemblies of neoprene elements and steel sleeves designed for seismically rated rigid equipment mountings, and matched to the type and size of attachment devices used.

2.5 SEISMIC BRACING COMPONENTS

- A. Slotted Steel Channel: 41-by-41-mm cross section, formed from 2.7-mm-thick steel, with 14-by-22-mm slots at a maximum of 50 mm o.c. in webs, and flange edges turned toward web.
1. Materials for Channel: ASTM A 1011, GR 33.
 2. Materials for Fittings and Accessories: ASTM A 635, ASTM A 576, or ASTM A 36.

3. Fittings and Accessories: Products of the same manufacturer as channels and designed for use with that product.
 4. Finish: Baked, rust-inhibiting, acrylic-enamel paint applied after cleaning and phosphate treatment, unless otherwise indicated.
- B. Cable-Type Bracing Assemblies: Zinc-coated, high-strength steel wire rope cable attached to steel thimbles, brackets, and bolts designed for cable service.
1. Arrange units for attachment to the braced component at one end and to the structure at the other end.
 2. Wire Rope Cable: Comply with ASTM A 603. Use 49- or 133-strand cable with a minimum strength of 2 times the calculated maximum seismic force to be resisted.
- C. Hanger Rod Stiffeners: Slotted steel channels with internally bolted connections to hanger rod.

3. PART EXECUTION

3.1 INSTALLATION

- A. Refer to the applicable code sections and Authority Having Jurisdiction for the exact seismic restraint requirements of piping, ductwork, conduit, equipment, etc.
- B. Layout of transverse and longitudinal bracing shall follow recommendations of approved design standards listed in Part 1 of this specification section.
- C. All rigid floor mounted equipment shall have a resilient media between the equipment mounting hole and the anchor bolt in concrete.
- D. All seismic restraint systems shall be installed in strict accordance with the manufacturer's written instructions and all certified submittal data.
- E. Installation of seismic restraints shall not cause any change in position of equipment, piping, or ductwork, resulting in stresses or misalignment.
- F. No rigid connections between equipment and the building structure shall be made that degrade the noise and vibration-isolation system specified.
- G. Do not install any equipment, piping, duct, or conduit that makes rigid connections with the building unless isolation is not specified.
- H. Coordinate work with all other trades to avoid rigid contact with the building. Any conflicts with other trades that will result in rigid contact with equipment or piping due to inadequate space or other unforeseen conditions shall be brought to the Architect/Engineer's attention prior to specific equipment selection.
- I. Prior to installation, bring to the Architect/Engineer's attention any discrepancies between the specifications and the field conditions, or changes required due to specific equipment selection.
- J. Bracing may occur from flanges of structural beams, upper truss cords of bar joists, cast in place inserts, or International Code Council approved seismic anchors for installation in concrete.
- K. Cable restraints shall be installed slightly slack to avoid short-circuiting the isolated suspended equipment, ductwork, piping, or conduit.
- L. Cable assemblies shall be installed taut on non-isolated systems. Solid braces may be used in place of cables on rigidly attached systems only.
- M. Do not install cables over sharp corners.

- N. Brace support rods when necessary to accept compressive loads. Welding of compression braces to the vertical support rods is not acceptable.
- O. Provide reinforced clevis bolts when required.
- P. The vibration isolation manufacturer shall furnish integral structural steel bases as required. Independent steel rails are not acceptable.
- Q. Post-Installed anchors shall be provided to meet seismic requirements.
- R. Vertical pipe risers flexibly supported to accommodate thermal motion and/or pipe vibration shall be guided to maintain pipe stability and provide horizontal seismic restraint.
- S. Seismic restraints shall be mechanically attached to the system. Looping restraints around the system is not acceptable.
- T. Piping crossing building seismic or expansion joints, passing from building to building, or supported from different portions of the building shall be installed to allow differential support displacements without damaging the pipe, equipment connections, or support connections. Pipe offsets, loops, anchors, and guides shall be installed as required to provide required motion capability and limit motion of adjacent piping.
- U. Do not brace a system to two different structures such as a wall and a ceiling.
- V. Provide appropriately sized openings in walls, floors, and ceilings for anticipated seismic movement. Provide fire seal systems in fire-rated walls.
- W. Exposed seismic supports in occupied areas shall be guarded or covered to protect occupants.

END OF SECTION

SECTION 21 05 53

FIRE SUPPRESSION IDENTIFICATION

1. PART GENERAL

1.1 SECTION INCLUDES

- A. Identification of products installed under Division 21.

1.2 REFERENCES

- A. ANSI/ASME A13.1 - Scheme for the Identification of Piping Systems.
- B. ASTM B-1, B-3, and B-8 for copper conductors.
- C. ASTM D-1248 for Polyethylene Extrusion Materials, ICEA S-70-547 Weatherproof Resistant Polyethylene Conductors, ICEA S-61-402/NEMA WC5 Thermoplastic Insulated Wire & Cable, ICEA S-95-658/NEMA WC70 Non-Shielded 0 – 2kv Cables.
- D. UL 1581 Standard for Electrical Wires, Cables, and Flexible Cords.

1.3 SUBMITTALS

- A. Submit shop drawings under provisions of Section 21 05 00. Include list of items identified, wording, letter sizes, and color coding.
- B. Include valve chart and schedule listing valve tag number, location, function, and valve manufacturer's name and model number.

2. PART PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

- A. 3M, Bunting, Calpico, Craftmark, Emedco, Kolbi Industries, Seton, W.H. Brady, Marking Services.

2.2 MATERIALS

- A. All pipe markers (purchased or stenciled) shall conform to ANSI A13.1. Marker lengths and letter sizes shall be at least the following:

<u>OD of Pipe or insulation</u>	<u>Marker Length</u>	<u>Size of Letters</u>
Up to and including 1-1/4"	8"	1/2"
1-1/2" to 2"	8"	3/4"
2-1/2" to 6"	12"	1-1/4"
8" to 10"	24"	2-1/2"
Over 10"	32"	3-1/2"

Plastic tags may be used for outside diameters under 3/4".

- B. Plastic Nameplates: Laminated three-layer phenolic with engraved black, 1/4" minimum letters on light contrasting background.
- C. Aluminum Nameplates: Black enamel background with natural aluminum border and engraved letters furnished with two mounting holes and screws.
- D. Plastic Tags: Minimum 1-1/2" square or round laminated three-layer phenolic with engraved, 1/4" minimum black letters on light contrasting background.

- E. Brass Tags: Brass background with engraved black letters. Tag size minimum 1-1/2" square or 1-1/2" round.
- F. Plastic Pipe Markers: Semi-rigid plastic, preformed to fit around pipe or pipe covering; indicating flow direction and fluid conveyed.
- G. Vinyl Pipe Markers: Colored vinyl with permanent pressure sensitive adhesive backing.
- H. Stencil Painted Pipe Markers: Use industrial enamel spray paint per ANSI Standard A13.1. Indicate fluid conveyed and flow direction.
- I. Underground Pipe Markers: Bright colored continuously printed plastic ribbon tape 6" wide by 3.5 mills thick, manufactured for direct burial, with aluminum foil core for location by non-ferric metal detectors and bold lettering identifying buried item.
- J. Tracer Wire:
 - 1. Single copper conductors shall be solid or stranded annealed or hard uncoated copper per UL83 and ASTM requirements. Tracer tape or copper-coated steel wire is not acceptable.
 - 2. Conductor shall be insulated with HMWPE as specified and applied in a concentric manner. The minimum at any point shall not be less than 90% of the specified average thickness in compliance with UL 83.
 - 3. Tracer wire shall be continuously spark tested at 7500 Volts DC. Other electrical and mechanical tests shall be in accordance with UL 1581.

3. PART EXECUTION

3.1 INSTALLATION

- A. Install all products per manufacturer's recommendations.
- B. Degrease and clean surfaces to receive adhesive for identification materials.
- C. Valves:
 - 1. All valves (except shutoff valves at equipment) shall have numbered tags.
 - 2. Provide or replace numbered tags on all existing valves that are connected to new systems or that have been revised.
 - 3. Provide all existing valves used to extend utilities to this project with numbered tags. Review tag numbering sequence with the Owner prior to ordering tags.
 - 4. Secure tags with heavy duty key chain and brass "S" link or with mechanically fastened plastic straps.
 - 5. Attach to handwheel or around valve stem. On lever operated valves, drill the lever to attach tags.
 - 6. Number all tags and show the service of the pipe.
 - 7. Provide one Plexiglas framed valve directory listing all valves, with respective tag numbers, uses and locations. Mount directory in location chosen by the Architect/Engineer.

D. Pipe Markers:

1. Adhesive Backed Markers: Use Brady Style 1, 2, or 3 on pipes 3" diameter and larger. Use Brady Style 4, 6, or 8 on pipes under 3" diameter. Similar styles by other listed manufacturers are acceptable. Secure all markers at both ends with a wrap of pressure sensitive tape completely around the pipe.
2. Snap-on Markers: Use Seton "Setmark" on pipes up to 5-7/8" OD. Use Seton "Setmark" with nylon or Velcro ties for pipes 6" OD and over. Similar styles by other listed manufacturers are acceptable.
3. Stencil Painted Pipe Markers:
 - a. Remove rust, grease, dirt, and all foreign substances from the pipe surface.
 - b. Apply primer on non-insulated pipes before painting.
 - c. Use background and letter colors as scheduled later in this section.
4. Apply markers and arrows in the following locations where clearly visible:
 - a. At each valve.
 - b. On both sides of walls that pipes penetrate.
 - c. At least every 20 feet along all pipes.
 - d. On each riser and each leg of each "T" joint.
 - e. At least once in every room and each story traversed.
5. Underground Pipe Markers: Install 8" to 10" below grade, directly above buried pipes.

E. Equipment:

1. All equipment not easily identifiable such as controls, relays, gauges, etc.; and all equipment in an area remote from its function shall have nameplates or plastic tags listing name, function, and drawing symbol. Do not label exposed equipment in public areas.
2. Fasten nameplates or plastic tags with stainless steel self-tapping screws or permanently bonding cement.
3. Mechanical equipment that is not covered by the U.S. National Appliance Energy Conservation Act (NAECA) of 1987 shall carry a permanent label installed by the manufacturer stating that the equipment complies with the requirements of ASHRAE 90.1.

3.2 SCHEDULE

- A. Pipes to be marked shall be labeled with the text as shown in the following table regardless of which method or material is used:

Pipe Service	Lettering Color	Background Color
FIRE PROTECTION WATER	White	Red
SPRINKLER WATER	White	Red
Tracer Wire - Water Pipe Lines	---	Blue
Tracer Wire - All other buried types	---	Green

- B. All piping downstream of the fire protection backflow preventer, upstream of sprinkler zone valves, standpipe piping, and combination sprinkler standpipe piping shall be labeled Fire Protection Water. All piping downstream of sprinkler zone valves shall be labeled Sprinkler Water.

END OF SECTION

SECTION 21 13 00

FIRE PROTECTION SYSTEMS

1. PART GENERAL

1.1 SECTION INCLUDES

- A. Pipe, Fittings, Valves, Sprinklers and Connections for Fire Protection System.
- B. Wet-Pipe Sprinkler System.
- C. Standpipe System.

1.2 QUALITY ASSURANCE

- A. Welding Materials and Procedures: Conform to ASME Code AWS D1.1-Structural Welding Code – Steel.
- B. Equipment and Components: Bear UL/FM label or marking.
- C. Valves: Bear UL/FM label or marking. Provide manufacturer's name and pressure rating marked on valve body. Pressure rating shall match specified pipe system pressure rating. Remanufactured valves are not acceptable.
- D. Specialist Firm: Company specializing in sprinkler systems with minimum three years' experience.
- E. Sprinkler design drawings submitted by the C16 Contractor shall be prepared by a PE, and signed and sealed by a Professional Engineer licensed in the state where the project is located.
- F. Fire sprinkler system pipefitters responsible for installing, altering, or repairing water-based fire protection systems will require certification by the California State Fire Marshal's office.
- G. All work shall be in accordance with NFPA 13.

1.3 REFERENCES

- A. ANSI/ASME B16.1 - Cast Iron Pipe Flanges and Flanged Fittings, Class 25, 125, 250, and 800.
- B. ANSI/ASME B16.3 - Malleable Iron Threaded Fittings, Class 150 and 300.
- C. ANSI/ASME B16.4 - Cast Iron Threaded Fittings, Class 125 and 250.
- D. ANSI/ASME B16.5 - Pipe Flanges and Flanged Fittings.
- E. ANSI/ASME B16.9 - Factory-made Wrought Steel Butt-Welding Fittings.
- F. ANSI/ASME B16.11 - Forged Steel Fittings, Socket-Welding and Threaded.
- G. ANSI/ASME B16.25 - Butt-Welding Ends.
- H. ANSI/ASME B36.10 - Welded and Seamless Wrought Steel Pipe.
- I. ANSI/ASME Section 9 - Welding and Brazing Qualifications.
- J. ANSI/ASTM A47 - Malleable Iron Castings.
- K. ANSI/ASTM A135 - Electric-Resistance-Welded Steel Pipe.
- L. ANSI/AWWA C110 - Ductile Iron and Gray Iron Fittings.
- M. ANSI/AWWA C151 - Ductile Iron Pipe, Centrifugally Cast.
- N. ASTM A53 - Pipe, Steel, Black and Hot-Dipped, Zinc-coated Welded and Seamless.
- O. AWS D10.9 - Specifications for Qualification of Welding Procedures and Welders for Piping and Tubing.
- P. FM - FM Global Approval Guide.
- Q. NFPA 101 - Life Safety Code,
- R. NFPA 13 - Installation of Sprinkler Systems.
- S. NFPA 14 - Standpipe and Hose Systems.
- T. NFPA 24 - Standard for the Installation of Private Fire Service Mains and Their Appurtenances.
- U. NFPA 25 - Standard for the Inspection, Testing, and Maintenance of Water-Based Fire Protection Systems.
- V. UL - Underwriter's Laboratory Fire Protection Equipment Directory.
- W. CBC California Building Code

- X. CFC California Fire Code

1.4 SUBMITTALS

- A. Submit shop drawings per Section 21 05 00. Indicate pipe materials, joining methods, supports, floor and wall penetration seals, sprinklers, equipment data and ratings, and hydraulic calculations.
- B. Submit detailed pipe and sprinkler layout and other calculations and forms as described in NFPA 13.
- C. Submit detailed working drawings and obtain review of them in the following order:
 - 1. Engineer/Architect.
 - 2. State Fire Marshal/Authority Having Jurisdiction
 - 3. Owner's Insurance Company
 - 4. Architect/Engineer

Begin construction after all approvals are received.

- D. Working drawings shall include piping and sprinkler layout, sprinkler types and ratings, sections and elevations at critical points. Show coordination with lighting, ductwork, and diffusers, and indicate basic flow and hydraulic design information, including main location and date that the test was taken.
- E. Submit electrical power/controls wiring diagrams and product data indicating general assembly, components, safety controls, and service connections.
- F. Provide the Owner with one copy of NFPA 25. *Standard for the Inspection Testing and Maintenance of Water-based Fire Protection Systems*.

1.5 EXTRA STOCK

- A. Provide metal storage cabinet, wrenches for each sprinkler type, and extra sprinklers per NFPA 13 and applicable building code.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Store valves and sprinklers in shipping containers, with labels in place.
- B. Provide temporary protective coating on iron and steel valves.
- C. Maintain temporary end caps and closures in place until installation.

1.7 WORK FURNISHED BUT INSTALLED UNDER OTHER SECTIONS

- A. Furnish sleeves to General Contractor for placement in walls and floors. Sleeve location to be determined by the Fire Protection Contractor prior to construction. If additional sleeves are required, they shall be core drilled by the Fire Protection Contractor.

1.8 SYSTEM DESCRIPTION

- A. Shop drawings shall follow the DSA approved drawings.
- B. System shall interface with building fire alarm system.
- C. Provide wet pipe sprinkler system to NFPA 13 and building code requirements as required by Owner's insurance company and as shown on the drawings. Provide standpipe system to NFPA 14 and building code requirements as required by Owner's insurance company and as shown on the drawings.
- D. Provide a Fire Department connection, if not provided within the site system.

1.9 REGULATORY REQUIREMENTS

- A. All material, equipment, and installation shall be approved by the Authorities Having Jurisdiction and the Owner's Insurance Company.
- B. The Authorities Having Jurisdiction and the Owner's Insurance Company shall have precedence over the drawings and specifications in case of discrepancies.
- C. The entire installation shall comply with all applicable codes.

1.10 COORDINATION DRAWINGS

- A. Reference Coordination Drawings article in Section 21 05 00 for required fire protection systems electronic CAD drawings to be provided to Coordinating Contractor for inclusion into composite coordination drawings.

1.11 OPERATION AND MAINTENANCE DATA

- A. Submit manufacturers' operation and maintenance data. Include written maintenance data on components of system, servicing requirements, and record drawings.

2. PART PRODUCTS

2.1 VALVES

A. Manufacturers:

- 1. Milwaukee.
- 2. Stockham.
- 3. Kennedy.
- 4. Mueller.
- 5. Substitutions: Section 01 60 00 - Product Requirements.

B. Gate Valves:

- 1. Up to and including 2 inches: Bronze body and trim, rising stem, hand wheel, solid wedge or disc, threaded ends. Similar to Stockham Model No. B-133.
- 2. Over 2 inches: Iron body, bronze trim, rising stem pre-grooved for mounting tamper switch, hand wheel, OS&Y, solid bronze or cast-iron wedge, flanged ends. Similar to Stockham Model No. G-634.

C. Globe or Angle Valves:

- 1. Up to and including 2 inches: Bronze body, bronze trim, rising stem and hand wheel, inside screw, renewable Buna n Seat disc, threaded ends, with back seating capacity. Similar to Kennedy Model No. 98-SD.

D. Ball Valves:

- 1. Up to and including 2 inches: Bronze two-piece body, brass, chrome plated bronze, or stainless steel ball, teflon seats and stuffing box ring, lever handle, threaded ends. Similar to Kennedy Model No. 775.

E. Butterfly Valves:

1. Bronze Body: Stainless steel disc, resilient replaceable seat, threaded or grooved ends, extended neck, hand wheel and gear drive and integral indicating device, and built-in tamper proof switch rated 10 amp at 115 volt AC.
2. Cast or Ductile Iron Body: Cast or ductile iron, chrome or nickel-plated ductile iron or aluminum bronze disc, resilient replaceable EPDM seat, wafer, lug, or grooved ends. With extended neck, hand wheel and gear drive and integral indicating device, and external tamper switch rated 10 amp at 115 volt AC.

F. Check Valves:

1. Up to and including 2 inches: Bronze body and swing disc, rubber seat, threaded ends. Similar to Stockham Model No. B-319Y.
2. Over 2 inches: Iron body, bronze trim, swing check, renewable disc and seat, flanged ends. Similar to Stockham Model No. G-939.
3. 4 inches and Over: Iron body, bronze disc with stainless steel spring, resilient seal, threaded, wafer, or flanged ends.

2.2 ABOVE GROUND PIPING

A. Steel Pipe: ASTM A53/A53M, Grade B; ASTM A135; ASTM A135 UL listed, threadable, light wall for mains larger than 2 inch; or ASTM A795; Schedule 40 black, outside applications shall be galvanized pipe. Pipes shall have a corrosion resistance ratio (CRR) of 1.00 or greater per UL listing. Piping shall be black carbon steel, except in FM approved dry systems, where pipe shall be hot-dipped galvanized to meet ASTM A795 zinc coating specifications. Pipe shall be Schedule 40 or equal; for 2 inches and smaller. Threaded joints and fittings. Schedule 10 for pipes size 2-1/2 inches or larger. Victaulic or grooved fittings may be used.

1. Steel Fittings: ASME B16.9, wrought steel, butt welded; ASME B16.25, butt weld ends; ASTM A234/A234M, wrought carbon steel and alloy steel; ASME B16.5, steel flanges and fittings; or ASME B16.11, forged steel socket welded and threaded.
2. Cast Iron Fittings: ASME B16.1, flanges and flanged fittings; or ASME B16.4, threaded fittings.
3. Malleable Iron Fittings: ASME B16.3, threaded fittings or ASTM A47.

2.3 SPRINKLERS

A. Manufacturers:

1. Ansul Incorporated.
2. Automatic Sprinkler Corp.
3. Grinnell Corp.
4. Reliable Sprinkler Corp.
5. Substitutions: Section 01 60 00 - Product Requirements.

B. Suspended and Hard Lid Ceiling Type:

1. Type: Recessed or Concealed pendant type with matching push on or screw on escutcheon plate as directed by the architect.
2. Finish: Chrome plated, or Enamel, color white as directed by the Architect.

3. Escutcheon Plate Finish: Chrome plated or Enamel, color white as directed by the Architect.
 4. Fusible Link: Quick response, glass bulb type temperature rated for specific area hazard.
 5. Similar to Reliable Model No. FIFR or G4A.
- C. Exposed Area Type:
1. Type: Standard upright type with guard as required.
 2. Finish: Brass.
 3. Fusible Link: Quick response glass bulb type temperature rated for specific area hazard.
 4. Similar to Reliable Model No. FIFR.
- D. Side wall Type:
1. Type: Standard or Recessed horizontal side wall type with matching push on or screw on escutcheon plate as directed by the Architect.
 2. Finish: Chrome plated, enamel, color white , as directed by the Architect.
 3. Escutcheon Plate Finish: Chrome plated or Enamel, color white as directed by the Architect.
 4. Fusible Link: Quick response glass bulb type temperature rated for specific area hazard.
 5. Similar to Reliable Model No. SW56.
- E. Exterior Type:
1. Dry Type: Recessed or Concealed pendant type with matching push on or screw on escutcheon plate.
 2. Finish: Chrome plated, or Enamel, color white as directed by the Architect.
 3. Escutcheon Plate Finish: Chrome plated or Enamel, color white as directed by the Architect.
 4. Fusible Link: Quick response, glass bulb type temperature rated for specific area hazard.
 5. Similar to Reliable Model No. F3QR.
- F. Guards: Finish to match sprinkler finish.

2.4 PIPING SPECIALTIES

- A. Wet Pipe Sprinkler Alarm Valve: Check type valve with EPDM seat, clapper to automatically actuate water motor alarm, with pressure retard chamber and variable pressure trim similar to Reliable Model No. G.
- B. Sprinkler Inspector's Test Fittings:
1. Standard: UL's listed or FM Global approved.
 2. Pressure Rating: 3000 psig.
 3. Body Material: Bronze body, brass stem, steel handle, chrome-plated bronze ball, virgin Teflon valve seat. Sight Glass: Bronze housing with viewing window.
 4. Components: A tamper resistant test orifice and a tapped port for system access.

5. Test Orifice Size: Nominal ½" as required by NFPA.
 6. Size: F.I.P.T., same as connected piping.
 7. Inlet and Outlet: Threaded.
 8. Similar to AGF Model No. 3011SG.
- C. Water Flow Switch: Vane type switch for mounting horizontal or vertical, with two contacts; rated 10 amp at 125 volt AC. Similar to Potter Electric Model No. VSR.
- D. Fire Department Connections:
1. Type: Flush mounted wall type with chrome plated finish.
 2. Outlets: Two-way with fire department thread size. Threaded dust-cap and chain of matching material and finish.
 3. Drain: 3/4 inch automatic drip, outside.
 4. Label: "Sprinkler - Fire Department Connection"
 5. Similar to Potter Roemer Model No. 5021F.

3. PART EXECUTION

3.1 INSTALLATION - PIPING

- A. General Installation Requirements:
1. Coordinate piping and sprinkler locations with all other trades. Ductwork, diffusers and light fixture locations shall have priority over sprinkler piping and sprinklers.
 2. Ream pipe and tube ends to full inside diameter. Remove burrs. Remove scale and foreign material, inside and outside, before assembly.
 3. Die cut screw joints with full cut standard taper pipe threads.
 4. Coat threads with pipe joint compound or wrap with Teflon tape.
 5. Locate piping to minimize obstruction of other work.
 6. Route piping in concealed spaces above finished ceiling.
 7. Use full and double lengths of pipe wherever possible.
 8. Slope all piping for complete drainage. Install auxiliary drains for all trapped piping per NFPA 13.
 9. Reducers are generally not shown. Where pipe sizes change at tee, the tee shall be the size of the largest pipe shown connecting to it.
 10. Comply with manufacturer's installation instructions.

B. Steel Piping:

1. In steel piping, main sized saddle branch connections or direct connection of branches to main is permitted if main is one pipe size larger than the branch for up to 6" mains and if main is two pipe sizes larger than branch for 8" and larger mains. Do not project branch pipes into main pipes.

C. Wall/Floor Penetration:

1. Provide sleeves when penetrating floors and walls.
2. Seal pipes passing through exterior walls with a wall seal per Section 21 05 29. Provide Schedule 40 galvanized sleeve at least 2 pipe sizes larger than the pipe. Sleeves through floors shall extend minimum 2" above finished floor.
3. Fire seal all pipe and sleeve penetrations (both wall and floor) to maintain fire separation required without restraining pipe.

D. Installation Requirements in Electrical Rooms:

1. Do not install piping or other equipment above electrical switchboards or panelboards. This includes a dedicated space extending 25'-0" from the floor to the structural ceiling with width and depth equal to the equipment. Fire protection equipment dedicated to the electrical equipment room or space may be installed above equipment if other alternatives are not available.

E. Hangers and Supports:

1. Hangers and supports are per NFPA 13 and UL/FM, with the following exceptions:
 - a. Do not use powder driven devices, explosive devices, wooden plugs, or plastic inserts.
 - b. Do not install fasteners to carry the load in tension, unless absolutely necessary.
2. Seismic supports are designed using Tolbrace by Tolco, or equivalent program accounting for Fp and Cp factors for 2-way and 4-way bracing. Seismic zone of influence are shown on the drawings to support these calculations. Tolbrace details are included in the drawings.

F. Exposed Piping:

1. Install chrome plated steel escutcheons where exposed pipes penetrate walls or floors.

3.2 INSTALLATION - VALVES

- A. Install gate valves with stems upright or horizontal, not inverted.

B. Shutoff Valve:

1. Install buried shutoff valves in valve boxes. Provide post indicators.
2. Provide drain valves at main shutoff valves, low points of piping and apparatus.

3.3 INSTALLATION - EQUIPMENT

- A. Coordinate piping and sprinkler locations with all other trades. Ductwork, diffusers and light fixture locations shall have priority over system equipment and sprinklers.

- B. Alarm Bell:
 - 1. Locate outside alarm bell on building wall as shown on drawings.
 - 2. Wire all bells, flow switches and supervisory switches to fire alarm system. All wiring shall be in conduit and meet the requirements of the electrical specifications.
- C. Test Valves:
 - 1. Install test valves where required. Pipe to outdoors or drain. Test connection shall have flow equivalent to the smallest K-factor sprinkler.
- D. Sprinklers:
 - 1. Locate sprinklers to clear lights, ducts and diffusers. Do not run sprinkler pipes through ducts. Ductwork has priority over sprinkler pipes. Offset pipes as needed.
 - 2. Center sprinklers in two directions in ceiling tiles and provide offsets as required.
 - 3. Do not allow concealed sprinkler cover plates to be painted. Sprinkler cover plates are to be factory painted only. Do not field paint.
 - 4. Apply strippable or paper covers so concealed sprinkler cover plates do not receive field paint finish.

3.4 INSTALLATION - STANDPIPE AND HOSE SYSTEM

- A. Locate and secure hose cabinet plumb.
- B. Locate angle valve in cabinet at 1500 mm above floor. Locate fire department connection below angle valve and not closer than 100 mm from side or bottom of cabinet.
- C. Connect wet standpipe system to water source ahead of domestic water connection.
- D. Where static pressure exceeds 1210 kPa gauge at any hose station, provide pressure regulating valves to limit the pressure on hose to 690 kPa.
- E. Where residual pressure at Class III hose station (40 mm) exceeds 690 kPa gauge, provide a pressure regulating valve to limit the residual pressure on the hose to 690 kPa gauge.
- F. Provide connection for alarm and supervisory control to building alarm system.
- G. Install backflow preventer as required by local Authorities Having Jurisdiction and as indicated on Fire Protection Material List.

3.5 SYSTEMS CLEANING AND TESTING

- A. General Requirement:
 - 1. All water used for testing and remaining in the piping system shall be obtained from a potable water source.
- B. Underground Piping:
 - 1. Flush all underground piping with minimum flow equal to the system design flow but not less than the following:
 - a. 25 l/s for 100 mm pipes.
 - b. 55 l/s for 150 mm pipes.
 - c. 100 l/s for 200 mm pipes.

- d. 155 l/s for 250 mm pipes.
 - e. 225 l/s for 300 mm pipes.
 - 2. Branches from existing or new underground mains to sprinkler risers shall be flushed out through two 65 mm hoses (with flow through open hose butts) attached to the riser with 100 mm temporary piping. Flushing through the drain of an alarm check or dry pipe valve is not acceptable.
- C. Interior Piping:
- 1. Verify adequate water flow at the inspector's test connection.
 - 2. Flush all interior piping to remove scale and other foreign material before placing system into service.
 - 3. Hydrostatically test the entire interior piping system at a minimum of 1380 kPa gauge or 345 kPa gauge more than the normal system working pressure for systems subjected to pressures more than 1035 kPa gauge. Maintain test pressure for 2 hours without loss of pressure.
- D. Standpipe and Hose Systems:
- 1. Hydrostatically test standpipe and hose systems in accordance with NFPA 14 and applicable building code requirements.
- E. Fire Alarm System:
- 1. Test the alarm system by operating the inspector's test connection or the alarm test valves. Verify that the building fire alarm system activates.
 - 2. Adjust all monitor switches for proper operation.

END OF SECTION

SECTION 22 05 00

BASIC PLUMBING REQUIREMENTS

1. PART GENERAL

1.1 SECTION INCLUDES

- A. Requirements applicable to all Division 22 Sections. Also refer to Division 1 - General Requirements.
- B. All materials and installation methods shall conform to the applicable standards, guidelines and codes referenced herein and within each specification section.

1.2 REFERENCES

- A. CCR California Code of Regulation
- B. CBC California Building Code
- C. CFC California Fire Code
- D. CEC California Electric Code
- E. CMC California Mechanical Code
- F. CPC California Plumbing Code
- G. California Title 24 - Building Energy Efficiency Standards
- H. SCAQMD Southern California Air Quality Management Division

1.3 DIVISION OF WORK BETWEEN MECHANICAL, ELECTRICAL & CONTROL CONTRACTORS

A. Definitions:

- 1. "Mechanical Contractors" refers to the following:
 - a. Plumbing Contractor.
 - b. Air Conditioning and Ventilating Contractor.
 - c. Temperature Control Contractor.
 - d. Fire Protection Contractor.
 - e. Testing, Adjusting, and Balancing Contractor.
- 2. Motor Control Wiring: The wiring associated with the remote operation of the magnetic coils of magnetic motor starters or relays, or the wiring that permits direct cycling of motors by means of devices in series with the motor power wiring. In the latter case the devices are usually single phase and are usually connected to the motor power wiring through a manual motor starter having "Manual-Off-Auto" provisions.
- 3. Control devices such as start-stop push buttons, thermostats, pressure switches, flow switches, relays, etc., generally represent the types of equipment associated with motor control wiring.
- 4. Motor control wiring is single phase and usually 120 volts. In some instances, the voltage will be the same as the motor power wiring. Generally, where the motor power wiring exceeds 120 volts, a control transformer is used to give a control voltage of 120 volts.
- 5. Temperature Control Wiring: The wiring associated with the operation of a motorized damper, solenoid valve or motorized valve, etc., either modulating or two-position, as opposed to wiring which directly powers or controls a motor used to drive equipment such as fans, pumps, etc.
 - a. This wiring will be from a 120 volt source and may continue as 120 volt, or be reduced in voltage (24 volt) in which case a control transformer shall be furnished as part of the temperature control wiring.

6. Control Motor: An electric device used to operate dampers, valves, etc. It may be two-position or modulating. Conventional characteristics of such a motor are 24 volts, 60 cycles, 1 phase, although other voltages may be encountered.
7. Voltage is generally specified and scheduled as distribution voltage. Motor submittals may be based on utilization voltage if it corresponds to the correct distribution voltage.

Distribution/Nominal Voltage	Utilization Voltage
120	115
208	200
240	230
277	265
480	460

B. General:

1. The purpose of these Specifications is to outline the Electrical and Mechanical Contractor's responsibilities related to electrical work required for items such as temperature controls, mechanical equipment, fans, chillers, compressors and the like. The exact wiring requirements for much of the equipment cannot be determined until the systems have been selected and submittals reviewed. Therefore, the electrical drawings show only known wiring related to such items. All wiring not shown on the electrical drawings, but required for mechanical systems, is the responsibility of the Mechanical Contractor.
2. Where the drawings require the Electrical Contractor to wire between equipment furnished by the Mechanical Contractor, such wiring shall terminate at terminals provided in the equipment. The Mechanical Contractor shall provide complete electrical power/controls wiring diagrams and supervision to the Electrical Contractor and designate the terminal numbers for correct wiring.
3. All electrical work shall conform to the National Electrical Code. All provisions of the Electrical Specifications concerning wiring, protection, etc., apply to wiring provided by the Mechanical Contractor unless noted otherwise.
4. Control low (24V) and control line (120V) voltage wiring, conduit, and related switches and relays required for the automatic control and/or interlock of motors and equipment, including final connection, are to be furnished and installed under Divisions 21, 22 and 23. Materials and installation to conform to Class 1 or 2 requirements, California Code of Regulation Title 24, Article E725.
5. All Contractors shall establish utility elevations prior to fabrication and shall coordinate their material and equipment with other trades. When a conflict arises, priority is as follows:
 - a. Light fixtures.
 - b. Gravity flow piping, including steam and condensate.
 - c. Electrical busduct.
 - d. Sheet metal.
 - e. Electrical cable trays, including access space.
 - f. Sprinkler piping and other piping.
 - g. Electrical conduits and wireway.

C. Mechanical Contractor's Responsibility:

1. Assumes responsibility for internal wiring of all equipment provided by the Mechanical Contractor, for example:
 - a. Split-System Units.
 - b. Makeup Air Units.
 - c. Packaged Rooftop Units.
 - d. Dust Collection System.

2. Assumes all responsibility for the Temperature Control wiring, when the Temperature Control Contractor is a Subcontractor to the Mechanical Contractor.
3. Temperature Control Contractor's Responsibility:
 - a. Wiring of all devices needed to make the Temperature Control System functional.
 - b. Verifying any control wiring on the electrical drawings as being by the Electrical Contractor. All wiring required for the Control System, but not shown on the electrical drawings, is the responsibility of the Temperature Control Contractor.
 - c. Coordinating equipment locations (such as relays, transformers, etc.) with the Electrical Contractor, where wiring of the equipment is by the Electrical Contractor.
4. This Contractor is responsible for coordination of utilities with all other Contractors. If any field coordination conflicts are found, the Contractor shall coordinate with other Contractors to determine a viable layout.

D. Electrical Contractor's Responsibility:

1. Provides all combination starters, manual starters and disconnect devices shown on the Electrical Drawings or indicated to be by the Electrical Contractor on the Mechanical Drawings or Specifications.
2. Installs and wires all remote control devices furnished by the Mechanical Contractor or Temperature Control Contractor when so noted on the Electrical Drawings.
3. Provides motor control and temperature control wiring, where so noted on the drawings.
4. Furnishes, installs and connects all relays, etc., for automatic shutdown of certain fans upon actuation of the Fire Alarm System as indicated and specified in Division 28.
5. This Contractor is responsible for coordination of utilities with all other Contractors. If any field coordination conflicts are found, the Contractor shall coordinate with other Contractors to determine a viable layout.

1.4 COORDINATION DRAWINGS

A. Definitions:

1. Coordination Drawings: A compilation of the pertinent layout and system drawings that show the sizes and locations, including elevations, of system components and required access areas to ensure that no two objects will occupy the same space.
 - a. Mechanical trades shall include, but are not limited to, mechanical equipment, ductwork, fire protection systems, plumbing piping, and any item that may impact coordination with other disciplines.
 - b. Electrical trades shall include, but are not limited to, electrical equipment, conduit 1.5" and larger, conduit racks, cable trays, pull boxes, transformers, raceway, busway, lighting, ceiling-mounted devices, and any item that may impact coordination with other disciplines.
 - c. Technology trades shall include, but are not limited to, technology equipment, racks, conduit 1.5" and larger, conduit racks, cable trays, ladder rack, pull boxes, raceway, ceiling-mounted devices, and any item that may impact coordination with other disciplines.
 - d. Maintenance clearances and code-required dedicated space shall be included.

- e. The coordination drawings shall include all underground, underfloor, in-floor, in chase, in ceiling, and vertical trade items.
 - 2. The contractors shall use the coordination process to identify the proper sequence of installation of all utilities above ceilings and in other congested areas, to ensure an orderly and coordinated end result, and to provide adequate access for service and maintenance.
- B. Participation:
- 1. The contractors and subcontractors responsible for work defined above shall participate in the coordination drawing process.
 - 2. One contractor shall be designated as the Coordinating Contractor for purposes of preparing a complete set of composite electronic CAD coordination drawings that include all applicable trades, and for coordinating the activities related to this process. The Coordinating Contractor for this project shall be the Mechanical Contractor.
 - a. The Coordinating Contractor shall utilize personnel familiar with requirements of this project and skilled as draftspersons/CAD operators, competent to prepare the required coordination drawings.
 - 3. Electronic CAD drawings shall be submitted to the Coordinating Contractor for addition of work by other trades. IMEG will provide electronic file copies of mechanical drawings for contractor's use if the contractor signs and returns an "Electronic File Transfer" waiver provided by IMEG. IMEG will not consider blatant reproductions of original file copies an acceptable alternative for coordination drawings.
- C. Drawing Requirements:
- 1. The file format and file naming convention shall be coordinated with and agreed to by all contractors participating in the coordination process and the Owner.
 - a. Scale of drawings:
 - 1) General plans: 1/4 Inch = 1'-0" (minimum).
 - 2) Mechanical, electrical, communication rooms, and including the surrounding areas within 10 feet: 1/2 Inch = 1'-0" (minimum).
 - 3) Shafts and risers: 1/2 Inch = 1'-0" (minimum).
 - 4) Sections of shafts and mechanical and electrical equipment rooms: 1/4 Inch = 1'-0" (minimum).
 - 5) Sections of congested areas: 1/2 Inch = 1'-0" (minimum).
 - 2. Ductwork layout drawings shall be the baseline system for other components. Ductwork layout drawings shall be modified to accommodate other components as the coordination process progresses.
 - 3. There may be more drawings required for risers, top and bottom levels of mechanical rooms, and shafts.
 - 4. The minimum quantity of drawings will be established at the first coordination meeting and sent to the A/E for review. Additional drawings may be required if other areas of congestion are discovered during the coordination process.

D. General:

1. Coordination drawing files shall be made available to the A/E and Owner's Representative. The A/E will only review identified conflicts and give an opinion, but will not perform as a coordinator.
2. A plotted set of coordination drawings shall be available at the project site.
3. Coordination drawings are not shop drawings and shall not be submitted as such.
4. The contract drawings are schematic in nature and do not show every fitting and appurtenance for each utility. Each contractor is expected to have included in his/her bid sufficient fittings, material, and labor to allow for adjustments in routing of utilities made necessary by the coordination process and to provide a complete and functional system.
5. The contractors will not be allowed additional costs or time extensions due to participation in the coordination process.
6. The contractors will not be allowed additional costs or time extensions for additional fittings, reroutings or changes of duct size, that are essentially equivalent sizes to those shown on the drawings and determined necessary through the coordination process.
7. The A/E reserves the right to determine space priority of equipment in the event of spatial conflicts or interference between equipment, piping, conduit, ducts, and equipment provided by the trades.
8. Changes to the contract documents that are necessary for systems installation and coordination shall be brought to the attention of the A/E.
9. Access panels shall preferably occur only in gypsum board walls or plaster ceilings where indicated on the drawings.
 - a. Access to mechanical, electrical, technology, and other items located above the ceiling shall be through accessible lay-in ceiling tile areas.
 - b. Potential layout changes shall be made to avoid additional access panels.
 - c. Additional access panels shall not be allowed without written approval from the A/E at the coordination drawing stage.
 - d. Providing additional access panels shall be considered after other alternatives are reviewed and discarded by the A/E and the Owner's Representative.
 - e. When additional access panels are required, they shall be provided without additional cost to the Owner.
10. Complete the coordination drawing process and obtain sign off of the drawings by all contractors prior to installing any of the components.
11. Conflicts that result after the coordination drawings are signed off shall be the responsibility of the contractor or subcontractor who did not properly identify their work requirements, or installed their work without proper coordination.
12. Updated coordination drawings that reflect as-built conditions may be used as record documents.

1.5 QUALITY ASSURANCE

A. Contractor's Responsibility Prior to Submitting Pricing Data:

1. The Contractor is responsible for constructing complete and operating systems. The Contractor acknowledges and understands that the Contract Documents are a two-dimensional representation of a three-dimensional object, subject to human interpretation. This representation may include imperfect data, interpreted codes, utility guidelines, three-dimensional conflicts, and required field coordination items. Such deficiencies can be corrected when identified prior to ordering material and starting installation. The Contractor agrees to carefully study and compare the individual Contract Documents and report at once in writing to the Design Team any deficiencies the Contractor may discover. The Contractor further agrees to require each subcontractor to likewise study the documents and report at once any deficiencies discovered.
2. The Contractor shall resolve all reported deficiencies with the Architect/Engineer prior to awarding any subcontracts, ordering material, or starting any work with the Contractor's own employees. Any work performed prior to receipt of instructions from the Design Team will be done at the Contractor's risk.

B. Qualifications:

1. Only products of reputable manufacturers are acceptable.
2. All Contractors and subcontractors shall employ only workers skilled in their trades.

C. Compliance with Codes, Laws, Ordinances:

1. Conform to all requirements of the DSA Codes, Laws, Ordinances and other regulations having jurisdiction.
2. Conform to all State Codes.
3. Conform to Federal Act S.3874 requiring the reduction of lead in drinking water.
4. If there is a discrepancy between the codes and regulations and these specifications, the Architect/Engineer shall determine the method or equipment used.
5. If the Contractor notes, at the time of bidding, any parts of the drawings or specifications that do not comply with the codes or regulations, he shall inform the Architect/Engineer in writing, requesting a clarification. If there is insufficient time for this procedure, he shall submit with his proposal a separate price to make the system comply with the codes and regulations.
6. All changes to the system made after letting of the contract, to comply with codes or requirements of Inspectors, shall be made by the Contractor without cost to the Owner.
7. If there is a discrepancy between manufacturer's recommendations and these specifications, the manufacturer's recommendations shall govern.
8. All rotating shafts and/or equipment shall be completely guarded from all contact. Partial guards and/or guards that do not meet all applicable OSHA standards are not acceptable. Contractor is responsible for providing this guarding if it is not provided with the equipment supplied.

D. Permits, Fees, Taxes, Inspections:

1. Procure all applicable permits and licenses.
2. Abide by all laws, regulations, ordinances, and other rules of the State or Political Subdivision where the work is done, or as required by any duly constituted public authority.

3. Pay all charges for permits or licenses.
4. Pay all fees and taxes imposed by the State, Municipal and/or other regulatory bodies.
5. Pay all charges arising out of required inspections by an authorized body.
6. Pay all charges arising out of required contract document reviews associated with the project and as initiated by the Owner or authorized agency/consultant.
7. Where applicable, all fixtures, equipment and materials shall be approved or listed by Underwriter's Laboratories, Inc.

E. Utility Company Requirements:

1. Secure from the appropriate private or public utility company all applicable requirements.
2. Comply with all utility company requirements.
3. Make application for and pay for service connections, such as gas.
4. Make application for and pay for all meters and metering systems required by the utility company.

F. Examination of Drawings:

1. The drawings for the plumbing work are completely diagrammatic, intended to convey the scope of the work and to indicate the general arrangements and locations of equipment, outlets, etc., and the approximate sizes of equipment.
2. Contractor shall determine the exact locations of equipment and rough-ins, and the exact routing of pipes and ducts to best fit the layout of the job.
3. Scaling of the drawings is not sufficient or accurate for determining these locations.
4. Where job conditions require reasonable changes in indicated arrangements and locations, such changes shall be made by the Contractor at no additional cost to the Owner.
5. Because of the scale of the drawings, certain basic items, such as fittings, boxes, valves, unions, etc., may not be shown, but where required by other sections of the specifications or required for proper installation of the work, such items shall be furnished and installed.
6. If an item is either on the drawings or in the specifications, it shall be included in this contract.
7. Determination of quantities of material and equipment required shall be made by the Contractor from the documents. Where discrepancies arise between drawings, schedules and/or specifications, the greater number shall govern.
8. Where used in mechanical documents, the word "furnish" shall mean supply for use, the word "install" shall mean connect complete and ready for operation, and the word "provide" shall mean to supply for use and connect complete and ready for operation.
 - a. Any item listed as furnished shall also be installed, unless otherwise noted.
 - b. Any item listed as installed shall also be furnished, unless otherwise noted.

G. Field Measurements:

1. Verify all pertinent dimensions at the job site before ordering any materials or fabricating any supports, pipes or ducts.

H. Electronic Media/Files:

1. Construction drawings for this project have been prepared utilizing Revit.
2. Contractors and Subcontractors may request electronic media files of the contract drawings and/or copies of the specifications. Specifications will be provided in PDF format.
3. Upon request for electronic media, the Contractor shall complete and return a signed "Electronic File Transmittal" form provided by IMEG.
4. If the information requested includes floor plans prepared by others, the Contractor will be responsible for obtaining approval from the appropriate Design Professional for use of that part of the document.
5. The electronic contract documents can be used for preparation of shop drawings and as-built drawings only. The information may not be used in whole or in part for any other project.
6. The drawings prepared by IMEG for bidding purposes may not be used directly for ductwork layout drawings or coordination drawings.
7. The use of these CAD documents by the Contractor does not relieve them from their responsibility for coordination of work with other trades and verification of space available for the installation.
8. The information is provided to expedite the project and assist the Contractor with no guarantee by IMEG as to the accuracy or correctness of the information provided. IMEG accepts no responsibility or liability for the Contractor's use of these documents.

1.6 SUBMITTALS

A. Submittals shall be required for the following items, and for additional items where required elsewhere in the specifications or on the drawings.

1. Submittals List:

<u>Referenced Specification Section</u>	<u>Submittal Item</u>
22 05 03	Fire Seal Systems
22 05 16	Expansion Compensation
22 05 29	Hangers and Supports
22 05 50	Seismic Restraint Systems
22 09 00	Instrumentation
22 10 00	Plumbing Piping Systems and Valves
22 10 23	Natural Gas Piping Systems
22 10 30	Plumbing Specialties
22 11 23	Domestic Water Pumps
22 15 19.13	Air Compressors
22 30 00	Plumbing Equipment
22 40 00	Plumbing Fixtures

B. General Submittal Procedures: In addition to the provisions of Division 1, the following are required:

1. Transmittal: Each transmittal shall include the following:
 - a. Date
 - b. Project title and number
 - c. Contractor's name and address
 - d. Division of work (e.g., plumbing, heating, ventilating, etc.)
 - e. Description of items submitted and relevant specification number

- f. Notations of deviations from the contract documents
 - g. Other pertinent data
- 2. Submittal Cover Sheet: Each submittal shall include a cover sheet containing:
 - a. Date
 - b. Project title and number
 - c. Architect/Engineer
 - d. Contractor and subcontractors' names and addresses
 - e. Supplier and manufacturer's names and addresses
 - f. Division of work (e.g., plumbing, heating, ventilating, etc.)
 - g. Description of item submitted (using project nomenclature) and relevant specification number
 - h. Notations of deviations from the contract documents
 - i. Other pertinent data
 - j. Provide space for Contractor's review stamps
- 3. Composition:
 - a. Submittals shall be submitted using specification sections and the project nomenclature for each item.
 - b. Individual submittal packages shall be prepared for items in each specification section. All items within a single specification section shall be packaged together where possible. An individual submittal may contain items from multiple specifications sections if the items are intimately linked (e.g., pumps and motors).
 - c. All sets shall contain an index of the items enclosed with a general topic description on the cover.
- 4. Content: Submittals shall include all fabrication, erection, layout, and setting drawings; manufacturers' standard drawings; schedules; descriptive literature, catalogs and brochures; performance and test data; electrical power wiring and control diagrams; dimensions; shipping and operating weights; shipping splits; service clearances; and all other drawings and descriptive data of materials of construction as may be required to show that the materials, equipment or systems and the location thereof conform to the requirements of the contract documents.
- 5. Contractor's Approval Stamp:
 - a. The Contractor shall thoroughly review and approve all shop drawings before submitting them to the Architect/Engineer. The Contractor shall stamp, date and sign each submittal certifying it has been reviewed.
 - b. Unstamped submittals will be rejected.
 - c. The Contractor's review shall include, but not be limited to, verification of the following:
 - 1) Only approved manufacturers are used.
 - 2) Addenda items have been incorporated.
 - 3) Catalog numbers and options match those specified.
 - 4) Performance data matches that specified.
 - 5) Electrical characteristics and loads match those specified.
 - 6) Equipment connection locations, sizes, capacities, etc. have been coordinated with other affected trades.
 - 7) Dimensions and service clearances are suitable for the intended location.
 - 8) Equipment dimensions are coordinated with support steel, housekeeping pads, openings, etc.

- 9) Constructability issues are resolved (e.g., weights and dimensions are suitable for getting the item into the building and into place, sinks fit into countertops, etc.).
 - d. The Contractor shall review, stamp and approve all subcontractors' submittals as described above.
 - e. **The Contractor's approval stamp is required on all submittals. Approval will indicate the Contractor's review of all material and a complete understanding of exactly what is to be furnished. Contractor shall clearly mark all deviations from the contract documents on all submittals. If deviations are not marked by the Contractor, then the item shall be required to meet all drawing and specification requirements.**
6. Submittal Identification and Markings:
- a. The Contractor shall clearly mark each item with the same nomenclature applied on the drawings or in the specifications.
 - b. The Contractor shall clearly indicate the size, finish, material, etc.
 - c. Where more than one model is shown on a manufacturer's sheet, the Contractor shall clearly indicate exactly which item and which data is intended.
 - d. All marks and identifications on the submittals shall be unambiguous.
7. Schedule submittals to expedite the project. Coordinate submission of related items.
 8. Identify variations from the contract documents and product or system limitations that may be detrimental to the successful performance of the completed work.
 9. Reproduction of contract documents alone is not acceptable for submittals.
 10. Incomplete submittals will be rejected without review. Partial submittals will only be reviewed with prior approval from the Architect/Engineer.
 11. Submittals not required by the contract documents may be returned without review.
 12. The Architect/Engineer's responsibility shall be to review one set of shop drawing submittals for each product. If the first submittal is incomplete or does not comply with the drawings and/or specifications, the Contractor shall be responsible to bear the cost for the Architect/Engineer to recheck and handle the additional shop drawing submittals.
 13. Submittals shall be reviewed and approved by the Architect/Engineer **before** releasing any equipment for manufacture or shipment.
 14. Contractor's responsibility for errors, omissions or deviation from the contract documents in submittals is not relieved by the Architect/Engineer's approval.
- C. Electronic Submittal Procedures:
1. Distribution: Email submittals as attachments to all parties designated by the Architect/Engineer, unless a web-based submittal program is used.
 2. Transmittals: Each submittal shall include an individual electronic letter of transmittal.
 3. Format: Electronic submittals shall be in PDF format only. Scanned copies, in PDF format, of paper originals are acceptable. Submittals that are not legible will be rejected. Do not set any permission restrictions on files; protected, locked, or secured documents will be rejected.

4. File Names: Electronic submittal file names shall include the relevant specification section number followed by a description of the item submitted, as follows. Where possible, include the transmittal as the first page of the PDF instead of using multiple electronic files.
 - a. Submittal file name: 22 XX XX.description.YYYYYMMDD
 - b. Transmittal file name: 22 XX XX.description.YYYYYMMDD
5. File Size: Electronic file size shall be limited to a maximum of 4MB. Larger files shall be transmitted via a pre-approved method.

1.7 CHANGE ORDERS

- A. A detailed material and labor takeoff shall be prepared for each change order, along with labor rates and markup percentages. Change orders with inadequate breakdown will be rejected.
- B. Change order work shall not proceed until authorized.

1.8 EQUIPMENT SUPPLIERS' INSPECTION

- A. The following equipment shall not be placed in operation until a competent installation and service representative of the manufacturer has inspected the installation and certified that the equipment is properly installed, adjusted and lubricated; that preliminary operating instructions have been given; and that the equipment is ready for operation:
 1. Fire Seal Systems
 2. Seismic Restraints and Equipment Bracing
- B. Contractor shall arrange for and obtain supplier's on-site inspection(s) at proper time(s) to assure each phase of equipment installation and/or connection is in accordance with the manufacturer's instructions.
- C. Submit copies of start-up reports to the Architect/Engineer and include copies of Owner's Operation and Maintenance Manuals.

1.9 PRODUCT DELIVERY, STORAGE, HANDLING & MAINTENANCE

- A. Exercise care in transporting and handling to avoid damage to materials. Store materials on the site to prevent damage. Keep materials clean, dry and free from harmful conditions. Immediately remove any materials that become wet or that are suspected of becoming contaminated with mold or other organisms.
- B. Keep all bearings properly lubricated and all belts properly tensioned and aligned.
- C. Coordinate the installation of heavy and large equipment with the General Contractor and/or Owner. If the Mechanical Contractor does not have prior documented experience in rigging and lifting similar equipment, he/she shall contract with a qualified lifting and rigging service that has similar documented experience. Follow all equipment lifting and support guidelines for handling and moving.
- D. Contractor is responsible for moving equipment into the building and/or site. Contractor shall review site prior to bid for path locations and any required building modifications to allow movement of equipment. Contractor shall coordinate his/her work with other trades.

1.10 NETWORK / INTERNET CONNECTED EQUIPMENT

- A. These specifications may require certain equipment or systems to have network, Internet and/or remote access capability ("Network Capability"). Any requirement for Network Capability shall be interpreted only as a functional capability and is not to be construed as authority to connect or enable any Network Capability. Network Capability may only be connected or enabled with the express written consent of the Owner.

1.11 WARRANTY

- A. Provide one-year warranty, unless otherwise noted, to the Owner for all fixtures, equipment, materials, and workmanship.
- B. The warranty period for all work in this Division of the specifications shall commence on the date of final acceptance, unless a whole or partial system or any separate piece of equipment or component is put into use for the benefit of any party other than the installing contractor with prior written authorization. In this instance, the warranty period shall commence on the date when such whole system, partial system or separate piece of equipment or component is placed in operation and accepted in writing by the Owner.
- C. Warranty requirements shall extend to correction, without cost to the Owner, of all Work found to be defective or nonconforming to the contract documents. The Contractor shall bear the cost of correcting all damage resulting from defects or nonconformance with contract documents.

1.12 INSURANCE

- A. Contractor shall maintain insurance coverage as set forth in Division 0 of these specifications.

1.13 MATERIAL SUBSTITUTION

- A. Where several manufacturers' names are given, the manufacturer for which a catalog number is given is the basis for job design and establishes the quality required.
- B. Equivalent equipment manufactured by the other named manufacturers may be used. Contractor shall ensure that all items submitted by these other manufacturers meet all requirements of the drawings and specifications, and fits in the allocated space.
- C. Any material, article or equipment of other unnamed manufacturers which will adequately perform the services and duties imposed by the design and is of a quality equal to or better than the material, article or equipment identified by the drawings and specifications may be used if approval is secured in writing from the Architect/Engineer not later than ten days prior to the bid opening.
- D. This Contractor assumes all costs incurred as a result of using the offered material, article or equipment, on his part or on the part of other Contractors whose work is affected.
- E. This Contractor may list voluntary add or deduct prices for alternate materials on the bid form. These items will not be used in determining the low bidder.
- F. All material substitutions requested later than ten (10) days prior to bid opening must be listed as voluntary changes on the bid form.

1.14 PROJECT COMMISSIONING

- A. The Contractor shall work with the Commissioning Agent (CxA) and provide all services as described in the Commissioning Plan.

2. PART EXECUTION

2.1 JOBSITE SAFETY

- A. Neither the professional activities of the Architect/Engineer, nor the presence of the Architect/Engineer or his or her employee and subconsultants at a construction site, shall relieve the Contractor and other entity of their obligations, duties and responsibilities including, but not limited to, construction means, methods, sequence, techniques or procedures necessary for performing, superintending or coordinating all portions of the work of construction in accordance with the contract documents and any health or safety precautions required by any regulatory agencies. The Architect/Engineer and his or her personnel have no authority to exercise any control over any construction contractor or other entity or their employees in connection with their work or any health or safety precautions. The Contractor is solely responsible for jobsite safety. The Architect/Engineer and the Architect/Engineer's consultants shall be indemnified and shall be made additional insureds under the Contractor's general liability insurance policy.

2.2 EXCAVATION, FILL, BACKFILL, COMPACTION

A. General:

1. Prior to the commencement of any excavation or digging, the Contractor shall verify all underground utilities with the regional utility locator. Provide prior notice to the locator before excavations. Contact information for most regional utility locaters can be found by calling 811.
2. The Contractor shall do all excavating, filling, backfilling and compacting associated with his work.

B. Excavation:

1. Make all excavations to accurate, solid, undisturbed earth, and to proper dimensions.
2. Where excavations are made in error below foundations, concrete of same strength as specified for the foundations or thoroughly compacted sand-gravel fill, as determined by the Architect/Engineer, shall be placed in such excess excavations. Place thoroughly compacted, clean, stable fill in excess excavations under slabs on grade, at the Contractor's expense.
3. Trim bottom and sides of excavations to grades required for foundations.
4. Protect excavations against frost and freezing.
5. Take care in excavating not to damage surrounding structures, equipment or buried pipe. Do not undermine footing or foundation.
6. Perform all trenching in a manner to prevent cave-ins and risk to workmen.
7. Where original surface is pavement or concrete, the surface shall be saw cut to provide clean edges and assist in the surface restoration.
8. Where satisfactory bearing soil for foundations is not found at the indicated levels, the Architect/Engineer or their representative shall be notified immediately, and no further work shall be done until further instructions are given by the Architect/Engineer or their representative.

C. Dewatering:

1. Contractor shall furnish, install, operate and remove all dewatering pumps and pipes needed to keep trenches and pits free of water.

D. Underground Obstructions:

1. Known underground piping, foundations, and other obstructions in the vicinity of construction are shown on the drawings. Use great care in making installations near underground obstruction.
2. If objects not shown on the drawings are encountered, remove, relocate, or perform extra work as directed by the Architect/Engineer.

E. Fill and Backfilling:

1. No rubbish or waste material is permitted for fill or backfill.
2. Provide all necessary sand for backfilling.
3. Dispose of the excess excavated earth as directed.
4. Backfill materials shall be suitable for required compaction, clean and free of perishable materials and stones greater than 4 inches in diameter. Water shall not be permitted to rise in unbackfilled trenches. No material shall be used for backfilling that contains frozen earth, debris or earth with a high void content.
5. Backfill all trenches and excavations immediately after installing pipes, or removal of forms, unless other protection is provided.
6. Around piers and isolated foundations and structures, backfill and fill shall be placed and consolidated simultaneously on all sides to prevent wedge action and displacement. Fill and backfill materials shall be spread in 6 inch uniform horizontal layers with each layer compacted separately to required density.
7. Lay all piping on a compacted bed of sand at least 3 inches deep. Backfill around pipes with sand, 6 inch layers, and compact each layer.
8. Use sand for backfill up to grade for all piping under slabs or paved areas. All other piping shall have sand backfill to 6 inches above the top of the pipe.
9. Place all backfill above the sand in uniform layers not exceeding 6 inches deep. Each layer shall be placed, then carefully and uniformly tamped, to eliminate lateral or vertical displacement.
10. Where the fill and backfill will ultimately be under a building, floor or paving, each layer of fill shall be compacted to 95% of the maximum density determined by AASHTO Designation T-99 or ASTM Designation D-698. Moisture content of soil at time of compaction shall not exceed plus or minus 2% of optimum moisture content determined by AASHTO T-99 or ASTM D-698 test.

F. Surface Restoration:

1. Where trenches are cut through graded, planted or landscaped areas, the areas shall be restored to the original condition. Replace all planting removed or damaged to its original condition. A minimum of 6 inches of topsoil shall be applied where disturbed areas are to be seeded or sodded.
2. Concrete or asphalt type pavement, seal coat, rock, gravel or earth surfaces removed or damaged shall be replaced with comparable materials and restored to original condition.

2.3 ARCHITECT/ENGINEER OBSERVATION OF WORK

- A. The Contractor shall provide seven (7) calendar days' notice to the Architect/Engineer prior to:
 - 1. Placing fill over underground and underslab utilities.
 - 2. Covering exterior walls, interior partitions and chases.
 - 3. Installing hard or suspended ceilings and soffits.
- B. The Architect/Engineer will have the opportunity to review the installation and provide a written report noting deficiencies requiring correction. The Contractor's schedule shall account for these reviews and show them as line items in the approved schedule.
- C. Above-Ceiling Final Observation
 - 1. All work above the ceilings must be complete prior to the Architect/Engineer's review. This includes, but is not limited to:
 - a. Pipe insulation is installed and fully sealed.
 - b. Pipe wall penetrations are sealed.
 - c. Pipe identification and valve tags are installed.
 - 2. In order to prevent the Above-Ceiling Final Observation from occurring too early, the Contractor shall review the status of the work and certify, in writing, that the work is ready for the Above-Ceiling Final Observation.
 - 3. It is understood that if the Architect/Engineer finds the ceilings have been installed prior to this review and prior to 7 days elapsing, the Architect/Engineer may not recommend further payments to the contractor until such time as full access has been provided.

2.4 PROJECT CLOSEOUT

- A. The following paragraphs supplement the requirements of Division 1.
- B. IDPH Final Occupancy Checklist for Request of Inspection:
 - 1. Each Contractor must submit all forms and certifications required by IDPH relating to their work at 85% completion of the project or when directed by the Owner/Architect/Engineer.
- C. Final Jobsite Observation:
 - 1. In order to prevent the Final Jobsite Observation from occurring too early, the Contractor is required to review the completion status of the project and certify that the job is ready for the final jobsite observation.
 - 2. Attached to the end of this section is a typical list of items that represent the degree of job completeness expected prior to requesting a review.
 - 3. Upon Contractor certification that the project is complete and ready for a final observation, the Contractor shall sign the attached certification and return it to the Architect/Engineer so that the final observation can be scheduled.
 - 4. It is understood that if the Architect/Engineer finds the job not ready for the final observation and that additional trips and observations are required to bring the project to completion, the costs incurred by the Architect/Engineer's additional time and expenses will be deducted from the Contractor's contract retainage prior to final payment at the completion of the job.
- D. Before final payment is authorized, this Contractor must submit the following:
 - 1. Operation and maintenance manuals with copies of approved shop drawings.
 - 2. Record documents including marked-up or reproducible drawings and specifications.

3. A report documenting the instructions given to the Owner's representatives complete with the number of hours spent in the instruction. The report shall bear the signature of an authorized agent of This Contractor and shall be signed by the Owner's representatives.
4. Start-up reports on all equipment requiring a factory installation inspection or start-up.
5. Provide spare parts, maintenance, and extra materials in quantities specified in individual specification sections. Deliver to project site and place in location as directed; receipt by Architect/Engineer required prior to final payment approval.

2.5 OPERATION AND MAINTENANCE MANUALS

A. General:

1. Provide an electronic copy of the O&M manuals as described below for Architect/Engineer's review and approval. The electronic copy shall be corrected as required to address the Architect/Engineer's comments. Once corrected, electronic copies and paper copies shall be distributed as directed by the Architect/Engineer.
2. Approved O&M manuals shall be completed and in the Owner's possession prior to Owner's acceptance and at least 10 days prior to instruction of operating personnel.

B. Electronic Submittal Procedures:

1. Distribution: Email the O&M manual as attachments to all parties designated by the Architect/Engineer.
2. Transmittals: Each submittal shall include an individual electronic letter of transmittal.
3. Format: Electronic submittals shall be in PDF format only. Scanned copies, in PDF format, of paper originals are acceptable. Submittals that are not legible will be rejected. Do not set any permission restrictions on files; protected, locked, or secured documents will be rejected.
4. File Names: Electronic submittal file names shall include the relevant specification section number followed by a description of the item submitted, as follows. Where possible, include the transmittal as the first page of the PDF instead of using multiple electronic files.
 - a. O&M file name: O&M.div22.contractor.YYYYMMDD
 - b. Transmittal file name: O&Mtransmittal.div22.contractor.YYYYMMDD
5. File Size: Electronic file size shall be limited to a maximum of 4MB. Larger files shall be divided into files that are clearly labeled as "1 of 2", "2 of 2", etc.
6. Provide the Owner with an approved copy of the O&M manual on compact discs (CD), digital video discs (DVD), or flash drives with a permanently affixed label, printed with the title "Operation and Maintenance Instructions", title of the project and subject matter of disc/flash drive when multiple disc/flash drives are required.
7. All text shall be searchable.
8. Bookmarks shall be used, dividing information first by specification section, then systems, major equipment and finally individual items. All bookmark titles shall include the nomenclature used in the construction documents and shall be an active link to the first page of the section being referenced.

C. Operation and Maintenance Instructions shall include:

1. Title Page: Include title page with project title, Architect, Engineer, Contractor, all subcontractors, and major equipment suppliers, with addresses, telephone numbers, website addresses, email addresses and point of contacts. Website URLs and email addresses shall be active links in the electronic submittal.
2. Table of Contents: Include a table of contents describing specification section, systems, major equipment, and individual items.
3. Copies of all final approved shop drawings and submittals. Include Architect's/Engineer's shop drawing review comments. Insert the individual shop drawing directly after the Operation and Maintenance information for the item(s) in the review form.
4. Copy of final approved test and balance reports.
5. Copies of all factory inspections and/or equipment startup reports.
6. Copies of warranties.
7. Schematic electrical power/controls wiring diagrams of the equipment that have been updated for field conditions. Field wiring shall have label numbers to match drawings.
8. Dimensional drawings of equipment.
9. Capacities and utility consumption of equipment.
10. Detailed parts lists with lists of suppliers.
11. Operating procedures for each system.
12. Maintenance schedule and procedures. Include a chart listing maintenance requirements and frequency.
13. Repair procedures for major components.
14. List of lubricants in all equipment and recommended frequency of lubrication.
15. Instruction books, cards, and manuals furnished with the equipment.

2.6 INSTRUCTING THE OWNER'S REPRESENTATIVES

- A. Adequately instruct the Owner's designated representatives in the maintenance, care, and operation of all systems installed under this contract.
- B. Provide verbal and written instructions to the Owner's representatives by FACTORY PERSONNEL in the care, maintenance, and operation of the equipment and systems.
- C. The Owner has the option to make a video recording of all instructions. Coordinate schedule of instructions to facilitate this recording.
- D. The instructions shall include:
 1. Explanation of all system flow diagrams.
 2. Maintenance of equipment.
 3. Start-up procedures for all major equipment.
 4. Explanation of seasonal system changes.

- E. The Architect/Engineer shall be notified of the time and place instructions will be given to the Owner's representatives so he or his representative can attend if desired.
- F. Minimum hours of instruction for each item shall be:
 - 1. Domestic Hot Water System - 4 hours.
- G. The Contractor shall prepare a detailed, written training agenda and submit it to the Architect/Engineer a minimum of four weeks prior to the formal training for approval. The written agenda shall include specific training points within the items described above. For example: how to adjust setpoints, troubleshooting, proper start-up, proper shut-down, seasonal changes, draining, venting, changing filters, changing belts, etc. Failure to provide and follow an approved training agenda may result in additional training required at the expense of the Contractor.
- H. Operating Instructions:
 - 1. Contractor is responsible for all instructions to the Owner's representatives for the mechanical and control systems.
 - 2. If the Contractor does not have staff that can adequately provide the required instructions he shall include in his bid an adequate amount to reimburse the Owner for the Architect/Engineer to perform these services.

2.7 SYSTEM STARTING AND ADJUSTING

- A. The plumbing systems shall be complete and operating. System startup, testing, adjusting, and balancing to obtain satisfactory system performance is the responsibility of the Contractor. This includes calibration and adjustments of all controls, noise level adjustments and final adjustments as required.
- B. Complete all manufacturer-recommended startup procedures and checklists to verify proper motor rotation, electrical power voltage is within equipment limitations, equipment controls maintain pressures and temperatures within acceptable ranges, all filters and protective guards are in-place, acceptable access is provided for maintenance and servicing, and equipment operation does not pose a danger to personnel or property.
- C. Contractor shall adjust the plumbing systems and controls at season changes during the one year warranty period, as required, to provide satisfactory operation and to prove performance of all systems in all seasons.
- D. All operating conditions and control sequences shall be tested during the start-up period. Test all interlocks, safety shutdowns, controls, and alarms.
- E. The Contractor, subcontractors, and equipment suppliers shall have skilled technicians to ensure that all systems perform properly. If the Architect/Engineer is requested to visit the job site for trouble shooting, assisting in start-up, obtaining satisfactory equipment operation, resolving installation and/or workmanship problems, equipment substitution issues or unsatisfactory system performance, including call backs during the warranty period, through no fault of the design; the Contractor shall reimburse the Owner on a time and materials basis for services rendered at the Architect/Engineer's standard hourly rates in effect when the services are requested. The Contractor shall pay the Owner for services required that are product, installation or workmanship related. Payment is due within 30 days after services are rendered.

2.8 RECORD DOCUMENTS

- A. The following paragraph supplements Division 1 requirements:

Contractor shall maintain at the job site a separate and complete set of plumbing drawings and specifications on which he shall clearly and permanently mark in complete detail all changes made to the plumbing systems.

- B. Mark drawings to indicate revisions to piping size and location, both exterior and interior; including locations devices, requiring periodic maintenance or repair; actual equipment locations, dimensioned from column lines; actual inverts and locations of underground piping; concealed equipment, dimensioned from column lines; mains and branches of piping systems, with valves and control devices located and numbered, concealed unions located, and with items requiring maintenance located; Change Orders; concealed control system devices.
- C. Before completion of the project, a set of reproducible plumbing drawings will be given to the Contractor for transfer of all as-built conditions from the paper set maintained at the job site. All marks on reproducibles shall be clear and permanent.
- D. Mark specifications to show approved substitutions; Change Orders, and actual equipment and materials used.
- E. Record changes daily and keep the marked drawings available for the Architect/Engineer's examination at any normal work time.
- F. Upon completing the job, and before final payment is made, give the marked-up drawings to the Architect/Engineer.

2.9 PAINTING

- A. This Contractor shall paint the following items:

1. Exposed piping

- B. Paint all equipment that is marred or damaged prior to the Owner's acceptance. Paint and color shall match original equipment paint and shall be obtained from the equipment supplier if available.
- C. Equipment in finished areas that will be painted to match the room decor will be painted by others. Should this Contractor install equipment in a finished area after the area has been painted, he shall have the equipment and all its supports, hangers, etc., painted to match the room decor.
- D. Equipment cabinets, casings, covers, metal jackets, etc., in equipment rooms or concealed spaces, shall be furnished in standard or prime finish, free from scratches, abrasions, chips, etc.
- E. Equipment in occupied spaces, or if standard to the unit, shall have a baked primer with baked enamel finish coat free from scratches, abrasions, chips, etc. If color option is specified or is standard to the unit, this Contractor shall, before ordering, verify with the Architect/Engineer his color preference and furnish this color.
- F. Paint all equipment in unfinished areas such as boiler room, mechanical spaces, storage room, etc., furnished by this Contractor. Equipment furnished with a factory coat of paint and enamel need not be painted, provided the factory applied finish is not marred or spattered. If so, equipment shall be refinished with the same paint as was factory applied.
- G. Paint all outdoor uninsulated steel piping the color selected by Owner or Architect/Engineer.
- H. Paint all outdoor exposed natural gas piping the color selected by Owner or Architect/Engineer.

- I. After surfaces have been thoroughly cleaned and are free of oil, dirt, and other foreign matter; paint all pipes and equipment with the following:
 1. Bare Metal Surfaces - Apply one coat of primer suitable for the metal being painted. Finish with two coats of Alkyd base enamel paint.
 2. Insulated Surfaces - Paint insulation jackets with two coats of semi-gloss acrylic latex paint.
 3. Color of paint shall be as follows:
 - a. Per Architect.

2.10 ADJUST AND CLEAN

- A. Thoroughly clean all equipment and systems prior to the Owner's final acceptance of the project. Clean all foreign paint, grease, oil, dirt, labels, stickers, and other foreign material from all equipment.
- B. Clean all areas where moisture is present. Immediately report any mold, biological growth, or water damage.
- C. Remove all rubbish, debris, etc., accumulated during construction from the premises.

2.11 SPECIAL REQUIREMENTS

- A. Contractor shall coordinate the installation of all equipment, valves, dampers, operators, etc., with other trades to maintain clear access area for servicing.
- B. All equipment shall be installed in such a way to maximize access to parts needing service or maintenance. Review the final field location, placement, and orientation of equipment with the Owner's designated representative prior to setting equipment.
- C. Installation of equipment or devices without regard to coordination of access requirements and confirmation with the Owner's designated representative will result in removal and reinstallation of the equipment at the Contractor's expense.

2.12 IAQ MAINTENANCE FOR OCCUPIED FACILITIES UNDER CONSTRUCTION

- A. Contractors shall make all reasonable efforts to prevent construction activities from affecting the air quality of the occupied areas of the building or outdoor areas near the building. These measures shall include, but not be limited to:
 1. All contractors shall endeavor to minimize the amount of contaminants generated during construction. Methods to be employed shall include, but not be limited to:
 - a. Minimizing the amount of dust generated.
 - b. Reducing solvent fumes and VOC emissions.
 - c. Maintain good housekeeping practices, including sweeping and periodic dust and debris removal. There should be no visible haze in the air.
 - d. Protect stored on-site and installed absorptive materials from moisture damage.
 2. Request that the Owner designate an IAQ representative.
 3. Review and receive approval from the Owner's IAQ representative for all IAQ-related construction activities and negative pressure containment plans.
 4. Inform the IAQ representative of all conditions that could adversely impact IAQ, including operations that will produce higher than normal dust production or odors.

5. Schedule activities that may cause IAQ conditions that are not acceptable to the Owner's IAQ representative during unoccupied periods.
6. Request copies of and follow all of the Owner's IAQ and infection control policies.
7. Unless no other access is possible, the entrance to construction site shall not be through the existing facility.
8. To minimize growth of infectious organisms, do not permit damp areas in or near the construction area to remain for over 24 hours.
9. In addition to the criteria above, provide measures as recommended in the SMACNA "IAQ Guidelines for Occupied Buildings Under Construction".

END OF SECTION

READINESS CERTIFICATION PRIOR TO FINAL JOBSITE OBSERVATION

To prevent the final job observation from occurring too early, we require that the Contractor review the completion status of the project and, by copy of this document, certify that the job is indeed ready for the final job observation. The following is a typical list of items that represent the degree of job completeness expected prior to your requesting a final job observation.

1. Penetrations fire sealed and labeled in accordance with specifications.
2. All pumps operating and balanced.
3. All plumbing fixtures installed and caulked.
4. Pipe insulation complete, pipes labeled and valves tagged.

Accepted by:

Prime Contractor _____

By _____ Date _____

Upon Contractor certification that the project is complete and ready for a final job observation, we require the Contractor to sign this agreement and return it to the Architect/Engineer so that the final observation can be scheduled.

It is understood that if the Architect/Engineer finds the job not ready for the final observation and that additional trips and observations are required to bring the project to completion, the costs incurred by the Architect/Engineers for additional time and expenses will be deducted from the Contractor's contract retainage prior to final payment at the completion of the job.

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SECTION 22 05 03

THROUGH PENETRATION FIRESTOPPING

1. PART GENERAL

1.1 SECTION INCLUDES

- A. Through-Penetration Firestopping.

1.2 QUALITY ASSURANCE

- A. Manufacturer: Company specializing in manufacturing products specified in this Section.
- B. Installer: Individuals performing work shall be certified by the manufacturer of the system selected for installation.

1.3 SUBMITTALS

- A. Submit under provisions of Section 22 05 00.
- B. Submit Firestopping Installers Certification for all installers on the project.
- C. Shop Drawings: Submit for each condition requiring firestopping. Include descriptions of the specific penetrating item, actual wall/floor construction, manufacturer's installation instructions, and UL or Intertek / Warnock Hersey Assembly number.
- D. Through-Penetration Firestop System Schedule: Indicate locations of each through-penetration firestop system, along with the following information:
 - 1. Types of penetrating items.
 - 2. Types of constructions penetrated, including fire-resistance ratings and, where applicable, thicknesses of construction penetrated.
 - 3. Through-penetration firestop systems for each location identified by firestop design designation of qualified testing and inspecting agency.
 - 4. F and T ratings for each firestop system.
- E. Maintain a notebook on the job site at all times that contains copies of approved submittals for all through penetration firestopping to be installed. Notebook shall be made available to the Authority Having Jurisdiction at their request and turned over to the Owner at the end of construction as part of the O&M Manuals.

1.4 DELIVERY, STORAGE, AND HANDLING

- A. Store, protect and handle products on site. Accept material on site in factory containers and packing. Inspect for damage. Protect from deterioration or damage due to moisture, temperature changes, contaminants, or other causes. Follow manufacturer's instructions for storage.
- B. Install material prior to expiration of product shelf life.

1.5 PERFORMANCE REQUIREMENTS

- A. General: For penetrations through the following fire-resistance-rated constructions, including both empty openings and openings containing penetrating items, provide through-penetration firestop systems that are produced and installed to resist spread of fire according to requirements indicated, resist passage of smoke and other gases, and maintain original fire-resistance rating of construction penetrated.
 - 1. Fire-resistance-rated walls including fire partitions, fire barriers, and smoke barriers.
 - 2. Fire-resistance-rated horizontal assemblies including floors, floor/ceiling assemblies, and ceiling membranes of roof/ceiling assemblies.
- B. Rated Systems: Provide through-penetration firestop systems with the following ratings determined per UL 1479:
 - 1. F-Rated Systems: Provide through-penetration firestop systems with F-ratings indicated, but not less than that equaling or exceeding fire-resistance rating of constructions penetrated.
 - 2. T-Rated Systems: For the following conditions, provide through-penetration firestop systems with T-ratings indicated, as well as F-ratings:
 - a. Floor penetrations located outside wall cavities.
 - b. Floor penetrations located outside fire-resistance-rated shaft enclosures.
- C. For through-penetration firestop systems exposed to light, traffic, moisture, or physical damage, provide products that, after curing, do not deteriorate when exposed to these conditions both during and after construction.
- D. For through-penetration firestop systems exposed to view, provide products with flame-spread and smoke-developed indexes of less than 25 and 450, respectively, as determined per ASTM E 84.
- E. For through-penetration firestop systems in air plenums, provide products with flame-spread and smoke-developed indexes of less than 25 and 50, respectively, as determined per ASTM E 84.

1.6 MEETINGS

- A. Pre-installation meeting: A pre-installation meeting shall be scheduled and shall include the Construction Manager, General Contractor, all Subcontractors associated with the installation of systems penetrating fire barriers, Firestopping Manufacturer's Representative, and the Owner.
 - 1. Review foreseeable methods related to firestopping work.
 - 2. Tour representative areas where firestopping is to be installed; inspect and discuss each type of condition and each type of substrate that will be encountered, and preparation to be performed by other trades.

1.7 WARRANTY

- A. Provide one year warranty on parts and labor.
- B. Warranty shall cover repair or replacement of firestop systems which fail in joint adhesion, cohesion, abrasion resistance, weather resistance, extrusion resistance, migration resistance, stain resistance, general durability, or appear to deteriorate in any manner not clearly specified by the manufacturer as an inherent quality of the material.

2. PART PRODUCTS

2.1 MANUFACTURERS

- A. Products: Subject to compliance with requirements, provide one of the through-penetration firestop systems indicated for each application that are produced by one of the following manufacturers. All firestopping systems installed shall be provided by a single manufacturer.

1. 3M; Fire Protection Products Division.
2. Hilti, Inc.
3. RectorSeal Corporation, Metacaulk.
4. Tremco; Sealant/Weatherproofing Division.
5. Johns-Manville.
6. Specified Technologies Inc. (S.T.I.)
7. Spec Seal Firestop Products
8. AD Firebarrier Protection Systems
9. Dow Corning Corp.
10. Fire Trak Corp.
11. International Protective Coating Corp.

2.2 THROUGH PENETRATION FIRESTOP SYSTEMS

- A. Provide materials and systems classified by or listed by Intertek / Warnock Hersey to provide firestopping equal to time rating of construction being penetrated.
- B. All firestopping materials shall be free of asbestos, lead, PCB's, and other materials that would require hazardous waste removal.
- C. Firestopping shall be flexible to allow for normal penetrating item movement due to expansion and contraction.
- D. Firestopping systems for plumbing and wet pipe sprinkler piping shall be moisture resistant.
- E. Provide firestopping systems capable of supporting floor loads where systems are exposed to possible floor loading or traffic.
- F. Provide firestopping systems allowing continuous insulation for all insulated pipes.
- G. Provide firestopping systems classified by UL or listed by Intertek / Warnock Hersey for penetrations through all fire rated construction. Firestopping systems shall be selected from the UL or listed by Intertek / Warnock Hersey Fire Resistance Directory Category XHEZ based on substrate construction and penetrating item size and material and shall fall within the range of numbers listed:
1. Combustible Framed Floors and Chase Walls - 1 or 2 Hour Rated
F Rating = Floor/Wall Rating
T Rating = Floor/Wall Rating

<u>Penetrating Item</u>	<u>UL System No.</u>
No Penetrating Item	FC 0000-0999*
Metallic Pipe or Conduit	FC 1000-1999
Non-Metallic Pipe or Conduit	FC 2000-2999
Electrical Cables	FC 3000-3999
Cable Trays	FC 4000-4999
Insulated Pipes	FC 5000-5999
Bus Duct and Misc. Electrical	FC 6000-6999
Duct without Damper and Misc. Mechanical	FC 7000-7999
Multiple Penetrations	FC 8000-8999

2. Non-Combustible Framed Walls - 1 or 2 Hour Rated
F Rating = Wall Rating
T Rating = 0

<u>Penetrating Item</u>	<u>UL System No.</u>
No Penetrating Item	WL 0000-0999*
Metallic Pipe or Conduit	WL 1000-1999
Non-Metallic Pipe or Conduit	WL 2000-2999
Electrical Cables	WL 3000-3999
Cable Trays	WL 4000-4999
Insulated Pipes	WL 5000-5999
Bus Duct and Misc. Electrical	WL 6000-6999
Duct without Damper and Misc. Mechanical	WL 7000-7999
Multiple Penetrations	WL 8000-8999

3. Concrete or Masonry Floors and Walls - 1 or 2 Hour Rated
F Rating = Wall/Floor Rating
T Rating (Floors) = Floor Rating

<u>Penetrating Item</u>	<u>UL System No.</u>
No Penetrating Item	CAJ 0000-0999*
Metallic Pipe or Conduit	CAJ 1000-1999
Non-Metallic Pipe or Conduit	CAJ 2000-2999
Electrical Cables	CAJ 3000-3999
Cable Trays	CAJ 4000-4999
Insulated Pipes	CAJ 5000-5999
Bus Duct and Misc. Electrical	CAJ 6000-6999
Duct without Damper and Misc. Mechanical	CAJ 7000-7999
Multiple Penetrations	CAJ 8000-8999

*Alternate method of firestopping is patching opening to match original rated construction.

- H. Any opening in walls or floors not covered by the listed series of numbers shall be coordinated with the firestopping manufacturer.
- I. Any openings in floors or walls not described in the UL or listed by Intertek / Warnock Hersey Fire Resistance Directory, or outlined in manufacturer's information shall be sealed in a manner agreed upon by the Firestopping Manufacturer, Owner, and the Authority Having Jurisdiction.

3. PART EXECUTION

3.1 EXAMINATION

- A. Ensure all surfaces that contact seal materials are free of dirt, dust, grease, oil, rust, or loose materials. Clean and repair surfaces as required. Remove laitance and form-release agents from concrete.
- B. Ensure substrate and penetrating items have been permanently installed prior to installing firestopping systems. Ensure penetrating items have been properly spaced and have proper clearance prior to installing firestopping systems.

- C. Surfaces to which sealing materials are to be installed must meet the selected UL or Intertek / Warnock Hersey system substrate criteria.
- D. Prime substrates where recommended in writing by through-penetration firestop system manufacturer. Confine primer to area of bond.

3.2 INSTALLATION

- A. In existing construction, provide firestopping of openings prior to and after installation of penetrating items. Remove any existing coatings on surfaces prior to firestopping installation. Temporary firestopping shall consist of packing openings with fire resistant mineral wool for the full thickness of substrate, or an alternate method approved by the Authority Having Jurisdiction. All openings shall be temporarily firestopped immediately upon their installation and shall remain so until the permanent UL or listed by Intertek / Warnock Hersey listed firestopping system is installed.
- B. Install penetration seal materials in accordance with printed instructions of the UL or Intertek / Warnock Hersey Fire Resistance Directory and with the manufacturer's printed application instructions.
- C. Install dams as required to properly contain firestopping materials within openings and as required to achieve required fire resistance rating. Remove combustible damming after appropriate curing.

3.3 CLEANING AND PROTECTING

- A. Clean excess fill materials adjacent to openings as Work progresses by methods and with cleaning materials that are approved in writing by through-penetration firestop system manufacturers and that do not cause damage.
- B. Provide final protection and maintain conditions during and after installation that ensure that through-penetration firestop systems are without damage or deterioration at time of Substantial Completion. If, despite such protection, damage or deterioration occurs, remove damaged or deteriorated through-penetration firestop systems immediately and install new materials to produce systems complying with specified requirements.

3.4 IDENTIFICATION

- A. Provide and install labels adjacent to each firestopping location. Label shall be provided by the firestop system supplier and contain the following information in a contrasting color:
 - 1. The words "Warning - Through Penetration Firestop System - Do Not Disturb. Notify Building Management of Any Damage."
 - 2. Firestop System Supplier; UL or listed by Intertek / Warnock Hersey system number; date installed; contractor name and phone number; manufacturer's representative name, address, and phone number.

3.5 INSPECTION

- A. All penetrations shall be inspected by the manufacturer's representative to ensure proper installation.
- B. Access to firestop systems shall be maintained for examination by the Authority Having Jurisdiction at their request.
- C. Proceed with enclosing through-penetration firestop system with other construction only after inspection reports are issued and firestop installations comply with requirements.

- D. The contractor shall allow for visual destructive review of 5% of installed firestop systems (minimum of one) to prove compliance with specifications and manufacturer's instructions and details. Destructive system removal shall be performed by the contractor and witnessed by the engineer and manufacturer's factory representative. The engineer shall have sole discretion of which firestop system installations will be reviewed. The contractor is responsible for all costs associated with this requirement including labor and material for removing and replacing the installed firestop system. If any firestop system is found to not be installed per manufacturer's specific instructions and details, all firestop systems are subject to destructive review and replacement at the engineer's discretion and the contractor's expense.

END OF SECTION

SECTION 22 05 16

PLUMBING EXPANSION COMPENSATION

1. PART GENERAL

1.1 SECTION INCLUDES

- A. Expansion Joints and Compensators.
- B. Pipe Loops, Offsets, and Swing Joints.

1.2 REFERENCES

- A. Conform to Standards of Expansion Joint Manufacturer's Association.

1.3 SUBMITTALS

- A. Submit shop drawings under provisions of Section 22 05 00.
- B. Expansion joint shop drawings shall include maximum motion.

1.4 DESIGN CRITERIA

- A. Unless noted otherwise, base expansion calculations on 50°F installation temperature to 140°F for domestic hot water, plus 30% safety factor.

2. PART PRODUCTS

A. Type EJ-2:

- 1. Multiple plies of 300 series stainless steel bellows.
- 2. Rated for 300 psi working pressure at 800°F.
- 3. Cycle life shall be at least 1,000 full range (compression and extension) cycles at rated stroke and 6,000 cycles at 1/2 rated stroke.
- 4. Axial motion shall be as scheduled on the drawings, but not less than 2" (compression and extension).
- 5. Joints shall have 300 lb. flanges on each end.
- 6. Provide stainless steel inner liner.
- 7. Provide removable metal insulation shroud around the bellows.
- 8. Acceptable Manufacturers: American BOA Type FS3300, Flexonics, RM Model X-Flex-300 Multiply, or Hyspan Model 1501.

B. Type EJ-4:

- 1. Assembly consisting of two flexible connectors, two stainless steel flexible connectors, two 90° elbows, and a 180° return pipe. Unit shall be in the form of a pipe loop.
- 2. Connectors shall have corrugated stainless hose bodies with stainless steel braided casings.

3. Connectors shall be rated for 150 psi working pressure at 70°F and 100 psi at 800°F.
 4. Sizes 2" and smaller shall have steel threaded connections.
 5. Sizes 2-1/2" and larger shall have 150 lb. steel flanges.
 6. Connectors shall be suitable for 1/2" permanent misalignment.
 7. Acceptable Manufacturer: Metraflex Type ML.
- C. Alignment Guides:
1. Bolted semi-steel spider.
 2. Bolted guiding cylinder with supporting legs welded to pipe support.
 3. Sized to allow insulation to pass through the outer cylinder.
 4. Acceptable Manufacturers: American BOA, Hyspan, Flexonics, Keflex, or Metraflex.
- D. Concrete Thrust Blocks - Rods and Clamps:
1. Bends, offsets, tees, crosses, and dead ends, including flange and spigot pieces, shall be suitably rodded or clamped and blocked with concrete thrust blocks.
 2. Rods shall be all thread type, galvanized steel conforming to ANSI B1.1, Class 2A FIT, USS National Coarse Thread, tensile strength 55/77 ksi, yield strength 36 ksi minimum.
 3. Rods and clamps shall receive one field coat of asphaltum after installation.

3. PART EXECUTION

3.1 INSTALLATION

- A. Accomplish structural work and provide equipment required to control expansion and contraction of piping; including loops, offsets, swing joints, and expansion joints where required.
- B. Rigidly anchor pipe to building structure where necessary. Provide pipe guides so all movement occurs along axis of pipe only.
- C. Each expansion joint shall have either one anchor or two alignment guides on each side of it. Guides shall be located within 4 and 14 pipe diameters of the expansion joint or as recommended by the joint manufacturer.
- D. Preset all expansion joints to allow for expected expansion from installation temperature to operating temperature.

END OF SECTION

SECTION 22 05 29

PLUMBING SUPPORTS AND ANCHORS

1. PART GENERAL

1.1 SECTION INCLUDES

- A. Hangers, Supports, and Associated Anchors.
- B. Equipment Bases and Supports.
- C. Sleeves and Seals.
- D. Flashing and Sealing of Equipment and Pipe Stacks.
- E. Cutting of Openings.
- F. Escutcheon Plates and Trim.

1.2 REFERENCES

- A. MSS SP-58 - Pipe Hangers and Supports - Materials, Design, Manufacture, Selection, Application, and Installation.
- B. MSS SP 69 - Pipe Hangers and Supports - Selection and Application.
- C. MSS SP 89 - Pipe Hangers and Supports - Fabrication and Installation Practices
- D. MSS SP-127 – Bracing for Piping Systems Seismic-Wind-Dynamic Design, Selection, Application

1.3 SUBMITTALS

- A. Submit shop drawings and product data under provisions of Section 22 05 00. Include plastic pipe manufacturers' support spacing requirements.

1.4 WORK FURNISHED BUT INSTALLED UNDER OTHER SECTIONS

- A. Furnish sleeves and hanger inserts to General Contractor for placement into formwork.

2. PART PRODUCTS

2.1 SEISMIC RESTRAINTS

- A. Refer to Section 22 05 50 for additional requirements for seismic restraints.

2.2 HANGER RODS

- A. Hanger rods for single rod hangers shall conform to the following:

Pipe Size	Hanger Rod Diameter	
	Column #1	Column #2
2" and smaller	3/8"	3/8"
2-1/2" through 3-5/8"	1/2"	1/2"
4" and 5"	5/8"	1/2"
6"	3/4"	5/8"

Column #1: Steel, cast iron pipe.

Column #2: Copper and plastic pipe.

- B. Rods for double rod hangers may be reduced one size. Minimum rod diameter is 3/8 inches.
- C. Hanger rods and accessories used in mechanical spaces or otherwise dry areas shall have ASTM B633 electro-plated zinc finish.
- D. All hanger rods, nuts, washers, clevises, etc., in damp areas shall have ASTM A123 hot-dip galvanized finish applied after fabrication. This applies to the following areas:
 - 1. Exterior

2.3 PIPE AND STRUCTURAL SUPPORTS

A. General:

- 1. Pipe hangers, clamps, and supports shall conform to Manufacturers Standardization Society MSS SP-58, 69, 89, and 127 (where applicable).
- 2. On all insulated piping, provide at each support an insert of same thickness and contour as adjoining insulation, between the pipe and insulation jacket, to prevent insulation from sagging and crushing. Refer to insulation specifications for materials and additional information.
 - a. Insulation Couplings:
 - 1) Insulation Coupling: Molded thermoplastic, -65°F to 275°F, sizes up to 4-1/8" OD, and receive insulation thickness up to 1". Suitable for use indoors or outdoors with UV stabilizers. Vertical insulation riser clamps shall have a 1,000lb vertical load rating. On cold pipes operating below 60°F, cover joint and coupling with vapor barrier mastic to ensure continuous vapor barrier.
 - 2) Horizontal Strut Mounted Insulated Pipe:
 - a) Acceptable Manufacturers: Klo-Shure or equal.
 - 3) Vertical:
 - a) Acceptable Manufacturers: Klo-Shure Titan or equal.
- 3. Copper piping located in an exposed area, including indirect waste piping in kitchens and janitor's closets, shall use split ring standoff hangers for copper tubing. Support shall include plastic pipe insert similar to Unistrut Cush-A-Clamp, Hydra-Zorb, Erico Cushion Clamp or Cooper Vibra-Clamp. Use electro-galvanized or more corrosion resistant and threaded rod for floor applications. Use anchors applicable to the wall type with corrosion resistant threaded rod for wall applications.

Acceptable Products:

Erico/M-Co	Model #456
B-Line	Fig. 3198HCT
Anvil	Fig. CT138R
Nibco/Tolco	Fig. 301CT

B. Vertical Supports:

1. Support and laterally brace vertical pipes at every floor level in multi-story structures, unless otherwise noted by applicable codes, but never at intervals over 15 feet. Support vertical pipes with riser clamps installed below hubs, couplings, or lugs. Provide sufficient flexibility to accommodate expansion and contraction to avoid compromising fire barrier penetrations or stressing piping at fixed takeoff locations.

Acceptable Products:

Cooper/B-Line - Fig B3373 Series
Erico - 510 Series
Nibco/Tolco - Fig. 82

2. Place restrained neoprene mounts beneath vertical pipe riser clamps to prevent sweating of cold pipes. Select neoprene mounts based on the weight of the pipe to be supported. Insulate over mounts.

Acceptable Products: Mason RBA, RCA, or BR.

3. Wall supports shall be used where vertical height of structure exceeds minimum spacing requirements. Install wall supports at same spacing as hangers or strut supports along vertical length of pipe runs. Wall supports shall be coordinated with the Structural Engineer.
4. Masonry Anchors: Fasten to concrete masonry units with expansion anchors or self-tapping masonry screws. For expansion anchors into hollow concrete block, use sleeve-type anchors designed for the specific application. Do not fasten in masonry joints. Do not use powder actuated fasteners, wooden plugs, or plastic inserts

C. Hangers and Clamps:

1. Oversize all hangers, clamps, and supports on insulated piping to allow insulation and jacket to pass through unbroken. This applies to both hot and cold pipes.
2. Hangers in direct contact with bare copper pipe shall include plastic pipe insert similar to Unistrut Cush-A-Clamp, Hydra-Zorb, Erico Cushion Clamp or Cooper Vibra-Clamp within their temperature limits of -65°F to +275°F.
3. On all insulated piping, provide a semi-cylindrical metallic shield and vapor barrier jacket.
4. Ferrous hot piping 2-1/2 inches and larger shall have steel saddles tack welded to the pipe at each support with a depth not less than specified for the insulation. Factory fabricated inserts may be used.

Acceptable Products:

Anvil - Fig. 160, 161, 162, 163, 164, 165
Cooper/B-Line - Fig. 3160, 3161, 3162, 3163, 3164, 3165
Nibco/Tolco - Fig. 260-1, 261-1 1/2, 262-2, 263-2 1/2, 264-3, 265-4

5. As an alternative to separate pipe insulation insert and saddle, properly sized integral rigid insulation sections may be used.

Acceptable Products:

Cooper/B-Line - Fig. B3380 through B3384
Pipe Shields - A1000, A2000
Erico - Model 124, 127

6. Unless otherwise indicated, hangers shall be as follows:

a. Clevis Type:

Service: Bare Metal Pipe
Rigid Plastic Pipe
Insulated Cold Pipe
Insulated Hot Pipe - 3 inches & Smaller

Acceptable Products:	Bare Steel, Plastic or Insulated Pipe	Bare Copper Pipe
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Anvil	Fig. 260	
Cooper/B-Line	Fig. 3100	Fig. B3100C
Erico	Model 400	
Nibco/Tolco	Fig. 1	Fig. 81PVC

b. Continuous Channel with Clevis Type:

Service: Plastic Tubing
Flexible Hose
Soft Copper Tubing

Acceptable Products:

Cooper/B-Line - Fig. B3106, with Fig. B3106V
Nibco/Tolco - Fig. 1V

c. Adjustable Swivel Ring Type:

Service: Bare Metal Pipe - 4 inches and Smaller

Acceptable Products:	Bare Steel Pipe	Bare Copper Pipe
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Anvil	Fig. 69	
Cooper/B-Line	Fig. B3170NF	Fig. B3170CTC
Nibco/Tolco	Fig. 200	Fig. 203

7. Support may be fabricated from U-channel strut or similar shapes. Piping less than 4" in diameter shall be secured to strut with clamps of proper design and capacity as required to maintain spacing and alignment. Strut shall be independently supported from hanger drops or building structure. Size and support shall be per manufacturer's installation requirements for structural support of piping. Clamps shall not interrupt piping insulation.

a. Strut used in mechanical spaces or otherwise dry areas shall have ASTM B633 electro-plated zinc finish.

b. Strut used in damp areas listed in hanger rods shall have ASTM A123 hot-dip galvanized finish applied after fabrication.

8. Unless otherwise indicated, pipe supports for use with struts shall be as follows:

a. Clamp Type:

Service: Bare Metal Pipe
Rigid Plastic Pipe
Insulated Cold Pipe
Insulated Hot Pipe - 3 inches and smaller

1) Clamps in direct contact with copper pipe shall include plastic pipe insert similar to Unistrut Cush-A-Clamp, Hydra-Zorb, Erico Cushion Clamp or Cooper Vibra-Clamp.

- 2) Pipes subject to expansion and contraction shall have clamps oversized to allow limited pipe movement.

Acceptable Products:	Bare Steel, Plastic or Insulated Pipe	Bare Copper Pipe
Unistrut	Fig. P1100 or P2500	
Cooper/B-Line	Fig. B2000 or B2400	Fig. BVT
Nibco/Tolco	Fig. A-14 or 2STR	

D. Upper (Structural) Attachments:

1. Unless otherwise shown, upper attachments for hanger rods or support struts shall be as follows:

a. Steel Structure Clamps

- 1) C-Type Wide Flange Beam Clamps (for use on top and/or bottom of wide flanges. Not permitted for use with bar-joists):

Acceptable Products:

Anvil	Fig. 92
Cooper/B-Line	Fig. B3033/B3034
Erico	Model 300
Nibco/Tolco	68

- 2) Scissor Type Beam Clamps (For use with bar-joists and wide flange):

Acceptable Products:

Anvil	Fig. 228, 292
Cooper/B-Line	Fig. B3054
Erico	Model 360
Nibco/Tolco	Fig. 329

b. Concrete

- 1) Concrete Inserts, Single Rod Galvanized:

Acceptable Products:

Anvil	Fig. 282
Cooper/B-Line	Fig. B3014
Erico	Model 355
Nibco/Tolco	Fig. 310

- 2) Concrete Inserts, Continuous Strip Galvanized:

Acceptable Products:

Unistrut Corp	P3200 Series
Cooper/B-Line	Fig. B22-J
Erico	CONCT

- 3) Masonry Anchors: Fasten to concrete masonry units with expansion anchors or self-tapping masonry screws. For expansion anchors into hollow concrete block, use sleeve-type anchors designed for the specific application. Do not fasten in masonry joints. Do not use powder actuated fasteners, wooden plugs, or plastic inserts.

c. Steel Structure Welding:

- 1) Unless otherwise noted, hangers, clips, and auxiliary support steel may be welded in lieu of bolting, clamping, or riveting to the building structural frame. Take adequate precautions during all welding operations for fire prevention and protecting walls and ceilings from smoke damage.

2.4 FOUNDATIONS, BASES, AND SUPPORTS

A. Basic Requirements:

1. Furnish and install foundations, bases, and supports (not specifically indicated on the Drawings or in the Specifications of either the General Construction or Mechanical work as provided by another Contractor) for mechanical equipment.
2. All concrete foundations, bases and supports, shall be reinforced. All steel bases and supports shall receive a prime coat of zinc chromate or red metal primer. After completion of work, give steel supports a final coat of gray enamel.

B. Concrete Bases (Housekeeping Pads):

1. Unless shown otherwise on the drawings, concrete bases shall be nominal 4 inches thick and shall extend 3 inches on all sides of the equipment (6 inches larger than factory base).
2. Where a base is less than 12 inches from a wall, extend the base to the wall to prevent a "dirt-trap".
3. Concrete materials and workmanship required for the Contractor's work shall be provided by him. Materials and workmanship shall conform to the applicable standards of the Portland Cement Association. Reinforce with 6"x6", W1.4-W1.4 welded wire fabric. Concrete shall withstand 3,000 pounds compression per square inch at 28 days.
4. Equipment requiring bases is as follows:
 - a. Expansion Tank
 - b. Water Heater

C. Roof Pipe Supports:

1. Provide pre-fabricated roof pipe supports for all piping installed on the roof.
2. Support shall guide and align pipe while permitting longitudinal expansion.
3. The base shall be rounded to prevent damage to the roof, and drainage holes shall prevent ponding of water in the support.
4. Support shall be UV, corrosion and freeze/thaw resistant.
5. Support shall include orange paint, reflective safety orange accents or similar markings for increased visibility.
6. The strut system shall have galvanized aluminum finish.
7. Acceptable Products: Anvil International HBS-Base Series, Cooper B-Line Dura-Blok, Erico Caddy Pyramid 50, 150, 300, or 600 (to match load), Miro Industries 1.5, 3-R, 4-R or 5-R (to match pipe).

- D. Supports:
1. Provide sufficient clips, inserts, hangers, racks, rods, and auxiliary steel to securely support all suspended material, equipment and conduit without sag.
 2. Hang heavy equipment from concrete floors or ceilings with Architect/Engineer-approved concrete inserts, furnished and installed by the Contractor whose work requires them, except where indicated otherwise.
- E. Grout:
1. Grout shall be non-shrinking premixed (Master Builders Company "Embecco"), unless otherwise indicated on the drawings or approved by the Architect/Engineer.
 2. Use Mix No. 1 for clearances of 1" or less, and Mix No. 2 for all larger clearances.
 3. Grout under equipment bases, around pipes, at pipe sleeves, etc., and where shown on the drawings.

2.5 OPENINGS IN FLOORS, WALLS AND CEILINGS

- A. Exact locations of all openings for the installation of materials shall be determined by the Contractor and given to the General Contractor for installation or construction as the structure is built.
- B. Coordinate all openings with other Contractors.
- C. Hire the proper tradesman and furnish all labor, material and equipment to cut openings in or through existing structures, or openings in new structures that were not installed, or additional openings. Repair all spalling and damage to the satisfaction of the Architect/Engineer. Make saw cuts before breaking out concrete to ensure even and uniform opening edges.
- D. Said cutting shall be at the complete expense of each Contractor. Failure to coordinate openings with other Contractors shall not exempt the Contractor from providing openings at his expense.
- E. Do not cut structural members without written approval of the Architect or Structural Engineer.

2.6 ROOF PENETRATIONS

- A. Seal pipes with surface temperature below 150°F penetrating single-ply roofs with conical stepped pipe flashings and stainless steel clamps equal to Portals Plus Pipe Boots. Material shall match roofing membrane.
- B. Break insulation only at the clamp for pipes between 60°F and 150°F. Seal outdoor insulation edges watertight.

2.7 SLEEVES AND LINTELS

- A. Each Contractor shall provide sleeves and lintels for all duct and pipe openings required for the Contractor's work in masonry walls and floors, unless specifically shown as being by others.
- B. Fabricate all sleeves from standard weight black steel pipe or as indicated on the drawings. Provide continuous sleeve. Cut or split sleeves are not acceptable.
- C. Fabricate all lintels for masonry walls from structural steel shapes or as indicated on the drawings. Have all lintels approved by the Architect or Structural Engineer.
- D. Sleeves through the floors on exposed risers shall be flush with the ceiling, with planed squared ends extending 1" above the floor in unfinished areas, and flush with the floor in finished areas, to accept spring closing floor plates.

- E. Sleeves shall not penetrate structural members or masonry walls without approval from the Structural Engineer. Sleeves shall then comply with the Architect/Engineer's design.
- F. Openings through unexcavated floors and/or foundation walls below the floor shall have a smooth finish with sufficient annular space around material passing through opening so slight settling will not place stress on the material or building structure.
- G. Install all sleeves concentric with pipes. Secure sleeves in concrete to wood forms. This Contractor is responsible for sleeves dislodged or moved when pouring concrete.
- H. Where pipes rise through concrete floors that are on earthen grade, provide 3/4" resilient expansion joint material (asphalt and cork) wrapped around the pipe, the full depth of concrete, at the point of penetration. Secure to prevent shifting during concrete placement and finishing.
- I. Size sleeves large enough to allow expansion and contraction movement. Provide continuous insulation wrapping.

2.8 ESCUTCHEON PLATES AND TRIM

- A. Fit escutcheons to all insulated or uninsulated exposed pipes passing through walls, floors, or ceilings of finished rooms.
- B. Escutcheons shall be heavy gauge, cold rolled steel, copper coated under a chromium plated finish, heavy spring clip, rigid hinge and latch.
- C. Install galvanized steel (unless otherwise indicated) trim strip to cover vacant space and raw construction edges of all rectangular openings in finished rooms. This includes pipe openings.

2.9 PIPE PENETRATIONS

- A. Seal all pipe penetrations. Seal non-rated walls and floor penetrations with grout or caulk. Backing material may be used.
- B. Seal fire rated wall and floor penetrations with fire seal system as specified.

2.10 PIPE ANCHORS

- A. Provide all items needed to allow adequate expansion and contraction of all piping. All piping shall be supported, guided, aligned, and anchored as required.
- B. Repair all piping leaks and associated damage. Pipes shall not rub on any part of the building.

2.11 FINISH

- A. Prime coat exposed steel hangers and supports. Hangers and supports in crawl spaces, pipe shafts, and suspended ceiling spaces are not considered exposed.

3. PART EXECUTION

3.1 PLUMBING SUPPORTS AND ANCHORS

- A. General Installation Requirements:
 - 1. Install all items per manufacturer's instructions.
 - 2. Coordinate the location and method of support of piping systems with all installations under other Divisions and Sections of the Specifications.
 - 3. Where pipe support members are welded to structural building framing, scrape, brush clean, and apply one coat of zinc rich primer to welding.

4. Supports shall extend directly to building structure. Do not support piping from duct hangers. Do not allow lighting or ceiling supports to be hung from piping supports.

B. Supports Requirements:

1. Install roof pipe supports to resist wind movement per manufacturer's recommendations. Method of securing base to roof shall be compatible with roofing materials.
2. Where building structural steel is fireproofed, all hangers, clamps, auxiliary steel, etc., which attach to it shall be installed prior to application of fireproofing. Repair all fireproofing damaged during pipe installation.
3. Set all concrete inserts in place before pouring concrete.
4. Furnish, install and prime all auxiliary structural steel for support of piping systems that are not shown on the Drawings as being by others.
5. Install hangers and supports complete with lock nuts, clamps, rods, bolts, couplings, swivels, inserts and required accessories.
6. Hangers for horizontal piping shall have adequate means of vertical adjustment for alignment.

C. Pipe Requirements:

1. Support all piping and equipment, including valves, strainers, traps and other specialties and accessories to avoid objectionable or excessive stress, deflection, swaying, sagging or vibration in the piping or building structure during erection, cleaning, testing and normal operation of the systems.
2. Do not, however, restrain piping to cause it to snake or buckle between supports or to prevent proper movement due to expansion and contraction.
3. Support piping at equipment and valves so they can be disconnected and removed without further supporting the piping.
4. Piping shall not introduce strains or distortion to connected equipment.
5. Parallel horizontal pipes may be supported on trapeze hangers made of structural shapes and hanger rods; otherwise, pipes shall be supported with individual hangers.
6. Trapeze hangers may be used where ducts interfere with normal pipe hanging.
7. Provide additional supports where pipe changes direction, adjacent to flanged valves and strainers, at equipment connections and heavy fittings.
8. Provide at least one hanger adjacent to each joint in grooved end steel pipe with mechanical couplings.

D. Provided the installation complies with all loading requirements of truss and joist manufacturers, the following practices are acceptable:

1. Loads of 100 lbs. or less may be attached anywhere along the top or bottom chords of trusses or joists with a minimum 3' spacing between loads.
2. Loads greater than 100 lbs. must be hung concentrically and may be hung from top or bottom chord, provided one of the following conditions is met:
 - a. The hanger is attached within 6" from a web/chord joint.

- b. Additional L2x2x1/4 web reinforcement is installed per manufacturer's requirements.
- 3. It is prohibited to cantilever a load using an angle or other structural component that is attached to a truss or joist in such a fashion that a torsional force is applied to that structural member.
- 4. If conditions cannot be met, coordinate installation with truss or joist manufacturer and contact Architect/Engineer.
- E. After piping and insulation installation are complete, cut hanger rods back at trapeze supports so they do not extend more than 3/4" below bottom face of lowest fastener and blunt any sharp edges.
- F. Do not exceed 25 lbs. per hanger and a minimum spacing of 2'-0" on center when attaching to metal roof decking (limitation not required with concrete on metal deck). This 25 lbs. load and 2'-0" spacing include adjacent electrical and architectural items hanging from deck. If the hanger restrictions cannot be achieved, supplemental framing off steel framing will need to be added.
- G. Do not exceed the manufacturer's recommended maximum load for any hanger or support.
- H. Spacing of Hangers shall not exceed the compressive strength of the insulation inserts, and in no case shall exceed the spacing as defined in 2016 CPC, Table 313.3 as applied to each piping system.

END OF SECTION

SECTION 22 05 48

PLUMBING VIBRATION ISOLATION

1. PART GENERAL

1.1 SECTION INCLUDES

- A. Vibration Isolation.
- B. Flexible Connectors.

1.2 SUBMITTALS

- A. Submit shop drawings per Section 22 05 00 and the Vibration Isolation Submittal Form at the end of this section.
- B. Vibration isolation submittals may be included with equipment being isolated, but must comply with this section.
- C. Base submittals shall include equipment served, construction, coatings, weights, and dimensions.
- D. Isolator submittals shall include:
 - 1. Equipment served
 - 2. Type of Isolator
 - 3. Load in Pounds per Isolator
 - 4. Recommended Maximum Load for Isolator
 - 5. Spring Constants of Isolators (for Spring Isolators)
 - 6. Load vs. Deflection Curves (for Neoprene Isolators)
 - 7. Specified Deflection
 - 8. Deflection to Solid (at least 150% of calculated deflection)
 - 9. Loaded (Operating) Deflection
 - 10. Free Height
 - 11. Loaded Height
 - 12. Kx/Ky (horizontal to vertical stiffness ratio – for spring isolators)
 - 13. Materials and Coatings
 - 14. Spring Diameters
- E. Make separate calculations for each isolator on equipment where the load is not equally distributed.
- F. Flexible connector shop drawings shall include overall face-to-face length and all specified properties.
- G. Submit certification that equipment, accessories, and components will withstand seismic forces defined in Section 22 05 50. Include the following:
 - 1. Basis for Certification: Indicate whether certification is based on actual test of assembled components or on calculation.
 - a. The term "withstand" means "the unit will remain in place without separation of any parts from the device when subjected to the seismic forces specified."
 - 2. Dimensioned Outline Drawings of Equipment Unit: Identify center of gravity and locate and describe mounting and anchorage provisions.
 - 3. Detailed description of equipment anchorage devices on which the certification is based and their installation requirements.

- H. Contractor shall provide seismic bracing calculations stamped by a licensed California Structural Engineer for all suspended utilities.
 - 1. Contractor to submit shop drawings showing the following:
 - a. All seismic bracing locations and type of restraint being used.
 - b. Maximum seismic loads shall be indicated on the shop drawings for each brace location.
 - c. Manufacturer's seismic restraint layout on contractor shop drawings to be stamped by a licensed California Structural Engineer for all suspended utilities.

2. PART PRODUCTS

2.1 BASIC CONSTRUCTION AND REQUIREMENTS

- A. Vibration isolation for this project is subject to seismic restraint requirements of Section 22 05 50.
- B. Vibration isolators shall have either known undeflected heights or other markings so deflection under load can be verified.
- C. All isolators shall operate in the linear portion of their load versus deflection curve. The linear portion of the deflection curve of all spring isolators shall extend 50% beyond the calculated operating deflection (e.g., 3" for 2" calculated deflection). The point of 50% additional deflection shall not exceed the recommended load rating of the isolator.
- D. The lateral to vertical stiffness ratio (K_x/K_y) of spring isolators shall be between 0.8 and 2.0.
- E. All neoprene shall have UV resistance sufficient for 20 years of outdoor service.
- F. All isolators shall be designed or treated for corrosion resistance. Steel bases shall be cleaned of welding slag and primed for interior use, and hot dip galvanized after fabrication for exterior use. All bolts and washers over 3/8" diameter located outdoors shall be hot dip galvanized per ASTM A153. All other bolts, nuts and washers shall be zinc electroplated. All ferrous portions of isolators, other than springs, for exterior use shall be hot dip galvanized after fabrication. Outdoor springs shall be neoprene dipped or hot dip galvanized. All damage to coatings shall be field repaired with two coats of zinc rich coating.
- G. Equip all mountings used with structural steel bases with height-saving brackets. Bottoms of the brackets shall be 1-1/2" to 2-1/2" above the floor or housekeeping pad, unless shown otherwise on the drawings. Steel bases shall have at least four points of support.
- H. All isolators, except M1, shall have provision for leveling.
- I. Construction criteria and standards of seismic restraint design for suspended pipes, ducts and mechanical equipment shall be per the International Seismic Application Technology (ISAT) OSHPD OPM #0485. (877)999-ISAT or Mason.

2.2 HANGERS

- A. Type H2:
 - 1. Vibration hangers shall contain a steel spring in a neoprene cup with a grommet to prevent short circuiting the hanger rod.
 - 2. The cup shall have a steel washer to distribute load on the neoprene and prevent its extrusion.

3. Spring diameters and hanger box lower hole sizes shall be large enough to permit the hanger rod to swing through a 30° arc before contacting the grommet and short circuiting the spring.
4. Provide end connections for hanging ductwork or piping.
5. Acceptable Manufacturers: Mason "30" or "W30", Kinetics "SRH", Amber/Booth "BSRA", Aeroflex "RSH", Vibration Eliminator Co. "SNC".

B. Type H3:

1. Vibration hangers shall have a steel spring in a neoprene cup with a grommet to prevent short circuiting of the hanger rod.
2. The cup shall have a steel washer to distribute load on the neoprene and prevent its extrusion.
3. Spring diameters and hanger box lower hole sizes shall be large enough to permit the hanger rod to swing through a 30° arc before contacting the grommet and short circuiting the spring.
4. Provide end connections for hanging ductwork or piping.
5. Hangers shall be capable of holding the load at a fixed elevation during installation. They shall have a secondary adjustment to transfer the load to the spring and maintain the same position.
6. Deflection shall be indicated by a pointer and scale.
7. Acceptable Manufacturer: Mason "PC30", Kinetics "SFH", Amber/Booth "BSW", Vibration Eliminator Co. "PCS".

2.3 FLEXIBLE CONNECTORS (NOISE AND VIBRATION ELIMINATORS)

A. Type FC1:

1. Spherical flexible connectors with multiple plies of nylon tire cord fabric and either EPDM or molded and cured neoprene. Outdoor units shall be EPDM.
2. Steel aircraft cables or threaded steel rods shall be used to prevent excess elongation.
3. All straight through connections shall be made with twin-spheres properly pre-extended as recommended by the manufacturer.
4. Connectors up to 2" size may have threaded ends.
5. Connectors 2-1/2" and over shall have floating steel flanges recessed to lock raised face neoprene flanges.
6. All connectors shall be rated for a minimum working pressure of 150 psi at 200°F.
7. Acceptable Manufacturer: Metraflex "Double Cable-Sphere", Minnesota Flex Corp., Mercer "200 Series", Twin City Hose "MS2".

B. Type FC2:

1. Stainless steel flexible connectors with corrugated stainless steel hose body and stainless steel braided casing.
2. Rated for minimum working pressures of 150 psi at 70°F and 100 psi at 800°F.

3. Sizes 2" and under shall have steel threaded connections.
4. Sizes 2-1/2" and over shall have 150 lb. steel flanges.
5. Suitable for 1/2" permanent misalignment.
6. Acceptable Manufacturers: Mason or Mercer "BSS-GU", Metraflex "ML", Twin City Hose "TCHS", American "BOA B4-1", Flexible Metal Hose Company "FM-21", or Wheatley.

3. PART EXECUTION

3.1 GENERAL INSTALLATION

- A. Install all products per manufacturer's recommendations.
- B. Provide vibration isolation as indicated on the drawings and as described herein.
- C. Clean the surface below all mountings that are not bolted down and apply adhesive cement equal to Mason Type WG between mounting and floor. If movement occurs, bolt mountings down. Isolate bolts from baseplates with neoprene washers and bushings.
- D. All static deflections listed in the drawings and specifications are the minimum acceptable actual deflection of the isolator under the weight of the installed equipment - not the maximum rated deflection of the isolator.
- E. Support equipment to be mounted on structural steel frames with isolators under the frames or under brackets welded to the frames. Where frames are not needed, fasten isolators directly to the equipment.
- F. Where a specific quantity of hangers is noted in these specifications, it shall mean hanger pairs for support points that require multiple hangers, such as pipes supported on a strut rack.

END OF SECTION

SECTION 22 05 50

SEISMIC REQUIREMENTS FOR EQUIPMENT AND SUPPORTS

1. PART GENERAL

1.1 SECTION INCLUDES

- A. Seismic Requirements.

1.2 QUALITY ASSURANCE

A. General:

1. Items used for seismic restraint of equipment and systems shall be specifically manufactured for seismic restraint.
2. These requirements are beyond those listed in Section 22 05 29 of these specifications. Where a conflict arises between the seismic requirements of this section and any other section, the Architect/Engineer shall be immediately notified for direction to proceed.

B. Manufacturer:

1. System Supports/Restraints: Company specializing in the manufacture of products specified in this Section.
2. Equipment: Each company providing equipment that must meet seismic requirements shall provide certification included in project submittals the equipment supplied for the project meets or exceeds the seismic requirements of the project.

- C. Testing Agency: An independent testing agency, acceptable to Authorities Having Jurisdiction, with experience and capability to conduct the testing indicated.

- D. Installer: Company specializing in performing the work of this Section.

- E. Suppliers: Following is a partial list of manufacturer/supplier contact information for seismic restraints:

1. Mason Industries, Inc. www.mason-ind.com.
2. Tolco (909) 737-5599, www.tolco.com

1.3 SUBMITTALS

- A. Submit under provisions of Section 22 05 00.

B. Shop Drawings:

1. Coordination Drawings: Plans and sections drawn to scale, coordinating seismic bracing of mechanical components with other systems and equipment in the vicinity, including other seismic restraints.
2. Manufacturer's Certifications: Professional Structural Engineer licensed in the state where the project is located shall review and approve manufacturer's certifications of compliance.
3. System Supports/Restraints - Submit for each condition requiring seismic bracing:
 - a. Calculations for each seismic brace and detail utilized on the project.
 - b. Plan drawings showing locations and types of seismic braces on contractor fabrication/installation drawings.

- c. Cross-reference between details and plan drawings to indicate exactly which brace is being installed at each location. Details provided are to clearly indicate attachments to structure, correctly representing the fastening requirements of bracing.
 - d. Clear indication of brace design forces and maximum potential component forces at attachment points to building structure for confirmation of acceptability by the Structural Engineer of Record.
- 4. Equipment - Submit for each piece of equipment supplied:
 - a. Certification that the equipment supplied for the project meets or exceeds the seismic requirements specified.
 - b. Specific details of seismic design features of equipment and maximum seismic loads imparted to the structural support.
- C. A seismic restraint designer shall be provided whether or not exceptions listed in the applicable building code are met. If seismic restraints are not provided for a system that requires seismic bracing, the seismic designer shall submit a signed and sealed letter to the Architect/Engineer and Authorities Having Jurisdiction stating the exceptions, along with code reference, utilized for each item. Seismic designer shall review system installation for general conformance to the exception requirements stated in the code and document, in writing, the system has been installed in accordance to the exception.

1.4 TESTING AND INSPECTION

- A. Special Inspection and Testing shall be done in accordance with Chapter 17 of the State of California Building Code.
- B. The District shall employ a Special Inspection Agency to perform the duties and responsibilities specified in Section 1704 and 1705.
- C. Work performed on the premises of a fabricator approved by the building official need not be tested and inspected. The fabricator shall submit a certificate of compliance that the work has been performed in accordance with the approved plans and specifications to the building official and the Architect and Engineer of Record.
- D. The Special Inspection Agency shall furnish inspection reports to the building official, the Owner, the Architect, the Engineer of Record, and the General Contractor. The reports shall be completed and furnished within 48 hours of inspected work. A final signed report stating whether the work requiring special inspection was, to the best of the Special Inspection Agency's knowledge, in conformance with the approved plans and specifications shall be submitted.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Deliver, store, protect and handle products to site. Accept material on site in factory containers and packing. Inspect for damage. Protect from damage and contamination by maintaining factory packaging until installation. Follow manufacturer's instructions for storage.

1.6 DESIGN REQUIREMENTS

- A. This project is subject to the seismic bracing requirements of California Building Code, Division of State Architect (DSA) Interpretation of Regulations.
- B. The following criteria are applicable to this project:
 - 1. Risk Category: I
 - 2. Seismic Factor: $I_E = 1.0$

3. Seismic Design Category: D
 4. Component Amplification Factors (a_p) and Component Response Modification Factors (R_p) shall be taken from Table 13.5-1 in ASCE 7-10 for the individual equipment or system being restrained.
 5. Component Importance Factors (I_p) shall be taken from Section 13.1.3 in ASCE 7-10 for the individual equipment or system being restrained.
 6. The total height of the structure and the height of the system to be restrained within the structure shall be determined in coordination with architectural plans and the General Contractor.
- C. Forces shall be calculated with the above requirements and Equation 13.3-1, -2, and -3 of ASCE 7-10, unless exempted by 13.1.4
 - D. Equipment shall meet California Building Code and ASCE 7 seismic qualification requirements in concurrence with ICC ES AC156 Acceptance Criteria for Seismic Qualification by Shake-Table Testing of Nonstructural Components and Systems.
 - E. All seismic anchorage and bracing shall comply with FM Global Property Loss Prevention Data Sheet 1-11, Fire Following Earthquakes.
- 1.7 COORDINATION
- A. Coordinate layout and installation of seismic bracing with building structural systems and architectural features, and with mechanical, fire-protection, electrical and other building features in the vicinity.
 - B. Coordinate concrete bases with building structural system.
- 1.8 WARRANTY
- A. Provide one-year warranty on parts and labor for manufacturer defects and installation workmanship.

2. PART PRODUCTS

2.1 SEISMIC DESIGN CRITERIA

- A. This section describes the requirements for seismic restraint of systems and equipment related to continued operation of the facility after a design seismic event.
- B. Definitions
 1. Stay in Place:
 - a. All systems and equipment shall be anchored and restrained such that the anchoring system is intended not to fail and equipment and/or system components will not fall.

2.2 SEISMIC BRACING AND SUPPORT OF SYSTEMS AND COMPONENTS

- A. General:
 1. Seismic restraint designer shall coordinate all attachments with the Structural Engineer of Record; refer to submittal requirements.

2. The seismic restraint design shall be based on actual equipment data obtained from manufacturer's submittals or the manufacturer. The equipment manufacturer shall verify and provide written certification the attachment points on the equipment can accept the combination of seismic, weight, and other imposed loads.
 3. Design analysis shall include calculated dead loads, static seismic loads, and capacity of materials utilized for the connection of the equipment or system to the structure.
 4. Analysis shall detail anchoring methods, bolt diameter, embedment, and weld length.
 5. All seismic restraint devices shall be designed to accept without failure the forces calculated per the applicable building code.
 6. All seismic restraints and combination isolator/restraints shall have verification of their seismic capabilities witnessed by an independent testing agency.
- B. Friction from gravity loads shall not be considered resistance to seismic forces.
- C. Fire protection systems shall meet the requirements of NFPA-13 and NFPA-14 for the building seismic requirements.
- D. Housekeeping Pads:
1. Reinforced housekeeping pads shall be provided to handle shear, tension, and compression forces with proper reinforcement, doweling, and attachments connecting the pad to the structural slab.

2.3 SEISMIC RESTRAINT AND CONSTRUCTION OF EQUIPMENT

- A. Equipment supplied for the project shall be designed to meet the requirements of lateral forces calculated using the applicable code and method described above.
- B. The following is a partial list of equipment that shall be restrained and that shall be constructed to meet seismic forces described in this section:
1. Air Compressors
 2. Pumps
 3. Tanks

2.4 MATERIALS

- A. Use the following materials for restraints:
1. Indoor Dry Locations: Steel, zinc plated.
 2. Outdoors and Damp Locations: Galvanized steel.
 3. Corrosive Locations: Stainless steel.

2.5 ANCHORAGE AND STRUCTURAL ATTACHMENT COMPONENTS

- A. Strength: Defined in reports by ICC Evaluation Service or another agency acceptable to authorities having jurisdiction.
1. Structural Safety Factor: Strength in tension and shear of components used shall be at least two times the maximum seismic forces to which they will be subjected.
- B. Concrete and Masonry Anchor Bolts and Studs: Steel-expansion wedge type. Comply with IBC, ACI and ICC ES requirements for cracked concrete anchors.
- C. Concrete Inserts: Steel-channel type.

- D. Through Bolts: Structural type, hex head, high strength. Comply with ASTM F3125, Grade A 325.
- E. Welding Lugs: Comply with MSS SP-69, Type 57.
- F. Beam Clamps for Steel Beams and Joists: Double sided. Single-sided type is not acceptable.
- G. Bushings for Floor-Mounted Equipment Anchors: Neoprene units designed for seismically rated rigid equipment mountings, and matched to the type and size of anchor bolts and studs used.
- H. Bushing Assemblies for Wall-Mounted Equipment Anchorage: Assemblies of neoprene elements and steel sleeves designed for seismically rated rigid equipment mountings, and matched to the type and size of attachment devices used.

2.6 SEISMIC BRACING COMPONENTS

- A. Slotted Steel Channel: 1-5/8-by-1-5/8-inch cross section, formed from 0.1046-inch-thick steel, with 9/16-by-7/8-inch slots at a maximum of 2 inches o.c. in webs, and flange edges turned toward web.
 - 1. Materials for Channel: ASTM A 1011, GR 33.
 - 2. Materials for Fittings and Accessories: ASTM A 635, ASTM A 576, or ASTM A 36.
 - 3. Fittings and Accessories: Products of the same manufacturer as channels and designed for use with that product.
 - 4. Finish: Baked, rust-inhibiting, acrylic-enamel paint applied after cleaning and phosphate treatment, unless otherwise indicated.
- B. Cable-Type Bracing Assemblies: Zinc-coated, high-strength steel wire rope cable attached to steel thimbles, brackets, and bolts designed for cable service.
 - 1. Arrange units for attachment to the braced component at one end and to the structure at the other end.
 - 2. Wire Rope Cable: Comply with ASTM A 603. Use 49- or 133-strand cable with a minimum strength of 2 times the calculated maximum seismic force to be resisted.
- C. Hanger Rod Stiffeners: Slotted steel channels with internally bolted connections to hanger rod.

3. PART EXECUTION

3.1 INSTALLATION

- A. Refer to the applicable code sections and Authority Having Jurisdiction for the exact seismic restraint requirements of piping, ductwork, conduit, equipment, etc.
- B. Layout of transverse and longitudinal bracing shall follow recommendations of approved design standards listed in Part 1 of this specification section.
- C. All rigid floor mounted equipment shall have a resilient media between the equipment mounting hole and the anchor bolt in concrete.
- D. All seismic restraint systems shall be installed in strict accordance with the manufacturer's written instructions and all certified submittal data.
- E. Installation of seismic restraints shall not cause any change in position of equipment, piping, or ductwork, resulting in stresses or misalignment.

- F. No rigid connections between equipment and the building structure shall be made that degrade the noise and vibration-isolation system specified.
- G. Do not install any equipment, piping, duct, or conduit that makes rigid connections with the building unless isolation is not specified.
- H. Coordinate work with all other trades to avoid rigid contact with the building. Any conflicts with other trades that will result in rigid contact with equipment or piping due to inadequate space or other unforeseen conditions shall be brought to the Architect/Engineer's attention prior to specific equipment selection.
- I. Prior to installation, bring to the Architect/Engineer's attention any discrepancies between the specifications and the field conditions, or changes required due to specific equipment selection.
- J. Bracing may occur from flanges of structural beams, upper truss cords of bar joists, cast in place inserts, or International Code Council approved seismic anchors for installation in concrete.
- K. Cable restraints shall be installed slightly slack to avoid short-circuiting the isolated suspended equipment, ductwork, piping, or conduit.
- L. Cable assemblies shall be installed taut on non-isolated systems. Solid braces may be used in place of cables on rigidly attached systems only.
- M. Do not install cables over sharp corners.
- N. Brace support rods when necessary to accept compressive loads. Welding of compression braces to the vertical support rods is not acceptable.
- O. Provide reinforced clevis bolts when required.
- P. The vibration isolation manufacturer shall furnish integral structural steel bases as required. Independent steel rails are not acceptable.
- Q. Post-Installed anchors shall be provided to meet seismic requirements.
- R. Vertical pipe risers flexibly supported to accommodate thermal motion and/or pipe vibration shall be guided to maintain pipe stability and provide horizontal seismic restraint.
- S. Seismic restraints shall be mechanically attached to the system. Looping restraints around the system is not acceptable.
- T. Piping crossing building seismic or expansion joints, passing from building to building, or supported from different portions of the building shall be installed to allow differential support displacements without damaging the pipe, equipment connections, or support connections. Pipe offsets, loops, anchors, and guides shall be installed as required to provide required motion capability and limit motion of adjacent piping.
- U. Water tanks shall be secured to their saddles by welding or proper concrete attachment, and those saddles shall be properly attached to the structure.
- V. Brace all terminal units with water coils as required by the building code and provide flexible connection to the coil if bracing is required.
- W. Do not brace a system to two different structures such as a wall and a ceiling.
- X. Provide appropriately sized openings in walls, floors, and ceilings for anticipated seismic movement. Provide fire seal systems in fire-rated walls.
- Y. Positively attach all roof mounted equipment to roof curbs. Positively attach all roof curbs to building structure.

Z. Exposed seismic supports in occupied areas shall be guarded or covered to protect occupants.

AA. Coordinate seismic bracing of architecturally exposed ductwork with the Architect/Engineer.

3.2 SEISMIC RESTRAINT EXCLUSIONS

A. Refer to the applicable code sections and Authority Having Jurisdiction for allowable exclusions.

END OF SECTION

SECTION 22 05 53

PLUMBING IDENTIFICATION

1. PART GENERAL

1.1 SECTION INCLUDES

- A. Identification of products installed under Division 22.

2. PART PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

- A. 3M, Bunting, Calpico, Craftmark, Emedco, Kolbi Industries, Seton, W.H. Brady, Marking Services.

2.2 MATERIALS

- A. All pipe markers (purchased or stenciled) shall conform to ANSI A13.1. Marker lengths and letter sizes shall be at least the following:

<u>OD of Pipe or insulation</u>	<u>Marker Length</u>	<u>Size of Letters</u>
Up to and including 1-1/4"	8"	1/2"
1-1/2" to 2"	8"	3/4"
2-1/2" to 6"	12"	1-1/4"

- B. Aluminum Nameplates: Black enamel background with natural aluminum border and engraved letters furnished with two mounting holes and screws.
- C. Brass Tags: Brass background with engraved black letters. Tag size minimum 1-1/2" square or 1-1/2" round.
- D. Vinyl Pipe Markers: Colored vinyl with permanent pressure sensitive adhesive backing.
- E. Underground Pipe Markers: Bright colored continuously printed plastic ribbon tape 6" wide by 3.5 mils thick, manufactured for direct burial, with aluminum foil core for location by non-ferrous metal detectors and bold lettering identifying buried item.
- F. Tracer Wire:
1. Single copper conductors shall be solid or stranded annealed or hard uncoated copper per UL83 and ASTM requirements. Tracer tape or copper-coated steel wire is not acceptable.
 2. Conductor shall be insulated with HMWPE as specified and applied in a concentric manner. The minimum at any point shall not be less than 90% of the specified average thickness in compliance with UL 83.
 3. Tracer wire shall be continuously spark tested at 7500 Volts DC. Other electrical and mechanical tests shall be in accordance with UL 1581.

3. PART EXECUTION

3.1 INSTALLATION

- A. Install all products per manufacturer's recommendations.

- B. Degrease and clean surfaces to receive adhesive for identification materials.
- C. Valves:
1. All valves (except shutoff valves at equipment) shall have numbered tags.
 2. Provide or replace numbered tags on all existing valves that are connected to new systems or that have been revised.
 3. Provide all existing valves used to extend utilities to this project with numbered tags. Review tag numbering sequence with the Owner prior to ordering tags.
 4. Secure tags with heavy duty key chain and brass "S" link or with mechanically fastened plastic straps.
 5. Attach to handwheel or around valve stem. On lever operated valves, drill the lever to attach tags.
 6. Number all tags and show the service of the pipe.
- D. Pipe Markers:
1. Adhesive Backed Markers: Use Brady Style 1, 2, or 3 on pipes 3" diameter and larger. Use Brady Style 4, 6, or 8 on pipes under 3" diameter. Similar styles by other listed manufacturers are acceptable. Secure all markers at both ends with a wrap of pressure sensitive tape completely around the pipe.
 2. Snap-on Markers: Use Seton "Setmark" on pipes up to 5-7/8" OD. Use Seton "Setmark" with nylon or Velcro ties for pipes 6" OD and over. Similar styles by other listed manufacturers are acceptable.
 3. Stencil Painted Pipe Markers:
 - a. Remove rust, grease, dirt, and all foreign substances from the pipe surface.
 - b. Apply primer on non-insulated pipes before painting.
 - c. Use background and letter colors as scheduled later in this section.
 4. Apply markers and arrows in the following locations where clearly visible:
 - a. At each valve.
 - b. On both sides of walls that pipes penetrate.
 - c. At least every 20 feet along all pipes.
 - d. On each riser and each leg of each "T" joint.
 - e. At least once in every room and each story traversed.
 5. Underground Pipe Markers: Install 8" to 10" below grade, directly above buried pipes.
- E. Equipment:
1. All equipment not easily identifiable such as controls, relays, gauges, etc.; and all equipment in an area remote from its function shall have nameplates or plastic tags listing name, function, and drawing symbol. Do not label exposed equipment in public areas.
- F. Tracer Wire:
1. Tracer wire shall be installed on top of all non-metallic buried utilities.
 2. Tracer wire shall be taped directly to plastic water or drain pipe.
 3. Tracer wire shall not be fastened directly or indirectly to gas piping.

4. Tracer wire when attached shall be secured to the pipe a minimum of every 10 feet and at all changes of direction.
5. Tape shall be Polyken "930-35", Protecto-Wrap "310", or approved equal.
6. Tracer wire shall be continuous between boxes and shall be tested for continuity.
7. Splices in tracer wire shall be made with a water proof splice kit to prevent corrosion. **Wire nuts shall not be used.**
8. The tracer wire shall daylight to grade through a 2" PVC conduit, at the point of the utility entrance to building. PVC conduit shall be capped and labeled as future contact point to locate the utility.

3.2 SCHEDULE

- A. Pipes to be marked shall be labeled with the text as shown in the following table regardless of which method or material is used:

Pipe Service	Lettering Color	Background Color
CONDENSATE DRAIN	Black	Yellow
DOMESTIC COLD WATER	White	Green
DOMESTIC HOT WATER - 115°F	Black	Yellow
DOMESTIC HOT WATER - 140°F	Black	Yellow
DOMESTIC HOT WATER CIRCULATING - 115°F	Black	Yellow
DOMESTIC HOT WATER CIRCULATING - 140°F	Black	Yellow
SANITARY SEWER	Black	Yellow
VENT	Black	Yellow
STORM SEWER (PRIMARY AND SECONDARY)	White	Green
NATURAL GAS	Black	Yellow
TEMPERED WATER	Black	Yellow
All Underground Pipes	Varies	Varies
Tracer Wire - Water Pipe Lines	---	Blue
Tracer Wire - Natural Gas Pipe Lines	---	Yellow
Tracer Wire - All other buried types	---	Green

END OF SECTION

SECTION 22 07 19

PLUMBING PIPING INSULATION

1. PART GENERAL

1.1 SECTION INCLUDES

- A. Piping Insulation.
- B. Insulation Jackets.

1.2 QUALITY ASSURANCE

- A. Applicator: Company specializing in piping insulation application with five years minimum experience.
- B. Materials: Flame spread/smoke developed rating of 25/50 in accordance with ASTM E84, NFPA 255, or UL 723 (where required).

2. PART PRODUCTS

2.1 INSULATION

- A. Type A: Glass fiber; ANSI/ASTM C547; 0.24 maximum 'K' value at 75°F; non-combustible. All purpose, white Kraft jacket bonded to aluminum foil and reinforced with fiberglass yarn, 25/50 flame spread/smoke developed rating when tested in accordance with ASTM E84 (UL 723).
- B. Type B: EPDM (NBR/PVC Blend is not permitted) elastomeric cellular foam; ANSI/ASTM C534; flexible plastic; 0.25 maximum 'K' value at 75°F, 25/50 flame spread/smoke developed rating when tested in accordance with ASTM E84 (UL 723). Maximum 1" thick per layer where multiple layers are specified.
- C. Type E: Preformed rigid cellular polyisocyanurate insulation; ANSI/ASTM C591; maximum 'K' value of 0.19 at 75°F; moisture resistant; suitable for -297°F to +300°F.

2.2 VAPOR BARRIER JACKETS

- A. Kraft reinforced foil vapor barrier with self-sealing adhesive joints. Beach puncture resistance ratio of at least 50 units. Tensile strength: 35 psi minimum. Single, self-seal acrylic adhesive on longitudinal jacket laps and butt strips.
- B. Polyvinylidene Chloride (PVDC or Saran) film and tape: Durable and highly moisture and moisture vapor resistant. Please refer to manufacturer's recommended installation guidelines.

3. PART EXECUTION

3.1 PREPARATION

- A. Install insulation after piping has been tested. Pipe shall be clean, dry and free of rust before applying insulation.

3.2 INSTALLATION

- A. General Installation Requirements:
 - 1. Install materials per manufacturer's instructions, building codes and industry standards.

2. Continue insulation with vapor barrier through penetrations. This applies to all insulated piping. Maintain fire rating of all penetrations.
3. On all insulated piping, provide at each support an insert of same thickness and contour as adjoining insulation, between the pipe and insulation jacket, to prevent insulation from sagging and crushing. The insert shall be suitable for planned temperatures, be suitable for use with specific pipe material, and shall be a 180° cylindrical segment the same length as metal shields. Inserts shall be a cellular glass (for all temperature ranges) or molded hydrous calcium silicate (for pipe with operating temperatures above 70°F), with a minimum compressive strength of 50 psi. Polyisocyanurate insulation with a minimum compressive strength of 24 psi is acceptable for pipe sizes 3"75 and below, minimum 60 psi for pipe sizes 4" and above, and operate below 300°F. Factory fabricated inserts may be used. Rectangular blocks, plugs, or wood material are not acceptable. Temporary wood blocking may be used by the Piping Contractor for proper height; however, these must be removed and replaced with proper inserts by the Insulation Contractor. Refer to Supports and Anchors specification section for additional information.
4. Neatly finish insulation at supports, protrusions, and interruptions.
5. Install metal shields between all hangers or supports and the pipe insulation. Shields shall be galvanized sheet metal, half-round with flared edges. Adhere shields to insulation. On cold piping, seal the shields vapor-tight to the insulation as required to maintain the vapor barrier, or add separate vapor barrier jacket.
6. Shields shall be at least the following lengths and gauges:

	Pipe Size	Shield Size
a.	1/2" to 3-1/2"	12" long x 18 gauge
b.	4"	12" long x 16 gauge
c.	5" to 6"	18" long x 16 gauge
d.	8" to 14"	24" long x 14 gauge
e.	16" to 24"	24" long x 12 gauge

7. All piping and insulation that does not meet 25/50 that is in an air plenum shall have written approval from the Authority Having Jurisdiction and the local fire department for authorization and materials approval. If approval has been allowed, the non-rated material shall be wrapped with a product that has passed ASTM E84 and/or NFPA 255 testing with a rating of 25/50 or below.
8. On 1" and smaller piping routed through metal wall studs, provide a plastic grommet to protect the piping. The piping shall be insulated between the wall studs, and the insulation shall butt up to each stud.

B. Insulated Piping Operating Below 60°F:

1. Insulate fittings, valves, unions, flanges, strainers, flexible connections, flexible hoses, and expansion joints. Seal all penetrations of vapor barrier.
2. On piping operating below 60°F in locations that are not mechanically cooled (e.g., penthouses, mechanical rooms, tunnels, chases at exterior walls, etc.), Type B insulation shall be used.
3. All balance valves with fluid operating below 60°F shall be insulated with a removable plug wrapped with vapor barrier tape to allow reading and adjusting of the valve.

C. Insulated Piping Operating Between 60°F and 140°F:

1. Do not insulate flanges and unions, but bevel and seal ends of insulation at such locations. Insulate all fittings, valves and strainers.

D. Exposed Piping:

1. Locate and cover seams in least visible locations.
2. Where exposed insulated piping extends above the floor, provide a sheet metal guard around the insulation extending 12" above the floor. Guard shall be 0.016" cylindrical smooth or stucco aluminum and shall fit tightly to the insulation.
3. On exposed piping serving kitchen equipment or plumbing fixtures, the piping does not need to be insulated if less than four feet in developed length. If piping is longer than four feet in developed length, the piping shall be insulated and have a plastic jacket.

3.3 INSULATION

A. Type A Insulation:

1. All Service Jackets: Seal all longitudinal joints with self-seal laps using a single pressure sensitive adhesive system. Do not staple.
2. Insulation without self-seal lap may be used if installed with Benjamin Foster 85-20 or equivalent Chicago Mastic, 3M or Childers lap adhesive.
3. Apply insulation with laps on top of pipe.
4. Fittings, Valve Bodies and Flanges: For 4" and smaller pipes, insulate with 1 lb. density insulation wrapped under compression to a thickness equal to the adjacent pipe insulation. For pipes over 4", use mitered segments of pipe insulation. Finish with preformed plastic fitting covers. Secure fitting covers with pressure sensitive tape at each end. Overlap tape at least 2" on itself. For pipes operating below 60°F, seal fitting covers with vapor retarder mastic in addition to tape.

B. Type B Insulation:

1. Elastomeric Cellular Foam: Where possible, slip insulation over the open end of pipe without slitting. Seal all butt ends, longitudinal seams, and fittings with adhesive. At elbows and tees, use mitered connections. Do not compress or crush insulation at cemented joints. Joints shall be sealed completely and not pucker or wrinkle. Paint the outside of outdoor insulation with two coats of latex enamel paint recommended by the manufacturer.
2. Self-seal insulation may be used on pipes operating below 170°F.

C. Type E Insulation:

1. Indoors, above grade or below grade, Polyvinylidene chloride (PVDC or Saran) vapor retarder film and tape: Seal all longitudinal joints with manufacturer approved adhesive. Secure butt joint strips in a similar manner. Refer to manufacturer's recommendations for installation guidelines.
2. Insulate pipe fittings with prefabricated insulation fittings.

3.4 SCHEDULE

Refer to attached insulation schedule.

END OF SECTION

SECTION 22 08 00

COMMISSIONING OF PLUMBING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings, Agreement, Part 0, Special Conditions and Forms and Division 01 Specifications Sections, apply to this Section
- B. Related Sections include the following:
 - 1. Section 01 91 13 - General Commissioning Requirements.
 - 2. Section 23 08 00 - Commissioning of HVAC.
 - 3. Section 26 08 00 - Commissioning of Electrical Systems.
 - 4. All other Division 22, 23, and 26 Sections.

1.2 SUMMARY

- A. Commissioning work shall be a team effort to ensure that all plumbing equipment and systems have been completely and properly installed, function together correctly to meet the design intent, and document system performance. Commissioning shall coordinate system documentation, equipment start-up, and performance testing.
- B. The Commissioning Agent (CA) shall have responsibility for coordinating and directing each step of the commissioning process.
- C. Commissioning work of Division 22 shall include, but not be limited to:
 - 1. Testing and start-up of the equipment.
 - 2. Completion of pre-functional/startup checklists.
 - 3. Testing, adjusting and balancing of water systems.
 - 4. Cooperation with the CA.
 - 5. Providing qualified personnel for participation in commissioning tests.

6. Completion of Contractor directed functional testing and associated forms.
 7. Completion of CA witnessed functional testing.
 8. Providing equipment, materials, and labor as necessary to correct construction and/or equipment deficiencies found during the commissioning process.
 9. Providing training and demonstrations for the systems specified in this Division of the specifications.
- D. The work included in the commissioning process involves a complete and thorough evaluation of the operation and performance of all components, systems, and sub-systems. The following equipment and systems shall be included:
1. Plumbing Fixtures
 2. Plumbing Distribution System
 3. Domestic Water Heaters
 4. Domestic Water Circulation Pumps
 5. Domestic Water Booster Pumps
- E. Timely and accurate documentation is essential for the commissioning process to be effective. Documentation required as part of the commissioning process shall be as specified in Section 01 91 13 - General Commissioning Requirements.
- F. Detailed testing shall be performed on all installed equipment and systems to ensure that operation and performance conform to contract documents. The following testing is required as part of the commissioning process:
1. Pre-functional/startup checklists are comprised of a full range of checks and tests to determine that all components, equipment, systems, and interfaces between systems operate in accordance with contract documents. These checks and tests are completed by the Division 22 sub-contractors and documented using pre-functional/startup checklists.
 2. Functional performance tests (FPT) shall determine if the Plumbing system is operating in accordance with the design intent. This includes all operating modes, interlocks, control responses, and specific responses to abnormal or emergency conditions. FPT shall be done by Contractor as "Contractor directed" testing and then tested again during CA witnessed testing.
- G. Acceptance testing of the plumbing, as required by Title 24, is not the responsibility of the CA. The Acceptance Tests and associated certificate of acceptance documentation are to be complete by the installing contractor and submitted to the local enforcement agency. The CA may witness the acceptance tests.

- H. Comprehensive training of O&M personnel shall be performed by the plumbing sub-contractor, and where appropriate, by other sub-contractors, and vendors prior to turnover of building to the Owner. The training shall include classroom instruction, along with hands-on instruction on the installed equipment and systems.

1.3 ROLES AND RESPONSIBILITIES

- A. Refer to Section 01 91 13 - General Commissioning Requirements for CxT roles and responsibilities. Division 22 subcontractors are members of the CxT.

PART 2 - PRODUCTS

2.1 TEST EQUIPMENT

- A. See Section 01 9113 – General Commissioning Requirements.

2.2 TEST EQUIPMENT - PROPRIETARY

- A. See Section 01 9113 – General Commissioning Requirements.

PART 3 - EXECUTION

3.1 GENERAL

- A. A commissioning kick-off meeting of all commissioning team members shall be held at a time and place designated by the Owner. The purpose shall be to familiarize all parties with the commissioning process, and to ensure that the responsibilities of each party are clearly understood.
- B. The Contractor shall complete all phases of work so the systems can be started, tested, balanced, and commissioning procedures undertaken. This includes the complete installation of all equipment, materials, fixtures, pipe, valves, wire, insulation, controls, etc., per the contract documents and related directives, clarifications, and change orders.
- C. A commissioning plan shall be developed by the CA. The Contractor shall assist the CA in preparing the commissioning plan by providing all necessary information pertaining to the actual equipment and installation. If Contractor initiated system changes have been made that alter the commissioning process, the CA shall notify the Owner.
- D. Acceptance procedures are normally intended to begin prior to completion of a system and/or sub-systems, and shall be coordinated with the Division 22 subcontractor. Start of acceptance procedures before system completion does not relieve the Contractor from completing those systems as per the schedule.

3.2 PARTICIPATION IN COMMISSIONING

- A. The Contractor shall provide skilled personnel to start-up and debug all systems within Division 22. These same personnel shall be made available to assist the CA in completing the commissioning program. Work schedules, time required for testing, etc., shall be requested by the CA and coordinated by the Contractor. Contractor shall ensure that the qualified personnel are available and present during the agreed upon schedules and of sufficient duration to complete the necessary tests, adjustments, and/or problem resolutions.
- B. System performance problems and discrepancies may require additional personnel time, CA time, reconstruction of systems, and/or replacement of system components. The additional Contractor personnel time shall be made available for subsequent commissioning periods until the required system performance is obtained at no additional cost to the Owner.
- C. The CA reserves the right to question the appropriateness and qualifications of the personnel relative to each item of equipment, system, and/or sub-system. Qualifications of personnel shall include expert knowledge relative to the specific equipment involved and a willingness to work with the CA. Contractor shall provide adequate documentation and tools to start-up and test the equipment, system, and/or sub-system.

3.3 DEFICIENCY RESOLUTION

- A. In some systems, maladjustments, misapplied equipment, and/or deficient performance under varying loads will result in additional work being required to commission the systems. This work shall be completed under the direction of the Owner, with input from the Contractor, equipment supplier, and CA. Whereas all members shall have input and the opportunity to discuss, debate, and work out problems, the Owner shall have final jurisdiction over any additional work done to achieve performance.
- B. Corrective work shall be completed in a timely fashion to permit the completion of the commissioning process. Experimentation to demonstrate system performance may be permitted. If the CA deems the experimentation work to be ineffective or untimely as it relates to the commissioning process, the CA shall notify the Owner, indicating the nature of the problem, expected steps to be taken, and suggested deadline(s) for completion of activities. If the deadline(s) pass without resolution of the problem, the Owner reserves the right to obtain supplementary services and/or equipment to resolve the problem. If a retest of a functional test fails, any costs incurred for further retesting shall be the Contractor's responsibility, including the CA's labor and travel expenses.

END OF SECTION

SECTION 22 09 00

INSTRUMENTATION

1. PART GENERAL

1.1 SECTION INCLUDES

- A. Positive Displacement Meters.
- B. Pressure Gauge.
- C. Pressure Gauge Accessories.
- D. Thermometers.
- E. Test Plugs.

1.2 SUBMITTALS

- A. Submit shop drawings per Section 22 05 00. Include list that indicates use, operating range, total range and location for manufactured components.

2. PART PRODUCTS

2.1 POSITIVE DISPLACEMENT METERS (LIQUID)

- A. AWWA C700 positive displacement disc type suitable for fluid with hermetically sealed register, remote reading to AWWA C706.
- B. Provide water meters with bronze case with cast iron frost-proof, breakaway bottom cap.
- C. Meters downstream of utility company meters shall be same manufacturer as utility company meter.
- D. Acceptable Manufacturers: Neptune, Badger, or Hersey.

2.2 PRESSURE GAUGES

- A. Gauges shall be 4-1/2" diameter with aluminum or stainless steel case with phosphor bronze bourdon tube, brass socket for water or oil application, 1/4" or 1/2" bottom connection. Gauges shall be 1% full scale accurate with bronze bushed brass movement and adjustable pointer. Standard ranges to be either pressure or pressure and vacuum as required of application.
- B. Acceptable Manufacturers: Ashcroft, Marsh, Marshalltown, Miljoco, Terice, U.S. Gauge Figure 1901, Weiss, Weksler, Wika.
- C. Acceptable Manufacturer: Ashcroft, Marshalltown, Marsh, Miljoco, Terice, U.S. Gauge Figure 1980, Weiss, Weksler, Wika.
- D. Select gauge range for normal reading near center of gauge.

2.3 PRESSURE GAUGE ACCESSORIES

- A. All pressure gauges shall have valves and pressure snubbers. All pressure gauges on steam shall have pigtail syphon.
- B. Shutoff Valve: 1/4" ball valve as specified for each piping system.
- C. Pressure snubber, brass with 1/4" connections, porous metal type.

2.4 THERMOMETERS

A. Dial Type:

1. 4-1/2" diameter, hermetically sealed case. Stainless steel case and stem. Accuracy of 1% full scale with external recalibrator.
2. Select thermometers for appropriate temperature range. Adjustable elbow joint with locking device to allow rotation of thermometer to any angle.
3. Stem lengths as required for application with minimum insertion of 2-1/2".
4. Thermometers for water shall have brass or steel separable socket. Thermometer wells shall be stainless steel, pressure rated to match piping system design pressure; with 2-inch extension for insulated piping and threaded cap nut with chain permanently fastened to well and cap.
5. Acceptable Manufacturer: Ashcroft, Marsh, Marshalltown, Miljoco, Tel-Tru, Trerice, U.S. Gauge, Weiss, Weksler, Wika.

B. Alcohol/Spirit Filled Type:

1. 9" long phenolic case, steel stem, accuracy of 1% full scale. Adjustable elbow joint with 180 degree adjustment in vertical plane, 360 degree adjustment in horizontal plane, and locking device to allow rotation of thermometer to any angle.
2. Select thermometer for appropriate temperature range.
3. Stem: Copper plated steel, aluminum, or brass for separable socket. Stem lengths as required for application with minimum insertion of 3-1/2".
4. Thermometers for water shall have brass or steel separable socket. Thermometer wells shall be stainless steel, pressure rated to match piping system design pressure; with 2-inch extension for insulated piping and threaded cap nut with chain permanently fastened to well and cap.
5. Acceptable Manufacturer: Marsh, Miljoco, Trerice, Weiss, Weksler, Wika.

C. Select scales to cover expected range of temperatures.

2.5 TEST PLUGS

- A. Test Plug: 1/4" or 1/2" brass fitting and cap, with Nordel core for temperatures up to 275°F, for receiving 1/8" outside diameter pressure or temperature probe. Plugs shall be rated for zero leakage from vacuum to 500 psi.
- B. Provide extended units for all plugs installed in insulated piping.
- C. Test Kit: Carrying case, internally padded and fitted containing one 3-1/2" diameter pressure gauge with 0-100 psi range, one gauge adapter with 1/8" probes, two 1-1/2" dial thermometers with 0° to 220°F and -25°F to 125°F ranges and 5" stems.
- D. Acceptable Manufacturers: Sisco, Flow Design, Peterson Equipment, MG Piping Products Co., Miljoco, Trerice, Watts Regulator.

3. PART EXECUTION

3.1 INSTALLATION

A. General Installation Requirements:

1. Install per manufacturer's instructions.
2. Coil and conceal excess capillary on remote element instruments.
3. Install gauges and thermometers in locations where they are easily read from normal operating level.
4. Do not install instrumentation when areas are under construction, except for required rough-in, taps, supports and test plugs.

B. Positive Displacement Meters:

1. Install positive displacement meters with shutoff valves on inlet and outlet. Provide full line size valved bypass with globe valve for liquid service meters.

C. Pressure Gauges:

1. Connect pressure gauges to suction and discharge side of all pumps.
2. Provide snubber for each pressure gauge.
3. Provide coil syphon for each pressure gauge connected to steam piping.

D. Thermometers:

1. Install thermometers in piping systems in sockets in short couplings. Enlarge pipes smaller than 2-1/2" for installation of thermometer sockets.
2. Install thermometer sockets adjacent to control system thermostat, transmitter and sensor sockets.

END OF SECTION

SECTION 22 10 00

PLUMBING PIPING

1. PART GENERAL

1.1 SECTION INCLUDES

- A. Pipe and Pipe Fittings.
- B. Valves.
- C. Domestic Water Piping System.
- D. Sanitary Drainage and Vent Piping System.
- E. Storm Drainage Piping System.
- F. Acid Waste and Vent Piping System.

1.2 QUALITY ASSURANCE

- A. Valves: Manufacturer's name and pressure rating marked on valve body. Remanufactured valves are not acceptable.
- B. Welding Materials and Procedures: Conform to ASME Code and applicable state labor regulations.
- C. Welders Certification: In accordance with ANSI/ASME Sec 9 or ANSI/AWS D1.1.
- D. Piping, Fittings, Valves, and Flux for Potable Water Systems: All components shall be lead free per Federal Act S.3874, Reduction of Lead in Drinking Water Act.
- E. Pipe hangers and supports shall be spaced per 2016 CPC, Table 313.3, as applied to each pipe system listed. Refer to Section 22 05 29 for hanger and support components. Seismic supports shall be submitted as a deferred approval using OPM guidelines. Shop drawings shall be submitted for review to the AHJ: DSA. Upon approval, these shop drawings shall be included in the record set.
- F. Potable water piping and fittings shall comply with California Assembly Bill AB1953 limiting lead content. Also described in 2016 CPC: 604.2 Lead Content.
- G. Valves for potable water systems shall comply with California Assembly Bill AB1953 limiting lead content. Also described in 2016 CPC: 604.2 Lead Content.
- H. Hubless clamps shall meet FM 1680 for OSHPD 1, 2 and 3.

1.3 SUBMITTALS

- A. Submit shop drawings per Section 22 05 00.

1.4 DELIVERY, STORAGE, AND HANDLING

- A. Deliver and store valves in shipping containers with labeling in place.

1.5 COORDINATION DRAWINGS

- A. Reference Coordination Drawings article in Section 22 05 00 for required plumbing systems electronic CAD drawings to be provided to Coordinating Contractor for inclusion into composite coordination drawings.

2. PART PRODUCTS

2.1 COLD WATER - POTABLE AND NON-POTABLE HOT WATER - POTABLE AND NON-POTABLE TEMPERED WATER - POTABLE AND NON-POTABLE

- A. Design Pressure: 175 psi.
Maximum Design Temperature: 200°F.
- B. Piping - All Sizes:
 - 1. Tubing: Type L hard drawn seamless copper tube, ASTM B88.
 - 2. Joints: Solder with 100% lead-free solder and flux, ASTM B32.
 - 3. Fittings: Wrought copper solder joint, ANSI B16.22.
- C. Shutoff Valves:
 - 1. Butterfly Valves:
 - a. BF-1:
 - 1) 2-1/2" thru 6", 175 psi CWP, elastomers rated for 20°F to 250°F at 125 psig, fully lugged end, ductile or cast iron body (not in contact with fluid); bronze, aluminum-bronze or EPDM coated ductile iron disc; EPDM seat, stainless steel stem, extended neck, 175 psi bubble-tight, bi-directional dead-end shutoff without backing flange or nuts and with cap screws extending to centerline of valve body (for pipe extension without draining system), 10 position locking operator up to 6" size. Cv of at least 1580 in 6" size. Center Line Series 200, Keystone #222, Watts #DBF-03-121-1P, Stockham LD712-B&3-E, Nibco LD2000N Series, Milwaukee CL series, Hammond 5200 series.
 - 2) 8" thru 12", 175# CWP, elastomers for 20°F to 225°F at 130 psi, fully lugged end, ductile or cast iron body (not in contact with fluid), bronze, EPDM coated ductile iron or aluminum-bronze disc, EPDM seat, stainless steel stem, extended neck, 175 psi bubble-tight, bi-directional dead-end shutoff without backing flange or nuts and with cap screws extending to the centerline of the valve body (to permit pipe extension without draining system), weatherproof gear operator. Center Line Series 200, Keystone #222, Watts #DBF-03-121-1G, Stockham LD722-B&3-E, Nibco LD2000N Series, Milwaukee CL series, Hammond 5200 series.
 - 2. Ball Valves:
 - a. BA-1:
 - 1) 3" and under, 150 psi saturated steam, 600 psi CWP, full port, screwed or solder ends (acceptable only if rated for soldering in line with 470°F melting point of lead-free solder), bronze body of a copper alloy containing less than 15% zinc, stainless steel ball and trim, Teflon seats and seals. Apollo #77C-140, Stockham #S-255-FB-P-UL BR1-R, Milwaukee #BA-400, Watts, Nibco #585-70-66, National Utilities Co., RUB.

NOTES:

- a) Provide extended shaft for all valves in insulated piping.

- b) Provide lock out trim for all valves opening to atmosphere installed in domestic water piping over 120°F, heating water piping over 120°F, steam, condensate, boiler feed water piping, compressed air piping and gasoline/kerosene piping, and as indicated on the drawings. Solid extended shaft is not required on valves with lock out trim.

D. Throttling/Shutoff Valves:

1. Globe Valves:

- a. GL-1: 2" and under, 150# saturated steam, 300# CWP, screwed, bronze. Crane #7TF, Stockham #B22T, Walworth #3095, Milwaukee #590, Hammond #IB413T, Watts #B-4010-T, Nibco T-235Y.
- b. GL-2: 2-1/2" thru 10", 125# steam @ 353°F, 200# CWP @ 150°F, flanged, iron body, bronze mounted. Crane #351, Hammond #IR116, Stockham #G-512, Walworth #8906F, Milwaukee #F2981, Watts #F-501, Nibco F-718B.

E. Check Valves:

- 1. CK-1: 2" and under, 125# steam @ 406°F, 200# CWP @ 150°F, screwed, bronze, horizontal swing. Crane #37, Hammond #IB904, Stockham #B319-Y, Walworth #3406, Milwaukee #509, Watts #G-5000, Nibco T-413B.
- 2. CK-14: 2-1/2" thru 12", 200# CWP, double disc wafer type, bronze or iron body, bronze trim, metal-to-metal or Viton seat, 316 SS shaft, Inconel 600 spring. Mission Duo Chek #12HPP (with Inconel springs), Mueller Steam Specialty Co. #71-AHB-K-W, Stockham #WG-961-EPDM or #WG-970-BUNA, Nibco w-920-W.

F. Strainers:

- 1. ST-1: Bronze body, screwed ends, screwed cover, 150 psi S @ 350°F, 200 psi CWP @ 150°F. Armstrong #F4SC, Metraflex #TS, Mueller Steam Specialty Co. #351, Sarco #BT, Watts #777.
- 2. ST-7: 2-1/2" thru 8", bronze body, flanged ends, flanged cover, 150# steam, 225# CWP. Mueller Steam Specialty Co. #851.

2.2 COLD WATER - POTABLE AND NON-POTABLE (UNDERGROUND)
HOT WATER - POTABLE AND NON-POTABLE (UNDERGROUND)
TEMPERED WATER - POTABLE AND NON-POTABLE (UNDERGROUND)

- A. Design Pressure: 150 psi.
Maximum Design Temperature: 200°F.

B. Piping - All Sizes:

- 1. Tubing: Type K annealed copper tube, ASTM B88.
- 2. Joints: Solder with 100% lead-free solder and flux, ASTM B32.
- 3. Fittings: Wrought copper solder joint, ANSI B16.22.

C. Pipe Sleeving - All Sizes:

- 1. Pipe: Schedule 40 rigid, unplasticized PVC-DWV, or ABS-DWV, normal impact Type I, with plain ends, conforming to ASTM Standards D2665 or D2661. Cellular core piping is not acceptable.

2. Joints: Solvent-weld socket type with solvent recommended by pipe manufacturer.
3. Fittings: Unplasticized PVC-DWV, or ABS-DWV, normal impact Type I, with solvent-weld socket type ends for Schedule 40 pipe. Provide long/extra-long radius fittings to eliminate pipe kinking.
4. Size: Minimum 6". Refer to drawings for additional sizes.
5. Use: All underground piping to fixtures.

2.3 SANITARY DRAINAGE (ABOVE GROUND)
 SANITARY INDIRECT DRAINAGE (ABOVE GROUND)
 SANITARY VENT (ABOVE GROUND)
 STORM DRAINAGE (ABOVE GROUND)

- A. Design Pressure: Gravity
 Maximum Design Temperature: 180°F
- B. Piping - All Sizes:
 1. Pipe and Fittings: Standard weight no-hub cast iron soil pipe, corrosion protective coating inside and outside, CISPI 301 or ASTM A888, NSF certified, CISPI trademark.
- C. Kitchen Indirect Drain Piping - 1-1/4" through 4":
 1. Pipe: Type DWV hard temper seamless copper drainage tube, ASTM B306.
 2. Joints: Solder with 100% lead-free solder and flux, ASTM B32.
 3. Fittings: Cast brass solder joint drainage type, ANSI B16.23 or wrought copper solder joint drainage type, ANSI B16.29.

2.4 SANITARY DRAINAGE (BELOW GROUND - INSIDE OF BUILDING)
 SANITARY VENT (BELOW GROUND - INSIDE BUILDING)
 STORM DRAINAGE (BELOW GROUND - INSIDE OF BUILDING)

- A. Design Pressure: Gravity
 Maximum Design Temperature: 180°F
- B. Piping - All Sizes:
 1. Pipe and Fittings: Standard weight no-hub cast iron soil pipe, epoxy paint corrosion protective coating inside and outside, CISPI 301 or ASTM A888.
 2. Joints: Heavy duty, neoprene sleeve gasket, ASTM C-564, 300 Series stainless steel shield, clamp, and screws with at least four screw type clamps, FM 1680 or ASTM C1540.
 3. Restraints: Install pipe and fittings per the Cast Iron Soil Pipe Institute's Designation 3011. Restrain pipe and fittings using an engineered and tested product manufactured for restraining no-hub cast iron soil pipe. Install per manufacturer's recommendations.
 4. Adapters: Transitions from cast iron soil pipe to other pipe materials with manufactured adapters. Heavy duty neoprene sleeve gasket, ASTM C-564, 300 Series stainless steel shield, clamp, and screws with not less than four screw type clamps, FM 1680 or ASTM C1540.

5. Acceptable Manufacturers: New Age Casting or approved equivalent.

2.5 GREASE SANITARY DRAINAGE (BELOW GROUND)
GREASE SANITARY DRAINAGE (ABOVE GROUND)
GREASE SANITARY VENT (BELOW GROUND)
GREASE SANITARY VENT (ABOVE GROUND)

A. Design Pressure: Gravity.

1. Design Temperature: 200°F Minimum.

B. Piping - 2" through 8":

1. Pipe and Fittings: Standard weight no-hub cast iron soil pipe, epoxy paint corrosion protective coating inside and outside, CISPI 301 or ASTM A888.
2. Joints: Heavy duty, neoprene sleeve gasket, ASTM C-564, 300 Series stainless steel shield, clamp, and screws with at least four screw type clamps, FM 1680 or ASTM C1540.
3. Restraints: Install pipe and fittings per the Cast Iron Soil Pipe Institute's Designation 3011. Restrain pipe and fittings using an engineered and tested product manufactured for restraining no-hub cast iron soil pipe. Install per manufacturer's recommendations.
4. Adapters: Transitions from cast iron soil pipe to other pipe materials with manufactured adapters. Heavy duty neoprene sleeve gasket, ASTM C-564, 300 Series stainless steel shield, clamp, and screws with not less than four screw type clamps, FM 1680 or ASTM C1540.

2.6 ACID WASTE AND VENT

A. Design Pressure - Gravity

B. Piping – All Sizes:

1. Pipe and Fittings: Polyvinylidene fluoride (PVDF) Schedule 40 drainage pipe, ASTM E-84, UL 723.
2. Joints:
 - a. Join pipe and fittings with electrically fused joints. Make fittings between dissimilar materials with adapters furnished by the polypropylene pipe manufacturer.
 - b. Above Floor Only: Mechanical joint with gasket, stainless steel outer sleeve and corrosion resistant nuts and bolts or threaded fittings with gasket and compression nuts.
3. Fittings: Polyvinylidene fluoride (PVDF) DWV pattern with socket ends for electrically fused joints.
4. Limitations: For use in return air plenums.

2.7 CONDENSATE DRAINAGE

A. Design Pressure: 175 psi.
Maximum Design Temperature: 200°F.

B. Piping - All Sizes:

1. Tubing: Type M hard drawn seamless copper tube, ASTM B88.

2. Joints: Solder with 100% lead-free solder and flux, ASTM B32.

2.8 LOCK OUT TRIM

- A. Provide lock out trim for all quarter turn shutoff valves opening to atmosphere and installed in domestic water piping over 120°F, in compressed air piping, and as indicated on the drawings.

2.9 VALVE OPERATORS

- A. Provide handwheels for gate valves and gear operators for butterfly valves.

2.10 VALVE CONNECTIONS

- A. Provide all connections to match pipe joints. Valves shall be same size as pipe unless noted otherwise.

3. PART EXECUTION

3.1 PREPARATION

- A. Install all products per manufacturer's recommendations.
- B. Ream pipe and tube ends. Remove burrs. Bevel plain end ferrous pipe.
- C. Remove scale and dirt, on inside and outside, before assembly.
- D. Connect to equipment with flanges or unions.
- E. Use only piping materials rated for the maximum temperature of the application, e.g., do not use PVC for dishwasher drainage or piping that receives boiler blowdown.

3.2 TESTING PIPING

- A. Sanitary Drainage:
Sanitary Vent:
Storm Drainage:
Acid Waste:
Acid Vent:
 1. Test piping per CPC requirements
- B. Hot Water - Potable and Non-Potable:
Cold Water - Potable and Non-Potable:
Tempered Water - Potable and Non-Potable:
Service Water:
 1. Test per CPC requirements.
 2. Test to be witnessed by the Architect/Engineer's representative, if requested by the Architect/Engineer.
- C. Fire Service:
 1. Hydrostatically test the entire system for two hours at 200 psig. Maximum leakage shall be:
 - a. Interior Piping: 0 quarts per hour.

- b. Underground Piping: 2 quarts per 100 joints per hour.
 - D. All Other Piping:
 - 1. Test per CPC requirements.
 - 2. Test compressed air piping per ASME 31.9 requirements
- 3.3 CLEANING PIPING
- A. Assembly:
 - 1. Before assembling pipe systems, remove all loose dirt, scale, oil and other foreign matter on internal or external surfaces by means consistent with good piping practice subject to approval of the Architect/Engineer's representative. Blow chips and burrs from machinery or thread cutting operation out of pipe before assembly. Wipe cutting oil from internal and external surfaces.
 - 2. During fabrication and assembly, remove slag and weld spatter from both internal and external joints by peening, chipping and wire brushing.
 - 3. Notify the Architect/Engineer's representative before starting any post erection cleaning in sufficient time to allow witnessing the operation. Consult with and obtain approval from the Architect/Engineer's representative regarding specific procedures and scheduling. Dispose of cleaning and flushing fluids properly.
 - 4. Prior to blowing or flushing erected piping systems, disconnect all instrumentation and equipment, open wide all valves, and be certain all strainer screens are in place.
 - B. All Water Piping:
 - 1. Flush all piping using faucets, flush valves, etc. until the flow is clean.
 - 2. After flushing, thoroughly clean all inlet strainers, aerators, and other such devices.
 - 3. If necessary, remove valves to clean out all foreign material.
 - C. Cleaning Deionized Water Piping:
 - 1. With the complete system operating, including UV sterilizers, fill the system with deionized water.
 - 2. Remove all air from the system. Perform pressure test (do not include tank). Balance water flow to all branches. With the circulating pump running, add chlorine to the storage tank slowly until the total system chlorine content is at least 50 PPM and continue to circulate for six hours and in accordance with the **State** Plumbing Code. Drain the system. Refill with deionized water. Run system at full capacity for three days with the R.O. system on manual and the excess water eliminated via the tank overflow drain. Do not allow chlorinated water to contact the R.O. water membrane.
 - 3. An Owner's representative shall be present at all sterilization and cleaning operations. Chlorine concentration in sterilization tank may not exceed 1%. If the Owner wishes, Contractor shall use hydrogen peroxide in lieu of chlorine for sterilization. Contractor shall furnish all sterilization chemicals.

D. Fire Service:

1. Flush all underground piping with minimum flow equal to the system design flow but not less than the following:
 - a. 390 gpm for 4" pipes.
 - b. 880 gpm for 6" pipes.
 - c. 1560 gpm for 8" pipes.
 - d. 2440 gpm for 10" pipes.
 - e. 3500 gpm for 12" pipes.

3.4 INSTALLATION

A. General Installation Requirements:

1. Provide dielectric connections between dissimilar metals.
2. Route piping in orderly manner and maintain gradient. Install to conserve building space.
3. Group piping whenever practical at common elevations.
4. Install piping to allow for expansion and contraction without stressing pipe, joints, or equipment.
5. Slope water piping and arrange to drain at low points.
6. Install bell and spigot piping with bells upstream.
7. Where pipe supports are welded to structural building framing, scrape, brush clean, and apply one coat of zinc rich primer to welds.
8. Seal pipes passing through exterior walls with a wall seal per Section 22 05 29. Provide Schedule 40 galvanized sleeve at least 2 pipe sizes larger than the pipe.
9. All non-potable outlets shall be clearly marked with a permanently affixed laminated sign with 3/8" high lettering saying "Non-Potable Water Not for Human Consumption." Sign shall have black lettering on a yellow background.
10. All vertical pipe drops to sinks or other equipment installed below the ceiling shall be routed within a wall cavity, unless specifically noted otherwise to be surface mounted.

B. Installation Requirements In Electrical Rooms:

1. Do not install piping or other equipment above electrical switchboards or panelboards. This includes a dedicated space extending 25 feet from the floor to the structural ceiling with width and depth equal to the equipment.

C. Valves/Fittings and Accessories:

1. Install shutoff valves that permit the isolation of equipment/fixtures in each room without isolating any other room or portion of the building. Individual fixture angle stops do not meet this requirement. Exception: Back-to-back rooms in no more than two adjacent rooms.
2. Provide clearance for installation of insulation and access to valves and fittings.
3. Provide access doors for concealed valves and fittings.
4. Install valve stems upright or horizontal, not inverted.

5. Provide one plug valve wrench for every ten plug valves 2" and smaller, minimum of one. Provide each plug valve 2-1/2" and larger with a wrench with set screw.
6. Install corrugated, stainless steel tubing system according to manufacturer's written instructions. Include striker plates to protect tubing from puncture where tubing is restrained and cannot move.

D. Underground Piping:

1. Install buried water piping outside the building with at least 3 feet of cover.
2. Underground fire protection service piping shall have at least 6-1/2 feet of cover, or as recommended by NFPA 24, whichever is greater.
3. Install thrust blocking and restraints on all underground fire protection service piping per NFPA 24 and as shown on drawings.
4. Install underground, sleeved, corrugated, stainless steel tubing system according to manufacturer's written instructions. Extend vent from sleeve to exterior of building and terminate with screened elbow.
5. Lay all underground piping in trenches. Provide and operate pumping equipment to keep trenches free of water.
6. For all underground piping, provide a foundation (the layer below the bedding) if the trench bottom is unstable. Lay underground plastic piping on 4" to 6" of sand bedding. When the trench is in rock, lay underground metallic piping on 6" of sand bedding. Provide recessed areas for pipe bells and joints. After joints are made, any misalignment in elevation shall be corrected by tamping sand around the pipe. Backfill with sand in uniform layers not over 6" deep to the spring line of all underground pipes, and carefully compact each layer to 90 percent Standard Proctor density. Backfill with sand up to 6" above pipe for landscaped areas. Remaining backfill may be soil. Under paving and buildings, the remaining backfill shall be sand and compacted to 98 percent Standard Proctor density.
7. As an option, the Contractor may provide factory applied protective coatings consisting of a polyethylene plastic film bonded to the pipe surface by a hot applied thermo-plastic adhesive.
 - a. Acceptable Manufacturer: Republic Steel Corp. "X-Tru-Coat"
8. Exercise care in handling, storing and laying pipe to avoid damaging factory applied coatings. If any damage occurs, repair the coating to a condition equal to the original.
9. Field application of protective coatings to joints, fittings and to any damaged factory applied coatings shall be similar to factory applied coatings specified above and shall be done in strict accordance with recommendations of the supplier of pipe coatings.
10. After completion of the fabrication, laying and field coating of the joints and fittings, but prior to backfilling, inspect the entire line in the presence of the Architect/Engineer's representative with an electronic holiday detector. Any defects in the protective coatings shall be repaired in accordance with requirements for original coatings.
11. Coat flange bolts and nuts in pits and below ground at the time of installation with a corrosion protective coating.

E. Sanitary and Storm Piping:

1. Install all sanitary piping inside the building with a slope of at least the following:

<u>Pipe Size</u>	<u>Minimum Slope</u>
3" and under	- 0.25" per foot
4" and over	- 0.125" per foot

- a. All sanitary systems transporting grease laden waste shall be sloped a minimum of 0.25" per foot regardless of size.
2. Install all storm piping inside the building with a slope of at least 0.125" per foot unless noted otherwise.
3. Install horizontal offset at all connections to roof drains to allow for pipe expansion.
4. Slope sanitary and storm piping outside the building to meet invert elevations shown on drawings and to maintain a minimum velocity of 3 feet per second.
5. All sanitary and storm piping shall have at least 24" of cover when leaving the building.
6. Starter fittings with internal baffles are not permitted.

3.5 PIPE ERECTION AND LAYING

- A. Carefully inspect all pipe, fittings, valves, equipment and accessories before installation. Any items that are unsuitable, cracked or otherwise defective shall be removed from the job immediately.
- B. All pipe, fittings, valves, equipment and accessories shall have factory applied markings, stampings, or nameplates with sufficient data to determine their conformance with specified requirements.
- C. Exercise care at every stage of storage, handling, laying and erecting to prevent entry of foreign matter into piping, fittings, valves, equipment and accessories. Do not install any item that is not clean.
- D. Until system is fully operational, all openings in piping and equipment shall be kept closed except when actual work is being performed on that item or system. Closures shall be plugs, caps, blind flanges or other items specifically designed and intended for this purpose.
- E. Run pipes straight and true, parallel to building lines with minimum use of offsets and couplings. Provide only offsets required to provide needed headroom or clearance and to provide needed flexibility in pipe lines.
- F. Make changes in direction of pipes only with fittings or pipe bends. Changes in size only with fittings. Do not use miter fittings, face or flush bushings, or street elbows. All fittings shall be of the long radius type, unless otherwise shown on the drawings or specified.
- G. Provide flanges or unions at all final connections to equipment, traps and valves.
- H. Arrange piping and connections so equipment served may be totally removed without disturbing piping beyond final connections and associated shutoff valves.
- I. Use full and double lengths of pipe wherever possible.
- J. Unless otherwise indicated, install all piping, including shutoff valves and strainers, to coils, pumps and other equipment at line size with reduction in size being made only at control valve or equipment.
- K. Cut all pipe to exact measurement and install without springing or forcing except in the case of expansion loops where cold springing is indicated on the drawings.

- L. Underground pipe shall be laid in dry trenches maintained free of accumulated water. Provide and operate sufficient pumping equipment to maintain excavations, trenches and pits free of water. Dispose of pumped water so operation areas and other facilities are not flooded. Pipe laying shall follow excavating as closely as possible.
- M. Unless otherwise indicated, branch take-offs shall be from top of mains or headers at either a 45° or 90° angle from the horizontal plane for air lines, and from top, bottom or side for liquids.
- N. Do not use geotextile fabric with footing tile if silt content of soil exceeds 40% or if clay content exceeds 50%. The fabric shall be installed around 1" river rock or 2" limestone.

3.6 DRAINING AND VENTING

- A. Unless otherwise indicated on the drawings, all horizontal water and compressed air lines, including branches, shall pitch 1" in 40 feet to low points for complete drainage, removal of condensate and venting.
- B. Maintain accurate grade where pipes pitch or slope for venting and drainage. No pipes shall have pockets due to changes in elevation.
- C. Provide drain valves at all low points of water piping systems for complete or sectionalized draining.
- D. Provide drip legs at low points and at the base of all risers in compressed air pipes. Drip legs shall be full line size on pipes through 4" and at least 4", but not less than half line size over 4". Drip legs shall be 12" minimum length, capped with a reducer to a drain valve.
- E. Use eccentric reducing fittings on horizontal runs when changing size of pipes for proper drainage and venting. Install compressed air and gravity drain pipes with bottom of pipe and eccentric reducers in a continuous line; all other liquid lines with top of pipe and eccentric reducers in a continuous line.
- F. Provide air vents at high points and wherever else required to eliminate air in all water piping systems.
- G. Install air vents in accessible locations. If necessary to trap and vent air in a remote location, install an 1/8" pipe from the tapping location to an accessible location and terminate with a venting device.
- H. All vent and drain piping shall be of same materials and construction for the service involved.

3.7 PLUMBING VENTS

- A. Vent as shown on the drawings and in accordance with all codes having jurisdiction.
- B. Extend the high side of the soil and waste stacks at least 12" above roof.
- C. Flash pipes at roof with premolded EPDM pipe flashing cones adhered to roof membrane by General Contractor. Secure top of cone with stainless steel clamp and seal watertight.
- D. Increase vent pipes through the roof two pipe sizes with long increasers located at least 12" below the roof.
- E. In no case shall the vent through the roof be less than 4" in diameter.
- F. Vent pipes through the roof shall be located a minimum of 15 feet from any air intake or exhaust opening on the roof.

3.8 BRANCH CONNECTIONS

- A. For domestic water and vent systems only, make branch connections with standard tee or cross fittings of the type required for the service.

- B. Reducers are generally not shown. Where pipe sizes change at tee, the tee shall be the size of the largest pipe shown connecting to it.
- C. Do not use double wye or double combination wye and eighth bend DWV fittings in horizontal piping.
- D. Branch connections from headers and mains may be cut into black steel pipe using forged weld-on fittings.
- E. Forged weld-on fittings are limited as follows:
 - 1. Must have at least same pressure rating as the main.
 - 2. Main must be 2-1/2" or larger.
 - 3. Branch line is at least two pipe sizes under main size.

3.9 JOINING OF PIPE

A. Threaded Joints:

- 1. Threads shall conform to ANSI B2.1 "Pipe Threads".
- 2. Ream pipe ends and remove all burrs and chips formed in cutting and threading.
- 3. Protect plated pipe and valve bodies from wrench marks when making up joints.
- 4. Apply thread lubricant to male threads as follows:

Vents and Roof Conductors:	Red graphite
All Other Services:	Teflon tape

B. Flanged Joints:

- 1. Steel pipe flanges shall conform to ANSI B16.5 "Steel Pipe Flanges and Flanged Fittings". Cast iron pipe flanges shall conform to ANSI B16.1 "Cast Iron Flanged and Flanged Fittings". Steel flanges shall be raised face except when bolted to flat face cast iron flange.
- 2. Bolting for services up to 500°F shall be ASTM A307 Grade B with square head bolts and heavy hexagonal nuts conforming to ANSI B18.2.1 "Square and Hex Bolts" and B18.2.2 "Square and Hex Nuts".
- 3. Set flange bolts beyond finger tightness with a torque wrench for equal tension in all bolts. Tighten bolts so those 180° apart are torqued in sequence.
- 4. Gaskets for flat face flanges shall be full face type. Gaskets for raised faced flanges shall conform to requirements for "Group I Gaskets" in ANSI B16.5. Unless otherwise specified gaskets shall meet the following requirements:
 - a. Gasket material and thickness approved by manufacturer for intended service, chemical compatibility, pipe system test pressure, and operating temperature range.
 - b. Maximum pressure rating of at least 250 psig.
 - c. Minimum temperature rating: -10°F.
 - d. Maximum temperature rating of at least 170°F for water systems operating 140°F and less.

C. Solder Joints:

1. Make up joints with 100% lead-free solder, ASTM B32. Cut tubing so ends are perfectly square and remove all burrs inside and outside. Thoroughly clean sockets of fittings and ends of tubing to remove all oxide, dirt and grease just prior to soldering. Apply flux evenly, but sparingly, over all surfaces to be joined. Heat joints uniformly so solder will flow to all mated surfaces. Wipe excess solder, leaving a uniform fillet around cup of fitting.
2. Flux shall be non-acid type.
3. Solder end valves may be installed directly in the piping system if the entire valve is suitable for use with 470°F melting point solder. Remove discs and seals during soldering if they are not suitable for 470°F.

D. Welded Joints:

1. Welding of all pipe joints, both as to procedures and qualification of welders, shall be in accordance with Section IX, ASME "Boiler & Pressure Vessel Code" unless mandatory local codes take precedence.
2. Furnish to the Owner's Representative prior to start of work certificates qualifying each welder.
3. The Owner's Representative reserves the right to require qualifying demonstration, at the Contractor's expense, of any welders assigned to the job.
4. Ends of pipe and fittings to be joined by butt welding shall be beveled, cleaned to bare metal and internal diameters aligned before tack welding.
5. Single-welded butt joints may be employed with or without the use of backing rings in all sizes. Where backing rings are not used on pumped pressurized systems, the root side of the weld shall either be chipped or ground flush with the piping wall. For services such as vents, overflows, and gravity drains, the backing ring may be eliminated, and the root of the weld need not be chipped or ground. Backing rings shall be of the material being welded.

E. Fusion Weld:

1. Make all field cuts of pipe square and true using a pipe cutter designed for plastic pipe.
2. Make sure proper heating heads are used for male and female situations.
3. Bevel the leading edge of pipe section with a 45° chamfer.
4. Utilize a fusion welding tool recommended and/or provided by the pipe and fitting manufacturer.
5. Not recommended for temperatures below 40°F.
6. Follow the manufacturer's cold weather installation procedures.
7. All installers shall undergo training provided by the manufacturer or manufacturer's representative.
8. Follow all manufacturer's installation instructions.

F. Electrically Fused Joints (Acid Waste and Acid Vent):

1. Fused joints shall be made in accordance with manufacturer's installation instructions.

2. All installers shall undergo training provided by the manufacturer or manufacturer's representative.
 3. Follow the manufacturer's cold weather installation procedures.
- G. Sleeve Gaskets (No-Hub) (Sanitary and Storm Pipe):
1. Gasket shall be heavy weight class, conforming to ASTM C564.
 2. The gasket shall have an internal center stop.
 3. The gasket shall be covered by a stainless steel band secured with a minimum of four stainless steel bands per fitting/joint.
 4. Sleeve gaskets shall be installed in accordance with the manufacturer's installation instructions.

3.10 DISINFECTION OF DOMESTIC WATER PIPING SYSTEM

- A. Disinfection shall comply with CPC - 609.9: Disinfection of Potable Water Systems

3.11 SERVICE CONNECTIONS

- A. Provide new sanitary and/or storm sewer services. Before commencing work check invert elevations needed for sewer connections, confirm inverts and verify these can be properly connected with slope for drainage and cover to avoid freezing.

END OF SECTION

SECTION 22 10 23

NATURAL GAS PIPING

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. Pipe and Pipe Fittings.
- B. Valves.
- C. Natural Gas Piping System.

1.2 QUALITY ASSURANCE

- A. Valves: Manufacturer's name and pressure rating marked on valve body. Remanufactured valves are not acceptable.
- B. Welding Materials, Procedures, and Operators: Conform to ASME Section 9, ANSI/AWS D1.1, and applicable state labor regulations.
- C. Welders Certification: In accordance with ANSI/ASME Sec 9 or ANSI/AWS D1.1.
- D. All work shall be performed in accordance with the CPC.
- E. Design hangers and supports under direct supervision of Professional Engineer experienced in design of this Work and licensed in State of California.

1.3 SUBMITTALS

- A. Submit product data under provisions of Section 22 05 00. Include data on pipe materials, fittings, valves, and accessories.
- B. Test Reports: Provide results of piping system pressure test.
- C. Welders Certificates: Certify welders employed on the Work, verifying AWS qualification within previous 12 months.

1.4 DELIVERY, STORAGE, AND HANDLING

- A. Store and protect piping to prevent entrance of foreign matter into pipe and to prevent exterior corrosion.
- B. Deliver and store valves in shipping containers with labeling in place.

1.5 COORDINATION DRAWINGS

- A. Reference Coordination Drawings article in Section 22 05 00 for the required natural gas piping system electronic CAD drawings to be provided to Coordinating Contractor for inclusion into composite coordination drawings.

PART 2 - PRODUCTS

2.1 NATURAL GAS (0 TO 125 PSI)

- A. Design Pressure: 125 psi.
Maximum Design Temperature: 350°F
- B. Piping - 2" and Under:
 - 1. Pipe: Standard weight steel, threaded and coupled, ASTM A53.
 - 2. Joints: Screwed. (NOTE: For below ground, all sizes to have welded joints.)
 - 3. Fittings: 150# steam - 300# CWP, black malleable iron, banded, ASTM A197, ANSI B16.3.
 - 4. Unions: 250# - 500# CWP, black malleable iron, ANSI B16.39, ground joint with brass seat.
- C. Piping – 2" and Under:
 - 1. Pipe: Corrugated stainless steel tubing, ASTM A240 Series 300 stainless steel, ANSI AGA-LC1.
 - 2. Jacket: UV resistant, electrically conductive polyethylene, color: black, ASTM E84 25-50 flame and smoke.
 - 3. Sleeve: Polyethylene, pre-sleeved from factory with field installed vent tees and water/gas tight heat shrink cuffs on each end.
 - 4. Fittings: Brass with mechanical ends to fit tubing. ASME B1.20.1 threaded ends for connection to threaded pipes and components.
 - 5. Limits: 5 psi or less. Below ground – inside building.
 - 6. Manufacturer: TracPipe (PS-II).
- D. Piping - 2-1/2" and Over:
 - 1. Pipe: Standard weight steel, beveled ends, ASTM A53.
 - 2. Joints: Butt welded and flanged.
 - 3. Fittings: Standard weight seamless steel, butt weld type, ASTM A234, Grade I, ANSI B16.9.
 - 4. Flanges: 150# forged steel, weld neck or slip-on, ASTM A181, Grade I, ANSI B16.5.
- E. Piping - All Sizes:
 - 1. Pipe: Polyethylene pipe, ASTM D2513, SDR 11.5.
 - 2. Joints: Fusion welded.
 - 3. Fittings: Socket type, ASTM D2683 or ASTM D2513.

4. Limits: Use only below ground outside of buildings.
- F. For Underground Gas Piping - Refer to paragraph "Underground Piping Protection."
1. Anode-less transition riser.
- G. Shutoff Valves/Throttling Valves:
1. BA-13: 2" and under, threaded 600 psi CWP; UL listed for 250# LP, flammable liquid, heating oil, natural and manufactured gases, 150 psi steam, bronze body and chrome plated brass ball, Teflon seats and packing. Apollo #80-100, Nibco #T580-70-UL or #T585-70-UL, Watts #B-6000.
 2. PL-1: 2" and under, 125# steam @ 450°F, 175# CWP @ 180°F, cast iron body, screwed, full port. Walworth #1700, DeZurik #425, S-RS49.
 3. PL-2: 2-1/2" thru 4", 125# steam @ 450°F, 175# CWP @ 180°F, flanged, cast iron body, full port. Walworth #1700F, DeZurik #425, F-RS49.
 4. PL-3: 6" and larger, 125# steam @ 450°F, 175# CWP, cast iron body, flanged, resilient faced plug, gear and handwheel operator, full port. Walworth #1707F, DeZurik #118, F-RS24.
- H. Gas Seismic Valves
1. Provide a valve consisting of a swing check valve arrangement with an acceleration-sensitive triggering mechanism. The trip mechanism shall consist of a steel ball resting on a tapered cup-shaped support. The trip mechanism shall be factory set and sealed. A sight glass shall be provided so that the Open or Closed indicator can be seen, and the trip mechanism status of the valve can be easily determined. The valve assembly shall be certified by the California State Architect's Office, approved by the local authority, and meet the requirements of ANSI Z21.70 and ASCE 25-97. Refer to schedule for model number.
- I. Check Valves:
1. CK-1: 2" and under, 125# steam @ 406°F, 200# CWP @ 150°F, screwed, bronze, horizontal swing. Crane #37, Hammond #IB904, Stockham #B319-Y, Walworth #3406, Milwaukee #509, Watts #B-5000, Nibco Y-413B.
 2. CK-13: 2-1/2" thru 12", 200# CWP, double disc wafer type, iron body, bronze or aluminum-bronze discs, 316SS shaft and spring, Viton, EPDM or BUNA-N, Cv of at least 700 in 6" size. Mueller Steam Specialty Co. #71-AHB-6-H, Stockham #WG-961 EPDM or #WG970 BUNA, NIBCO W-920-W, Crane.
- J. Strainers:
1. ST-2: Cast iron body, 125 lb. flanged ends, bolted cover, 125 psi S @ 350°F, 175 psi CWP @ 150°F. Armstrong #A1FL, Metraflex #TF, Mueller Steam Specialty Co. #751, Sarco #CI-125, Watts #77F-D.
 2. ST-4: Cast iron body, screwed ends, screwed cover, 250# steam @ 406°F, 300# CWP @ 150°F. Armstrong #A1SC, Metraflex #SM, Mueller Steam Specialty Co. #11, Sarco #IT.

2.2 STRAINERS

- A. Unless otherwise indicated, strainers shall be Y-pattern and have stainless steel screens with perforations as follows:

Pipe Size	1/4" - 2"	2-1/2" - 10"	12" - 18"
Gases	1/32"	3/64"	1/16"

- B. Furnish pipe nipple with shutoff valve to blow down all strainer screens.
- C. Use iron body strainers in ferrous piping.

2.3 DRAIN VALVES AND BLOWDOWN VALVES

- A. Drain valve and blowdown valve shall mean a shutoff valve as specified for the intended service with added 3/4" male hose thread outlet, cap, and retaining chain.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Ream pipe and tube ends, remove burrs, bevel plain end ferrous pipe.
- B. Remove scale and dirt on inside and outside before assembly.
- C. Connect to all equipment with flanges or unions.
- D. After completion, fill, clean, and treat systems. Refer to Section 23 25 00 for treatment.

3.2 TESTING PIPING

- A. Low Pressure - Up to 1 psi:
1. Test piping with 20 psi air pressure. System must hold this pressure without adding air for two hours.
- B. High Pressure - Above 1 psi:
1. Test piping with compressed air at twice the operating gas pressure, but at least 20 psi. System must hold this pressure without adding air for two hours.
- C. A non-combustible odorant, such as oil of wintergreen, may be added to help locate leaks.

3.3 CLEANING PIPING

- A. Assembly:
1. Prior to assembly of pipe and piping components, remove all loose dirt, scale, oil and other foreign matter on internal or external surfaces by means consistent with good piping practice subject to approval of the Architect/Engineer. Blow chips and burrs out of pipe before assembly. Wipe cutting oil from internal and external surfaces.
 2. During fabrication and assembly, remove slag and weld spatter from both internal and external joints by peening, chipping and wire brushing to the degree consistent with good piping practices.

3. Notify the Architect/Engineer prior to starting any post erection cleaning operation in time to allow witnessing the operation. Properly dispose of cleaning and flushing fluids.
4. Prior to blowing or flushing erected piping systems, disconnect all instrumentation and equipment, open wide all valves, control valves, and balance valves, and verify all strainer screens are in place.

3.4 INSTALLATION

- A. Route piping in orderly manner, straight, plumb, with consistent pitch, parallel to building structure, with minimum use of offsets and couplings. Provide only offsets required for needed headroom or clearance and needed flexibility in pipe system.
- B. Install piping to conserve building space, and not interfere with other work.
- C. Do not install piping or other equipment above electrical switchboards or panelboards. This includes a dedicated space extending 25 feet from the floor to the structural ceiling with width and depth equal to the equipment.
- D. Group piping whenever practical at common elevations.
- E. Install piping to allow for expansion and contraction without stressing pipe, joints, or connected equipment.
- F. Install thrust blocking and restraints on all buried piping at elbows and other changes in pipe direction.
- G. Provide chain operators for all valves over 2" size that are over 10'-0" above finished floor. Extend to 7'-0" above finished floor.
- H. Provide valve position indicator on all valves 10'-0" or greater above finish floor and not located above ceiling.
- I. Provide clearance for access to valves and fittings.
- J. Provide access doors where valves are not exposed.
- K. Prepare pipe, fittings, supports, and accessories for finish painting.
- L. Install valves with stems upright or horizontal, not inverted.
- M. Provide shutoff valves and flanges or unions at all connections to equipment, traps, and items that require servicing.
- N. Provide shutoff valves to isolate part of systems and vertical risers.
- O. Arrange piping and piping connections so equipment may be serviced or totally removed without disturbing piping beyond final connections and associated shutoff valves.
- P. Reducers are generally not shown. Where pipe sizes are not shown, the larger size in either direction shall continue through the fitting nearest to the indication of a smaller pipe size.
- Q. Lay all underground piping in trenches. Provide and operate pumping equipment to keep trenches free of water.

- R. Seal pipes passing through exterior walls with a wall seal per Section 23 05 29. Provide Schedule 40 galvanized sleeve at least 2 pipe sizes larger than the pipe.
- S. For all underground piping, provide a foundation (the layer below the bedding) if the trench bottom is unstable. Lay underground plastic piping on 4" to 6" of sand bedding. When the trench is in rock, lay underground metallic piping on 6" of sand bedding. Provide recessed areas for pipe bells and joints. After joints are made, any misalignment in elevation shall be corrected by tamping sand around the pipe. Backfill with sand in uniform layers not over 6" deep to the spring line of all underground pipes, and carefully compact each layer to 90 percent Standard Proctor density. Backfill with sand up to 6" above pipe for landscaped areas. Remaining backfill may be soil. Under paving and buildings, the remaining backfill shall be sand and compacted to 98 percent Standard Proctor density.
- T. Underground Piping Protection:
1. Direct buried, uninsulated steel pipe shall have a factory applied external protective coating consisting of two coats with an intermediate layer of 18 mil fibrous glass mat. Coating thickness shall total not less than 3/32". The outer coating shall be further protected by a wrapping of heavy Kraft paper. This external protection shall extend and be exposed for a minimum of 1 foot beyond the buried or concealed portion of the pipe.
 - a. Acceptable Manufacturers: Pipe Line Service Co., Franklin Park, Illinois, Lithcote Corp., Melrose Park, Illinois
 2. As an option, the Contractor may provide factory applied protective coatings consisting of a polyethylene plastic film bonded to the pipe surface by a hot applied thermo-plastic adhesive.
 - a. Acceptable Manufacturer: Republic Steel Corp. "X-Tru-Coat"
 3. Exercise care in handling, storing and laying pipe to avoid damaging factory applied coatings. If any damage occurs, repair the coating to a condition equal to the original.
 4. Field application of protective coatings to joints, fittings and to any damaged factory applied coatings shall be similar to factory applied coatings specified above and shall be done in strict accordance with recommendations of the supplier of pipe coatings.
 5. After completion of the fabrication, laying and field coating of the joints and fittings, but prior to backfilling, inspect the entire line in the presence of the Architect/Engineer's representative with an electronic holiday detector. Any defects in the protective coatings shall be repaired in accordance with requirements for original coatings.
 6. Coat flange bolts and nuts in pits and below ground at the time of installation with a corrosion protective coating.
- U. All vertical pipe drops to equipment installed below the ceiling shall be routed within a wall cavity, unless specifically noted otherwise to be surface mounted.
- V. Install underground plastic pipe with an electrically continuous corrosion-resistant tracer wire (minimum AWG 14) or tape per section 22 05 53 to facilitate locating. One end of the tracer wire or tape shall be brought aboveground at a building wall or riser.

- W. Install corrugated, stainless steel tubing system according to manufacturer's written instructions. Include striker plates to protect tubing from puncture where tubing is restrained and cannot move.
- X. Install underground, sleeved, corrugated, stainless steel tubing system according to manufacturer's written instructions. Extend vent from sleeve to exterior of building and terminate with screened elbow.
- Y. Establish minimum separation of one (1) foot from other services' piping in accordance with CPC code.

3.5 BONDING AND GROUNDING

- A. Install aboveground portions of gas piping systems upstream from equipment shutoff valves, electrically continuous and bonded to a grounding electrode, in accordance with California Electrical Code.
- B. Conform to California Electrical Code for electrical connections between wiring and electrically operated control devices.

3.6 PIPE ERECTION AND LAYING

- A. Carefully inspect all pipe, fittings, valves, equipment and accessories prior to installation. Immediately reject and remove from the job any items which are unsuitable, cracked or otherwise defective.
- B. All pipe, fittings, valves, equipment and accessories shall have factory-applied markings, stampings, or nameplates sufficient to determine their conformance with specified requirements.
- C. Exercise care at every stage of storage, handling, laying and erecting to prevent entry of foreign matter into piping, fittings, valves, equipment and accessories. Do not erect or install any unclean item.
- D. During construction, until system is fully operational, keep all openings in piping and equipment closed at all times except when actual work is being performed on that item. Closures shall be plugs, caps, blind flanges or other items designed for this purpose.
- E. Change direction of pipes only with fittings or pipe bends. Change size only with fittings. Do not use miter fittings, face or flush bushings, or street elbows. **All fittings shall be long radius type**, unless otherwise shown on the drawings or specified. Construct welded elbows of angles not available as standard fittings by cutting and welding standard elbows to form smooth, long radius fittings.
- F. Use full and double lengths of pipe wherever possible.
- G. Cut all pipe to exact measurement and install without springing or forcing.
- H. Do not create, even temporarily, undue loads, forces or strains on valves, equipment or building elements.
- I. Underground pipe shall be laid in dry trenches maintained free of accumulated water. Provide and operate sufficient pumping equipment to maintain excavations, trenches and pits free of water. Dispose of pumped water so operation areas and other facilities are not flooded. Pipe laying shall follow excavating as closely as possible.

3.7 DRAINING AND VENTING

- A. Unless otherwise indicated on the drawings, all horizontal pipes, including branches, shall pitch 1" in 40 feet to low points for complete drainage.
- B. Use eccentric reducing fittings on horizontal runs when changing size for proper drainage and venting. Install gas pipes with bottom of pipe and eccentric reducers in a continuous line.
- C. Provide drip legs at low points and at the base of all risers in gas pipes. Drip legs shall be full line size on pipes through 4" and at least 4", but not less than half line size over 4". Drip legs shall be 12" minimum length, capped with a reducer to a drain valve.

3.8 BRANCH CONNECTIONS

- A. Make branch connections with standard tee or cross fittings of the type required for the service unless otherwise specified herein or detailed on the drawings.
- B. At the option of the Contractor, branch connections from headers and mains may be cut into black steel pipe using forged weld-on fittings.
- C. Use of forged weld-on fittings is also limited as follows:
 - 1. Must have at least same pressure rating as the main.
 - 2. Header or main must be 2-1/2" or over.
 - 3. Branch line is at least two pipe sizes under header or main size.
- D. Reducers are generally not shown. Where pipe sizes change at tee, the tee shall be the size of the largest pipe shown connecting to it.
- E. All branch piping connections for natural gas shall take off on the top or on the side of the main.

3.9 JOINING OF PIPE

- A. Threaded Joints:
 - 1. Ream pipe ends and remove all burrs and chips.
 - 2. Protect plated pipe and valve bodies from wrench marks when making up joints.
 - 3. Apply Teflon tape to male threads.
- B. Flanged Joints:
 - 1. Steel flanges shall be raised face.
 - 2. Bolting for services up to 500°F shall be ASTM A307 Grade B with square head bolts and heavy hexagonal nuts conforming to ANSI B18.2.1 "Square and Hex Bolts" and B18.2.2 "Square and Hex Nuts".
 - 3. Torque bolts in at least three passes, tightening to 1/3, 2/3, and final torque in a cross pattern with an indicating torque wrench for equal tension in all bolts.

4. Gaskets for flat face flanges shall be full face type. Gaskets for raised faced flanges shall conform to requirements for "Group I Gaskets" in ANSI B16.5. Unless otherwise specified gaskets shall meet the following requirements:
 - a. Gasket material and thickness approved by manufacturer for intended service, chemical compatibility, pipe system test pressure, and operating temperature range.
 - b. Maximum pressure rating of at least 250 psig.
 - c. Minimum temperature rating: -10°F.
 - d. Maximum temperature rating of at least 170°F for water systems operating 140°F and less.

C. Welded Joints:

1. Welding of all pipe joints, both as to procedures and qualification of welders, shall be in accordance with Section IX, ASME "Boiler & Pressure Vessel Code" unless local codes take precedence.
2. Furnish certificates qualifying each welder to the Owner's Representative prior to start of work.
3. The Owner's Representative reserves the right to require qualifying demonstration, at the Contractor's expense, of any welders assigned to the job.
4. Ends of pipe and fittings to be joined by butt-welding shall be beveled, cleaned to bare metal and internal diameters aligned before tack welding.
5. Backing rings shall be used for all butt weld joints 3" size and over, and for all sizes where operating pressure is over 200 psig and/or temperature is over 400°F. Backing rings shall be of the material being welded.

D. Fusion Weld:

1. Make all field cuts of pipe square and true using a pipe cutter designed for plastic pipe.
2. Make sure proper heating heads are used for male and female situations.
3. Bevel the leading edge of pipe section with a 45° chamfer.
4. Utilize a fusion welding tool recommended and/or provided by the pipe and fitting manufacturer.
5. Not recommended for temperatures below 40°F.
6. Follow the manufacturer's cold weather installation procedures.
7. All installers shall undergo training provided by the manufacturer or manufacturer's representative.
8. Follow all manufacturers' installation instructions.

3.10 PAINTING EXPOSED PIPE

- A. Paint all outdoor exposed natural gas piping the color selected by Owner or Architect/Engineer.

3.11 SERVICE CONNECTIONS

- A. Provide new gas service complete with gas meter and regulators. Verify gas service pressure with the Utility Company.

END OF SECTION

SECTION 22 10 30

PLUMBING SPECIALTIES

1. PART GENERAL

1.1 SECTION INCLUDES

- A. Cleanouts.
- B. Traps.
- C. Trap Primers.
- D. Floor Drains and Sinks
- E. Hub Drains and Standpipes
- F. Roof Drains.
- G. Backflow Preventers.
- H. Strainers.
- I. Unions.
- J. Balancing Valves.
- K. Water Hammer Arresters.
- L. Dielectric Fittings (Connections Between Dissimilar Metals).
- M. Air Vents.
- N. Drain Valves.
- O. Relief Valves.

1.2 QUALITY ASSURANCE

- A. Manufacturer: For each product specified, provide components by same manufacturer throughout.
- B. Perform work in accordance with State of California Plumbing Codes and municipality of local area standards.

1.3 SUBMITTALS

- A. Submit shop drawings under provisions of Section 22 05 00.
- B. Include sizes, rough-in requirements, service sizes, and finishes.

2. PART PRODUCTS

2.1 CLEANOUTS

- A. Provide cleanouts as shown and specified on the drawings as well as required by code.
- B. Coordinate floor cleanout cover with surrounding floor finish. Provide either solid, recessed for tile or terrazzo or carpet marker as applicable.
- C. Cleanouts on exposed pipes shall be cast iron with heavy duty cast brass plug with raised head.
- D. Cleanout shall be same size as the pipe up to 6" and 6" for larger pipes.

2.2 YARD CLEANOUTS

- A. Provide yard cleanouts as shown and specified on the drawings as well as required by code.
- B. Cleanout shall be same size as pipe up to 6" and 6" for larger pipes.

2.3 TRAPS

- A. Provide all individual connections to the sanitary system with P-traps, except where such drains discharge directly into a properly trapped collection basin or sump. Unless otherwise specified or shown, traps shall be:
1. Chromium plated cast brass when used with plumbing fixtures or when installed exposed in finished spaces.
 2. Insulated at accessible lavatories.
 3. Cast iron, deep-seal pattern where concealed above ceiling, below grade or in unfinished areas.
 4. Deep-seal pattern of the same material and/or coating where drainage lines are of special materials or coatings such as polypropylene, PVDF, CPVC, etc.
- B. Each trap shall be completely filled with water at the end of construction but before building turnover to the Owner. All floor drains, floor sinks, trench drains, etc. shall be filled with water and a 1/2" minimum layer of mineral oil.

2.4 TRAP PRIMERS

- A. Provide trap primers as shown and specified on the drawings.

2.5 FLOOR DRAINS AND SINKS

- A. Floor drains and sinks shall be in the form of a receptor with grate/strainer set flush with the surrounding floor.
- B. Provide floor drains and sinks as shown and specified on the drawings as well as required by code.

2.6 HUB DRAINS AND STANDPIPES

- A. A hub drain shall be in the form of a hub or pipe without a grate/strainer extending through the floor for receiving indirect waste. A hub drain has a flood level rim above the finished floor.
- B. Provide hub drains as shown and specified on the drawings as well as required by code.

2.7 ROOF DRAINS

- A. Provide roof drains as shown and specified on the drawings as well as required by code.

2.8 BACKFLOW PREVENTERS

- A. Provide backflow preventers as shown and specified on the drawings as well as required by code.

2.9 STRAINERS

- A. Unless otherwise indicated, strainers shall be Y-pattern and have stainless steel screens with perforations as follows:

Pipe Size	1/4" - 2"	2-1/2" - 10"	12" - 18"
air	1/32"	3/64"	1/16"
water	3/64"	1/16"	1/8"
lube, hydraulic, No. 6 fuel and waste oils	3/16"	3/16"	3/16"

- B. Furnish pipe nipple with shutoff valve to blow down all strainer screens.

- C. Use bronze body strainers in copper piping and iron body strainers in ferrous piping.

2.10 UNIONS

- A. Copper pipe - wrought copper fitting - ground joint.
- B. Black Steel (Schedule 40) Pipe - malleable iron, ground joint, 150 psi, bronze to bronze seat.
- C. Galvanized Steel Pipe - galvanized malleable iron, ground joint, 150 psi, bronze to bronze seat.

2.11 WATER PRESSURE REDUCING VALVES

- A. PRV-1: Self-contained type up to 2-1/2" size, diaphragm actuated, with cast iron body, stainless steel springs, diaphragm, trim and seats for maximum operating pressure of 150 psig and maximum pressure drop of 100 psi. Acceptable Manufacturers: Fisher Type 95H, Cash Acme Series B, Masoneilan 17 Series, Trerice 921 or 1002, Watts U5 Series.

2.12 BALANCING VALVE

- A. Rated for 125 psi working pressure and 250°F operating temperature, taps for determining flow with a portable meter, positive shutoff valves for each meter connection, memory feature, tight shutoff, and a permanent pressure drop between 1' and 2' water column at full flow with valve 100% open. Furnish with molded, removable insulation covers.
- B. Provide a nomograph to determine flow from meter reading (and valve position on units which sense pressure across a valve). Graph shall extend below the specified minimum flow.
- C. Flow rate of 0.5 GPM or larger: Valves in copper piping shall be brass or bronze. Acceptable Manufacturers: Flow Design "Accusetter", Preso "B+", Armstrong "CVB", Bell & Gossett "Circuit Setter Plus", Griswold "Quickset", Gerand "Balvalve Venturi" or Nibco Globe Style balancing valve.
- D. Flow rate less than 0.5 GPM: Valves in copper piping shall be brass or bronze. Cv value shall be less than 1.0 when valve is completely open, and minimum balanceable flow rate shall not exceed 0.1 GPM with a meter reading of at least 2.5 feet. Acceptable manufacturers: Bell & Gossett "Circuit Setter RF", Flow Design, Preso, Armstrong, Griswold, Gerand, or Nibco balancing valve.
- E. Manufacturer shall size balancing valves for the scheduled flow rate. Flow rate shall be measurable on manufacturer's standard meters.

2.13 WATER HAMMER ARRESTERS

- A. Provide water hammer arresters as shown and specified on the drawings as well as required by code.
- B. ANSI A112.26.1; sized and located in accordance with PDI WH-201, precharged for operation between -100°F and 300°F and maximum 250 psig working pressure.

2.14 DIELECTRIC FITTINGS (CONNECTIONS BETWEEN DISSIMILAR METALS)

- A. Connections between dissimilar metals shall be insulating dielectric types that provide a water gap between the connected metals, and that either allow no metal path for electron transfer or that provide a wide water gap lined with a non-conductive material to impede electron transfer through the water path.
- B. Joints shall be rated for the temperature, pressure, and other characteristics of the service in which they are used, including testing procedure.

- C. Aluminum, iron, steel, brass, copper, bronze, and stainless steel are commonly used and require isolation from each other with the following exceptions:
 - 1. Iron, steel, and stainless steel connected to each other.
 - 2. Brass, copper, and bronze connected to each other.
 - 3. Brass or bronze valves and specialties connected in closed systems with steel, iron, or stainless steel on both sides of the brass or bronze valves and specialties. Where two or more brass or bronze items occur together, they shall be connected with brass nipples. Brass or bronze valves and specialties cannot be used as a dielectric separation between pipe materials.
- D. Dielectric protection is required at connections to equipment of a material different than the piping.
- E. Screwed Joints (acceptable up to 2" size):
 - 1. Dielectric waterway rated for 300 psi CWP and 225°F.
 - 2. Acceptable Manufacturers: Elster Group ClearFlow fittings, Victaulic Series 47, Grinnell Series 407, Matco-Norca.
- F. Flanged Joints (any size):
 - 1. Use 1/8" minimum thickness, non-conductive, full-face gaskets.
 - 2. Employ one-piece molded sleeve-washer combinations to break the electrical path through the bolts.
 - 3. Sleeve-washers are required on one side only, with sleeves minimum 1/32" thick and washers minimum 1/8" thick.
 - 4. Install steel washers on both sides of flanges to prevent damage to the sleeve-washer.
 - 5. Separate sleeves and washers may be used only if the sleeves are manufactured to exact lengths and installed carefully so the sleeves must extend partially past each steel washer when tightened.
 - 6. Acceptable Manufacturers: EPCO, Central Plastics, Pipeline Seal and Insulator, F. H. Maloney, or Calpico.

2.15 AIR VENTS

- A. Provide means for venting air at all high points in the piping system and at all other points where air may be trapped.
- B. At end of main and other points where large volume of air may be trapped - Use 1/4" globe valve, angle type, 125 psi, Crane #89, attached to coupling in top of main, 1/4" discharge pipe turned down with cap.

2.16 DRAIN VALVES

- A. Drain valves shall be shutoff valves as specified for the intended service with added 3/4" male hose thread outlet and cap.

2.17 RELIEF VALVES

- A. RV-4: (Domestic Hot Water) Pressure and Temperature relief, cast bronze body and internal parts, stainless steel spring, test lever, threaded inlet and outlet. Maximum setting of 150 psi and 210°F temperature. Capacities ASME certified and labeled. Acceptable Manufacturers: Cash Series FV, Watts #40, #120, #N240, #340.

3. PART EXECUTION

3.1 INSTALLATION AND APPLICATION

- A. Coordinate construction to receive drains at required invert elevations.
- B. Install all items per manufacturer's instructions.
- C. Water Hammer Arresters:
 - 1. Install water hammer arresters in accessible locations. Provide access doors as required. Coordinate type with Architect/Engineer/Owner.
 - 2. Water hammer arrestors shall be installed in cold and hot water lines upstream of all plumbing fixtures or equipment, with a quick acting valve or multiple quick acting valves. Quick acting valves shall be defined as solenoid actuated valves, manual flush valves, sensor activated faucets and flush valves, squeeze handle spray faucets, and other similar type valves.
 - 3. Install multiple water hammer arrestors in toilet group branch piping greater than 20 feet in developed length from the cold and hot water mains.
- D. Cleanouts:
 - 1. Provide cleanouts where shown on the drawings and as required by code, but in no case farther apart than 50 feet in pipe less than 6" size and 100 feet apart in 6" and larger pipes inside the building.
 - 2. Provide cleanouts at bases of all sanitary and storm risers as shown on the drawings and as required by code.
 - 3. Extend cleanouts to the floor with long sweep elbows.
 - 4. Install a full size, two-way cleanout within 5 feet of the foundation inside or outside of building.
 - 5. Extend cleanouts to finished floor or wall surface. Lubricate threaded cleanout plugs with graphite and linseed oil. Ensure clearance at cleanouts for rodding of drainage system.
 - 6. Wall cleanouts shall be installed above the flow line of the pipe they serve, but no less than 12" above the finished floor.
- E. Yard Cleanouts:
 - 1. Install cleanouts on maximum 90 foot centers (including riser) for pipes 8" and smaller.
 - 2. Extend cleanout to grade. Encase cleanout in 5" thick concrete pad extending 6" beyond cleanout, set low enough not to interfere with lawn mowers.
- F. Trap Primers:
 - 1. Install trap primer on drains not receiving continuous discharge and subject to drying out.

2. Connect trap primer to an active water line 1-1/2" in size or less and which will produce a 3 PSI pressure drop upon fixture operation downstream of the trap primer.

G. Floor Drains and Floor Sinks:

1. Drains in upper floors shall have a flashing of EPDM or similar membrane sheet. The sheet shall be at least 36" X 36" square with the drain in the center. Clamp membrane in auxiliary clamping ring of floor drain.
2. Use alternate sealing method when installing drains in existing floor slabs.
3. Coordinate sloping requirements with the architectural plans and specifications.
4. Top of floor drain and sinks grate/strainer shall not extend above the finished floor elevation.
5. Top of floor drain and sink grate/strainer shall not extend above the finished floor elevation. Grate/strainer shall be installed flush with surrounding finished floor. Should the Plumbing Contractor believe this presents a conflict with code, the issue should be evaluated before installation of the floor drain or sink begins. Proceeding with installing a floor drain or sink raised above the finished floor without prior approval will result in the Contractor being required to remove the drain or sink in question and reinstall it at the approved elevation.

H. Hub Drains and Standpipes

1. The top of a hub drain/standpipe shall extend above the finished floor elevation. Refer to drawings for dimensions above the finished floor.
2. Access shall be provided to drains and standpipes for rodding.

I. Roof Drains:

1. Roof drains shall have bearing pans.
2. Provide auxiliary support steel under drains as required to prevent movement of the drain.
3. All roof drains shall have underdeck clamps.
4. Drains in built-up roofing systems shall have a 36" x 36", 3 lb density lead sheet flashing.

J. Backflow Preventer:

1. Provide an air gap fitting and piping to drain. On 2-1/2" and larger units, install a tail piece from air gap fitting to drain to prevent water from spraying out of drain air gap receptor. Maintain air gap distance required by Code.
2. Units shall be field tested and tagged in accordance with manufacturer's instructions and applicable codes by a certified tester before initial operation.
3. Install unit between 12" and 60" above finish floor.

K. Balancing Valves:

1. Install balancing valves with straight, unobstructed pipe section both upstream and downstream as required, per manufacturer's installation instructions.

END OF SECTION

SECTION 22 30 00

PLUMBING EQUIPMENT

1. PART GENERAL

1.1 SECTION INCLUDES

- A. Water Heaters.

1.2 QUALITY ASSURANCE

- A. Products and installation of specified products shall conform to recommendations and requirements of the following organizations:
 - 1. American Gas Association (AGA).
 - 2. National Sanitation Foundation (NSF).
 - 3. American Society of Mechanical Engineers (ASME).
 - 4. National Board of Boiler and Pressure Vessel Inspectors (NBBPVI).
 - 5. National Electrical Manufacturers' Association (NEMA).
 - 6. Underwriters' Laboratories (UL).
- B. Perform work in accordance with State of California Plumbing Codes and municipality of local area standards.
- C. Water Heater Performance Requirements: Equipment efficiency not less than prescribed by ASHRAE 90.1 when tested in accordance with DOE 10 CFR, ANSI Z21.10.1 and ANSI Z21.10.3.
- D. Conform to ASME Section VIII for construction of water heaters and heat exchangers. Provide boilers registered with National Board of Boiler and Pressure Vessel Inspectors.

1.3 SUBMITTALS

- A. Submit shop drawings under provisions of Section 22 05 00.
- B. Include dimension drawings of water heaters indicating components and connections to other equipment and piping.
- C. Include heat exchanger dimensions, size of tappings, and performance data.
- D. Include dimensions of tanks, tank lining methods, anchors, attachments, lifting points, tappings, and drains.
- E. For equipment connected to an electric power source, submit short circuit rating (SCCR) of integrated unit.
- F. Submit manufacturer's installation instructions including control and electrical power/controls wiring diagrams.
- G. Submit manufacturer's certificate that pressure vessels meet or exceed specified requirements.
- H. Submit operation, maintenance, and inspection data, replacement part numbers and availability, and service depot location and telephone number.

- I. Submit certification that water heaters, accessories, and components will withstand seismic forces defined in Section 22 05 50. Include the following:
 1. Basis for Certification: Indicate whether certification is based on actual test of assembled components or on calculation.
 - a. The term "withstand" means "the unit will remain in place without separation of any parts from the device when subjected to the seismic forces specified."
 2. Dimensioned Outline Drawings of Equipment Unit: Identify center of gravity and locate and describe mounting and anchorage provisions.
 3. Detailed description of equipment anchorage devices on which the certification is based and their installation requirements.

1.4 DELIVERY, STORAGE, AND HANDLING

- A. Provide temporary inlet and outlet caps. Maintain caps in place until installation.

1.5 REGULATORY REQUIREMENTS

- A. Water heaters shall conform to AGA, ANSI/NFPA 54, ANSI/NFPA 70, ANSI/UL 1453 as applicable.
- B. Conform to ANSI/ASME Section 8 Division 1 for fabrication of steel pressure vessels.
- C. Conform to ANSI/ASME Section 10 for manufacture of fiber-reinforced plastic pressure vessels.

2. PART PRODUCTS

2.1 WATER HEATERS

- A. All water heaters shall be as scheduled on the drawings.

3. PART EXECUTION

3.1 INSTALLATION

- A. Install all items in accordance with manufacturer's instructions.

3.2 WATER HEATER INSTALLATION

- A. Install water heaters on concrete bases. Coordinate sizes and locations of concrete bases. Refer to Section 22 05 29.
- B. Install water heaters level and plumb, according to drawings, manufacturer's instructions, and referenced standards. Maintain manufacturer's recommended clearances. Arrange units so controls and devices needing service are accessible.
- C. Install combination temperature and pressure relief valves in top portion of storage tanks. Use relief valves with sensing elements that extend into tanks. Extend drain piping full size from relief valve and discharge by positive air gap onto closest floor drain. Discharge pipe material shall be same as domestic water piping.
- D. Install gas water heaters according to NFPA 54.

END OF SECTION

SECTION 22 40 00

PLUMBING FIXTURES

1. PART GENERAL

1.1 SECTION INCLUDES

- A. All plumbing fixtures.

1.2 SUBMITTALS

- A. Submit product data under provisions of Section 22 05 00. Submittals shall include fixture carriers for record purposes only. Architect/Engineer does not review or approve carriers except for manufacturer.
- B. Include fixtures, sizes, rough-in dimensions, utility sizes, trim, and finishes.
- C. For fixtures and trim requiring electrical connections, submit product data indicating general assembly, components, electrical power/controls wiring diagrams, and service connections.
- D. Manufacturer shall provide special seismic certification per OSHPD CAN 2-1708a.5 with submittal. Submittals without certification will be returned and not reviewed.

2. PART PRODUCTS

2.1 DSA FIXTURE REQUIREMENTS

- A. Plumbing fixtures and accessories provided in a toilet room or bathing room are required to comply with CBC Section 11B-213.2 and shall comply with CBC Section 11B-213.3.
- B. Effective March 1, 2017, all single-user toilet facilities shall be identified as Gender-Neutral facilities by a door symbol that complies with CBC Sections 11B-216.8 and 11B-703.2.6.3. No pictogram, text, or braille is required on the symbol. If tactile jamb signage is provided, the signage shall comply with the appropriate technical requirements of CBC Section 11B-703. Examples of appropriate designations are "ALL-GENDER RESTROOM", "RESTROOM" or "UNISEX RESTROOM". DSA BU 17-01.
- C. Accessible plumbing fixtures shall comply with all the requirements in CBC Division 6.
- D. Clearance around accessible water closets and in toilet compartments shall be 60 inches minimum measured perpendicular from the side wall and 56 inches minimum measured perpendicular from the rear wall per CBC Section 11B-604.4.1.
- E. Heights and location of all accessible fixtures shall be mounted according to CBC Sections 11B-602 through 11B-612.
- F. Fixture controls shall comply with CBC Sections 11B-601.3 for drinking fountains, 11B-604.6 for water closets, 11B-604.9.5 for children's water closets, 11B-605.4 for urinals, 11B-606.4 for lavatories and sinks, 11B-607.5 for bathtubs, 11B-608.5 for showers, and 11B-611.3 for washing machines and clothes dryers.
- G. Accessible sinks shall be 6-1/2" deep maximum. Sinks shall be mounted with the front of the higher of the rim and counter surface 34" maximum above the finish floor or ground.
- H. Water supply and drain pipes under lavatories and sinks shall be insulated or otherwise configured to protect against contact. There shall be no sharp or abrasive surfaces under lavatories and sinks. CBC Section 11B-606.

2.2 MATERIALS

A. Wall Hung Fixture Carriers:

1. Material: All Metal, ASME/ANSI A112.6.1M.
2. Acceptable Manufacturers: Zurn, Smith, Wade, Josam, Watts, Mifab.
3. Water closet carrier shall be rated to support 500 lbs. unless noted otherwise on the drawings.

B. All fixtures shall be as scheduled on the drawings.

C. All china shall be from the same manufacturer where possible.

D. All lavatory and sink trim shall be from the same manufacturer where possible.

E. All fixtures shall be lead free. Faucets, traps, stops, and other fixture accessories shall not contain more lead than allowed per the latest State or Federal Act.

3. PART EXECUTION

3.1 INSTALLATION

A. General Installation Requirements:

1. Review millwork shop drawings. Confirm location and size of fixtures and openings before rough-in and installation.
2. Install each fixture with trap easily removable for servicing and cleaning. Use screwed tailpiece couplings. Connect fixture waste to stack with slip fitting.
3. Provide fixtures with chrome plated rigid or flexible supplies, loose key stops, reducers, and escutcheons.
4. Install components level and plumb.
5. Caulk joint between finish floor and floor mounted fixtures and between finish walls and wall mounted fixtures with silicon caulk. Caulk the joint, between rim and fixture where a fixture builds into a counter top, with caulking compound. Refer to DIVISION 7 for "Caulking" requirements. Color to match fixture.
6. Where there is a possibility of water following pipe brackets, etc., into a wall; caulk escutcheons, space around brackets, etc., to exclude water. Refer to DIVISION 7 for "Caulking" requirements.
7. Refer to architectural drawings for fixture mounting heights.
8. All non-potable outlets shall be clearly marked with a permanently affixed laminated sign with 3/8" high lettering saying "Non-Potable Water Not for Human Consumption." Sign shall have black lettering on a yellow background.

B. Wall-Mounted Fixture Requirements:

1. All wall-mounted fixtures shall have compatible carriers designed for their intended service and suitable for the space available and configuration of fixtures. All carriers shall extend to the floor and be anchored to the slab.

C. Floor-Mounted Fixture Requirements:

1. Where floor mounted fixtures are installed on a sloped floor, the open void below the fixture shall be grouted, leveled, and caulked to eliminate stress on the fixture and to prevent water migration to the floor below.

D. Exposed or Inside Accessible Cabinets Traps, Valve and Pipe Requirements:

1. All traps exposed under fixtures or inside accessible cabinets shall be chrome plated brass.
2. All water or waste piping for plumbing fixtures that is exposed or inside cabinets shall be chrome plated.
3. All exposed flush valves for water closets and urinals shall have a chrome plated hanger to anchor the piping to the wall.
4. All exposed water supply piping and fittings in a finished space to a shower valve, hose bibb, or other water outlet shall be chrome plated.

E. ADA Accessible Exposed Sink and Lavatory Trim:

1. All exposed sink and lavatory traps, piping and angle stops installed at accessible sink and lavatory locations shall include offset style drain tailpiece, p-trap installed near and parallel with back wall, and insulation kit specially manufactured for this installation. Armaflex with duct tape is not acceptable.

F. ADA Accessible Water Closet Requirements:

1. Handicapped accessible water closet flush valve handles shall face the center of the stall.
2. Coordinate flush valves in handicap accessible locations with grab bars installed by the General Contractor. Make modifications as necessary to flush valve piping to avoid conflict with grab bars. Common solutions include shortened or offset vacuum breaker tailpieces.

3.2 ADJUSTING AND CLEANING

- A. Adjust stops or valves for intended water flow rate to fixtures without splashing, noise, or overflow.
- B. At completion, clean plumbing fixtures, equipment, and faucet aerator screens.

3.3 FIXTURE ROUGH-IN SCHEDULE

- A. Rough-in fixture piping connections in accordance with table on plumbing drawings of minimum sizes for particular fixtures.

END OF SECTION

SECTION 23 05 00

BASIC HVAC REQUIREMENTS

1. PART GENERAL

1.1 SECTION INCLUDES

- A. Requirements applicable to all Division 23 Sections. Also refer to Division 1 - General Requirements.
- B. All materials and installation methods shall conform to the applicable standards, guidelines and codes referenced herein and within each specification section.

1.2 REFERENCES

- A. CCR California Code of Regulation
- B. CBC California Building Code
- C. CFC California Fire Code
- D. CEC California Electric Code
- E. CMC California Mechanical Code
- F. CPC California Plumbing Code
- G. California Title 24 - Building Energy Efficiency Standards
- H. SCAQMD Southern California Air Quality Management Division

1.3 DIVISION OF WORK BETWEEN MECHANICAL, ELECTRICAL & CONTROL CONTRACTORS

A. Definitions:

- 1. "Mechanical Contractors" refers to the following:
 - a. Plumbing Contractor.
 - b. Air Conditioning and Ventilating Contractor.
 - c. Temperature Control Contractor.
 - d. Fire Protection Contractor.
 - e. Testing, Adjusting, and Balancing Contractor.
- 2. Motor Control Wiring: The wiring associated with the remote operation of the magnetic coils of magnetic motor starters or relays, or the wiring that permits direct cycling of motors by means of devices in series with the motor power wiring. In the latter case the devices are usually single phase and are usually connected to the motor power wiring through a manual motor starter having "Manual-Off-Auto" provisions.
- 3. Control devices such as start-stop push buttons, thermostats, pressure switches, flow switches, relays, etc., generally represent the types of equipment associated with motor control wiring.
- 4. Motor control wiring is single phase and usually 120 volts. In some instances, the voltage will be the same as the motor power wiring. Generally, where the motor power wiring exceeds 120 volts, a control transformer is used to give a control voltage of 120 volts.
- 5. Temperature Control Wiring: The wiring associated with the operation of a motorized damper, solenoid valve or motorized valve, etc., either modulating or two-position, as opposed to wiring which directly powers or controls a motor used to drive equipment such as fans, pumps, etc.
 - a. This wiring will be from a 120 volt source and may continue as 120 volt, or be reduced in voltage (24 volt) in which case a control transformer shall be furnished as part of the temperature control wiring.

6. Control Motor: An electric device used to operate dampers, valves, etc. It may be two-position or modulating. Conventional characteristics of such a motor are 24 volts, 60 cycles, 1 phase, although other voltages may be encountered.
7. Voltage is generally specified and scheduled as distribution voltage. Motor submittals may be based on utilization voltage if it corresponds to the correct distribution voltage.

Distribution/Nominal Voltage	Utilization Voltage
120	115
208	200
240	230
277	265
480	460

B. General:

1. The purpose of these Specifications is to outline the Electrical and Mechanical Contractor's responsibilities related to electrical work required for items such as temperature controls, mechanical equipment, fans, chillers, compressors and the like. The exact wiring requirements for much of the equipment cannot be determined until the systems have been selected and submittals reviewed. Therefore, the electrical drawings show only known wiring related to such items. All wiring not shown on the electrical drawings, but required for mechanical systems, is the responsibility of the Mechanical Contractor.
2. Where the drawings require the Electrical Contractor to wire between equipment furnished by the Mechanical Contractor, such wiring shall terminate at terminals provided in the equipment. The Mechanical Contractor shall provide complete electrical power/controls wiring diagrams and supervision to the Electrical Contractor and designate the terminal numbers for correct wiring.
3. All electrical work shall conform to the National Electrical Code. All provisions of the Electrical Specifications concerning wiring, protection, etc., apply to wiring provided by the Mechanical Contractor unless noted otherwise.
4. Control low (24V) and control line (120V) voltage wiring, conduit, and related switches and relays required for the automatic control and/or interlock of motors and equipment, including final connection, are to be furnished and installed under Divisions 21, 22 and 23. Materials and installation to conform to Class 1 or 2 requirements, California Code of Regulation Title 24, Article E725.
5. All Contractors shall establish utility elevations prior to fabrication and shall coordinate their material and equipment with other trades. When a conflict arises, priority is as follows:
 - a. Light fixtures.
 - b. Gravity flow piping, including condensate.
 - c. Electrical busduct.
 - d. Sheet metal.
 - e. Electrical cable trays, including access space.
 - f. Sprinkler piping and other piping.
 - g. Electrical conduits and wireway.

C. Mechanical Contractor's Responsibility:

1. Assumes responsibility for internal wiring of all equipment provided by the Mechanical Contractor, for example:
 - a. Split-System Units.
 - b. Makeup Air Units.
 - c. Packaged Rooftop Units.
 - d. Dust Collection System.

2. Assumes all responsibility for the Temperature Control wiring, when the Temperature Control Contractor is a Subcontractor to the Mechanical Contractor.
3. Temperature Control Contractor's Responsibility:
 - a. Wiring of all devices needed to make the Temperature Control System functional.
 - b. Verifying any control wiring on the electrical drawings as being by the Electrical Contractor. All wiring required for the Control System, but not shown on the electrical drawings, is the responsibility of the Temperature Control Contractor.
 - c. Coordinating equipment locations (such as relays, transformers, etc.) with the Electrical Contractor, where wiring of the equipment is by the Electrical Contractor.
4. This Contractor is responsible for coordination of utilities with all other Contractors. If any field coordination conflicts are found, the Contractor shall coordinate with other Contractors to determine a viable layout.

D. Electrical Contractor's Responsibility:

1. Provides all combination starters, manual starters and disconnect devices shown on the Electrical Drawings or indicated to be by the Electrical Contractor on the Mechanical Drawings or Specifications.
2. Installs and wires all remote control devices furnished by the Mechanical Contractor or Temperature Control Contractor when so noted on the Electrical Drawings.
3. Provides motor control and temperature control wiring, where so noted on the drawings.
4. Furnishes, installs and connects all relays, etc., for automatic shutdown of certain fans upon actuation of the Fire Alarm System as indicated and specified in Division 28.
5. This Contractor is responsible for coordination of utilities with all other Contractors. If any field coordination conflicts are found, the Contractor shall coordinate with other Contractors to determine a viable layout.

1.4 COORDINATION DRAWINGS

A. Definitions:

1. Coordination Drawings: A compilation of the pertinent layout and system drawings that show the sizes and locations, including elevations, of system components and required access areas to ensure that no two objects will occupy the same space.
 - a. Mechanical trades shall include, but are not limited to, mechanical equipment, ductwork, fire protection systems, plumbing piping, and any item that may impact coordination with other disciplines.
 - b. Electrical trades shall include, but are not limited to, electrical equipment, conduit 1.5" and larger, conduit racks, cable trays, pull boxes, transformers, raceway, busway, lighting, ceiling-mounted devices, and any item that may impact coordination with other disciplines.
 - c. Technology trades shall include, but are not limited to, technology equipment, racks, conduit 1.5" and larger, conduit racks, cable trays, ladder rack, pull boxes, raceway, ceiling-mounted devices, and any item that may impact coordination with other disciplines.
 - d. Maintenance clearances and code-required dedicated space shall be included.

- e. The coordination drawings shall include all underground, underfloor, in-floor, in-ceiling, in chase, and vertical trade items.
 - 2. The contractors shall use the coordination process to identify the proper sequence of installation of all utilities above ceilings and in other congested areas, to ensure an orderly and coordinated end result, and to provide adequate access for service and maintenance.
- B. Participation:
- 1. The contractors and subcontractors responsible for work defined above shall participate in the coordination drawing process.
 - 2. One contractor shall be designated as the Coordinating Contractor for purposes of preparing a complete set of composite electronic CAD coordination drawings that include all applicable trades, and for coordinating the activities related to this process. The Coordinating Contractor for this project shall be the Mechanical Contractor.
 - a. The Coordinating Contractor shall utilize personnel familiar with requirements of this project and skilled as draftspersons/CAD operators, competent to prepare the required coordination drawings.
 - 3. Electronic CAD drawings shall be submitted to the Coordinating Contractor for addition of work by other trades. IMEG will provide electronic file copies of mechanical drawings for contractor's use if the contractor signs and returns an "Electronic File Transfer" waiver provided by IMEG. IMEG will not consider blatant reproductions of original file copies an acceptable alternative for coordination drawings.
- C. Drawing Requirements:
- 1. The file format and file naming convention shall be coordinated with and agreed to by all contractors participating in the coordination process and the Owner.
 - a. Scale of drawings:
 - 1) General plans: 1/4 Inch = 1'-0" (minimum).
 - 2) Mechanical, electrical, communication rooms, and including the surrounding areas within 10 feet: 1/2 Inch = 1'-0" (minimum).
 - 3) Shafts and risers: 1/2 Inch = 1'-0" (minimum).
 - 4) Sections of shafts and mechanical and electrical equipment rooms: 1/4 Inch = 1'-0" (minimum).
 - 5) Sections of congested areas: 1/2 Inch = 1'-0" (minimum).
 - 2. Ductwork layout drawings shall be the baseline system for other components. Ductwork layout drawings shall be modified to accommodate other components as the coordination process progresses.
 - 3. There may be more drawings required for risers, top and bottom levels of mechanical rooms, and shafts.
 - 4. The minimum quantity of drawings will be established at the first coordination meeting and sent to the A/E for review. Additional drawings may be required if other areas of congestion are discovered during the coordination process.

D. General:

1. Coordination drawing files shall be made available to the A/E and Owner's Representative. The A/E will only review identified conflicts and give an opinion, but will not perform as a coordinator.
2. A plotted set of coordination drawings shall be available at the project site.
3. Coordination drawings are not shop drawings and shall not be submitted as such.
4. The contract drawings are schematic in nature and do not show every fitting and appurtenance for each utility. Each contractor is expected to have included in his/her bid sufficient fittings, material, and labor to allow for adjustments in routing of utilities made necessary by the coordination process and to provide a complete and functional system.
5. The contractors will not be allowed additional costs or time extensions due to participation in the coordination process.
6. The contractors will not be allowed additional costs or time extensions for additional fittings, reroutings or changes of duct size, that are essentially equivalent sizes to those shown on the drawings and determined necessary through the coordination process.
7. The A/E reserves the right to determine space priority of equipment in the event of spatial conflicts or interference between equipment, piping, conduit, ducts, and equipment provided by the trades.
8. Changes to the contract documents that are necessary for systems installation and coordination shall be brought to the attention of the A/E.
9. Access panels shall preferably occur only in gypsum board walls or plaster ceilings where indicated on the drawings.
 - a. Access to mechanical, electrical, technology, and other items located above the ceiling shall be through accessible lay-in ceiling tile areas.
 - b. Potential layout changes shall be made to avoid additional access panels.
 - c. Additional access panels shall not be allowed without written approval from the A/E at the coordination drawing stage.
 - d. Providing additional access panels shall be considered after other alternatives are reviewed and discarded by the A/E and the Owner's Representative.
 - e. When additional access panels are required, they shall be provided without additional cost to the Owner.
10. Complete the coordination drawing process and obtain sign off of the drawings by all contractors prior to installing any of the components.
11. Conflicts that result after the coordination drawings are signed off shall be the responsibility of the contractor or subcontractor who did not properly identify their work requirements, or installed their work without proper coordination.
12. Updated coordination drawings that reflect as-built conditions may be used as record documents.

1.5 QUALITY ASSURANCE

A. Contractor's Responsibility Prior to Submitting Pricing Data:

1. The Contractor is responsible for constructing complete and operating systems. The Contractor acknowledges and understands that the Contract Documents are a two-dimensional representation of a three-dimensional object, subject to human interpretation. This representation may include imperfect data, interpreted codes, utility guidelines, three-dimensional conflicts, and required field coordination items. Such deficiencies can be corrected when identified prior to ordering material and starting installation. The Contractor agrees to carefully study and compare the individual Contract Documents and report at once in writing to the Design Team any deficiencies the Contractor may discover. The Contractor further agrees to require each subcontractor to likewise study the documents and report at once any deficiencies discovered.
2. The Contractor shall resolve all reported deficiencies with the Architect/Engineer prior to awarding any subcontracts, ordering material, or starting any work with the Contractor's own employees. Any work performed prior to receipt of instructions from the Design Team will be done at the Contractor's risk.

B. Qualifications:

1. Only products of reputable manufacturers are acceptable.
2. All Contractors and subcontractors shall employ only workers skilled in their trades.

C. Compliance with Codes, Laws, Ordinances:

1. Conform to all requirements of the Division of the State Architect (DSA) Codes, Laws, Ordinances and other regulations having jurisdiction.
2. Conform to all State Codes.
3. If there is a discrepancy between the codes and regulations and these specifications, the Architect/Engineer shall determine the method or equipment used.
4. If the Contractor notes, at the time of bidding, any parts of the drawings or specifications that do not comply with the codes or regulations, he shall inform the Architect/Engineer in writing, requesting a clarification. If there is insufficient time for this procedure, he shall submit with his proposal a separate price to make the system comply with the codes and regulations.
5. All changes to the system made after letting of the contract, to comply with codes or requirements of Inspectors, shall be made by the Contractor without cost to the Owner.
6. If there is a discrepancy between manufacturer's recommendations and these specifications, the manufacturer's recommendations shall govern.
7. All rotating shafts and/or equipment shall be completely guarded from all contact. Partial guards and/or guards that do not meet all applicable OSHA standards are not acceptable. Contractor is responsible for providing this guarding if it is not provided with the equipment supplied.

D. Permits, Fees, Taxes, Inspections:

1. Procure all applicable permits and licenses.
2. Abide by all laws, regulations, ordinances, and other rules of the State or Political Subdivision where the work is done, or as required by any duly constituted public authority.
3. Pay all charges for permits or licenses.

4. Pay all fees and taxes imposed by the State, Municipal and/or other regulatory bodies.
5. Pay all charges arising out of required inspections by an authorized body.
6. Pay all charges arising out of required contract document reviews associated with the project and as initiated by the Owner or authorized agency/consultant.
7. Where applicable, all fixtures, equipment and materials shall be approved or listed by Underwriter's Laboratories, Inc.

E. Examination of Drawings:

1. The drawings for the mechanical work are completely diagrammatic, intended to convey the scope of the work and to indicate the general arrangements and locations of equipment, outlets, etc., and the approximate sizes of equipment.
2. Contractor shall determine the exact locations of equipment and rough-ins, and the exact routing of pipes and ducts to best fit the layout of the job.
3. Scaling of the drawings is not sufficient or accurate for determining these locations.
4. Where job conditions require reasonable changes in indicated arrangements and locations, such changes shall be made by the Contractor at no additional cost to the Owner.
5. Because of the scale of the drawings, certain basic items, such as fittings, boxes, valves, unions, etc., may not be shown, but where required by other sections of the specifications or required for proper installation of the work, such items shall be furnished and installed.
6. If an item is either on the drawings or in the specifications, it shall be included in this contract.
7. Determination of quantities of material and equipment required shall be made by the Contractor from the documents. Where discrepancies arise between drawings, schedules and/or specifications, the greater number shall govern.
8. Where used in mechanical documents, the word "furnish" shall mean supply for use, the word "install" shall mean connect complete and ready for operation, and the word "provide" shall mean to supply for use and connect complete and ready for operation.
 - a. Any item listed as furnished shall also be installed, unless otherwise noted.
 - b. Any item listed as installed shall also be furnished, unless otherwise noted.

F. Field Measurements:

1. Verify all pertinent dimensions at the job site before ordering any materials or fabricating any supports, pipes or ducts.

G. Electronic Media/Files:

1. Construction drawings for this project have been prepared utilizing Revit.
2. Contractors and Subcontractors may request electronic media files of the contract drawings and/or copies of the specifications. Specifications will be provided in PDF format.
3. Upon request for electronic media, the Contractor shall complete and return a signed "Electronic File Transmittal" form provided by IMEG.
4. If the information requested includes floor plans prepared by others, the Contractor will be responsible for obtaining approval from the appropriate Design Professional for use of that part of the document.

5. The electronic contract documents can be used for preparation of shop drawings and as-built drawings only. The information may not be used in whole or in part for any other project.
6. The drawings prepared by IMEG for bidding purposes may not be used directly for ductwork layout drawings or coordination drawings.
7. The use of these CAD documents by the Contractor does not relieve them from their responsibility for coordination of work with other trades and verification of space available for the installation.
8. The information is provided to expedite the project and assist the Contractor with no guarantee by IMEG as to the accuracy or correctness of the information provided. IMEG accepts no responsibility or liability for the Contractor's use of these documents.

1.6 SUBMITTALS

- A. Submittals shall be required for the following items, and for additional items where required elsewhere in the specifications or on the drawings.

1. Submittals list:

Referenced Specification Section	Submittal Item
23 05 03	Fire Seal Systems
23 05 13	Motors
23 05 29 23 34 23	Prefabricated Curbs
23 05 48	Vibration Isolation Equipment
23 05 50	Seismic Restraint Systems
23 05 93	Testing, Adjusting, and Balancing
23 09 00	Controls
23 09 13	Instrumentation
23 31 00	Ductwork
23 31 00	Ductwork Layout Drawings
23 33 00	Duct Silencers
23 33 00	Combination Fire Smoke Dampers
23 34 16	Centrifugal Fans
23 34 23	Power Ventilators
23 35 14	Dust Collection Systems
23 37 00	Grilles, Registers, and Diffusers
23 74 11	Rooftop Air Conditioning Units
23 81 26	Split System Air Conditioning Units

- B. General Submittal Procedures: In addition to the provisions of Division 1, the following are required:

1. Transmittal: Each transmittal shall include the following:

- a. Date
- b. Project title and number
- c. Contractor's name and address
- d. Division of work (e.g., plumbing, heating, ventilating, etc.)
- e. Description of items submitted and relevant specification number
- f. Notations of deviations from the contract documents
- g. Other pertinent data

2. Submittal Cover Sheet: Each submittal shall include a cover sheet containing:

- a. Date
- b. Project title and number

- c. Architect/Engineer
- d. Contractor and subcontractors' names and addresses
- e. Supplier and manufacturer's names and addresses
- f. Division of work (e.g., plumbing, heating, ventilating, etc.)
- g. Description of item submitted (using project nomenclature) and relevant specification number
- h. Notations of deviations from the contract documents
- i. Other pertinent data
- j. Provide space for Contractor's review stamps

3. Composition:

- a. Submittals shall be submitted using specification sections and the project nomenclature for each item.
- b. Individual submittal packages shall be prepared for items in each specification section. All items within a single specification section shall be packaged together where possible. An individual submittal may contain items from multiple specifications sections if the items are intimately linked (e.g., pumps and motors).
- c. All sets shall contain an index of the items enclosed with a general topic description on the cover.

4. Content: Submittals shall include all fabrication, erection, layout, and setting drawings; manufacturers' standard drawings; schedules; descriptive literature, catalogs and brochures; performance and test data; electrical power wiring and control diagrams; dimensions; shipping and operating weights; shipping splits; service clearances; and all other drawings and descriptive data of materials of construction as may be required to show that the materials, equipment or systems and the location thereof conform to the requirements of the contract documents.

5. Contractor's Approval Stamp:

- a. The Contractor shall thoroughly review and approve all shop drawings before submitting them to the Architect/Engineer. The Contractor shall stamp, date and sign each submittal certifying it has been reviewed.
- b. Unstamped submittals will be rejected.
- c. The Contractor's review shall include, but not be limited to, verification of the following:
 - 1) Only approved manufacturers are used.
 - 2) Addenda items have been incorporated.
 - 3) Catalog numbers and options match those specified.
 - 4) Performance data matches that specified.
 - 5) Electrical characteristics and loads match those specified.
 - 6) Equipment connection locations, sizes, capacities, etc. have been coordinated with other affected trades.
 - 7) Dimensions and service clearances are suitable for the intended location.
 - 8) Equipment dimensions are coordinated with support steel, housekeeping pads, openings, etc.
 - 9) Constructability issues are resolved (e.g., weights and dimensions are suitable for getting the item into the building and into place, sinks fit into countertops, etc.).
- d. The Contractor shall review, stamp and approve all subcontractors' submittals as described above.

- e. **The Contractor's approval stamp is required on all submittals. Approval will indicate the Contractor's review of all material and a complete understanding of exactly what is to be furnished. Contractor shall clearly mark all deviations from the contract documents on all submittals. If deviations are not marked by the Contractor, then the item shall be required to meet all drawing and specification requirements.**
- 6. Submittal Identification and Markings:
 - a. The Contractor shall clearly mark each item with the same nomenclature applied on the drawings or in the specifications.
 - b. The Contractor shall clearly indicate the size, finish, material, etc.
 - c. Where more than one model is shown on a manufacturer's sheet, the Contractor shall clearly indicate exactly which item and which data is intended.
 - d. All marks and identifications on the submittals shall be unambiguous.
 - 7. Schedule submittals to expedite the project. Coordinate submission of related items.
 - 8. Identify variations from the contract documents and product or system limitations that may be detrimental to the successful performance of the completed work.
 - 9. Reproduction of contract documents alone is not acceptable for submittals.
 - 10. Incomplete submittals will be rejected without review. Partial submittals will only be reviewed with prior approval from the Architect/Engineer.
 - 11. Submittals not required by the contract documents may be returned without review.
 - 12. The Architect/Engineer's responsibility shall be to review one set of shop drawing submittals for each product. If the first submittal is incomplete or does not comply with the drawings and/or specifications, the Contractor shall be responsible to bear the cost for the Architect/Engineer to recheck and handle the additional shop drawing submittals.
 - 13. Submittals shall be reviewed and approved by the Architect/Engineer **before** releasing any equipment for manufacture or shipment.
 - 14. Contractor's responsibility for errors, omissions or deviation from the contract documents in submittals is not relieved by the Architect/Engineer's approval.
- C. Electronic Submittal Procedures:
 - 1. Distribution: Email submittals as attachments to all parties designated by the Architect/Engineer, unless a web-based submittal program is used.
 - 2. Transmittals: Each submittal shall include an individual electronic letter of transmittal.
 - 3. Format: Electronic submittals shall be in PDF format only. Scanned copies, in PDF format, of paper originals are acceptable. Submittals that are not legible will be rejected. Do not set any permission restrictions on files; protected, locked, or secured documents will be rejected.
 - 4. File Names: Electronic submittal file names shall include the relevant specification section number followed by a description of the item submitted, as follows. Where possible, include the transmittal as the first page of the PDF instead of using multiple electronic files.
 - a. Submittal file name: 23 XX XX.description.YYYYMMDD
 - b. Transmittal file name: 23 XX XX.description.YYYYMMDD

5. File Size: Electronic file size shall be limited to a maximum of 4MB. Larger files shall be transmitted via a pre-approved method.

D. Paper Copy Submittal Procedures:

1. Paper copies are acceptable where electronic copies are not provided.
2. The Contractor shall submit ten (10) paper copies of each shop drawing.
3. Each set shall be bound in a three-ring binder or presentation binder. Copies that are loose or in pocket folders are not acceptable.

1.7 CHANGE ORDERS

- A. A detailed material and labor takeoff shall be prepared for each change order, along with labor rates and markup percentages. Change orders with inadequate breakdown will be rejected.
- B. Change order work shall not proceed until authorized.

1.8 EQUIPMENT SUPPLIERS' INSPECTION

- A. Contractor shall arrange for and obtain supplier's on-site inspection(s) at proper time(s) to assure each phase of equipment installation and/or connection is in accordance with the manufacturer's instructions.
- B. Submit copies of start-up reports to the Architect/Engineer and include copies of Owner's Operation and Maintenance Manuals.

1.9 PRODUCT DELIVERY, STORAGE, HANDLING & MAINTENANCE

- A. Exercise care in transporting and handling to avoid damage to materials. Store materials on the site to prevent damage. Keep materials clean, dry and free from harmful conditions. Immediately remove any materials that become wet or that are suspected of becoming contaminated with mold or other organisms.
- B. Keep all bearings properly lubricated and all belts properly tensioned and aligned.
- C. Coordinate the installation of heavy and large equipment with the General Contractor and/or Owner. If the Mechanical Contractor does not have prior documented experience in rigging and lifting similar equipment, he/she shall contract with a qualified lifting and rigging service that has similar documented experience. Follow all equipment lifting and support guidelines for handling and moving.
- D. Contractor is responsible for moving equipment into the building and/or site. Contractor shall review site prior to bid for path locations and any required building modifications to allow movement of equipment. Contractor shall coordinate his/her work with other trades.

1.10 WARRANTY

- A. Provide one-year warranty, unless otherwise noted, to the Owner for all fixtures, equipment, materials, and workmanship.
- B. The warranty period for all work in this Division of the specifications shall commence on the date of final acceptance, unless a whole or partial system or any separate piece of equipment or component is put into use for the benefit of any party other than the installing contractor with prior written authorization. In this instance, the warranty period shall commence on the date when such whole system, partial system or separate piece of equipment or component is placed in operation and accepted in writing by the Owner.
- C. Warranty requirements shall extend to correction, without cost to the Owner, of all Work found to be defective or nonconforming to the contract documents. The Contractor shall bear the cost of correcting all damage resulting from defects or nonconformance with contract documents.

1.11 INSURANCE

- A. Contractor shall maintain insurance coverage as set forth in Division 0 of these specifications.

1.12 MATERIAL SUBSTITUTION

- A. Where several manufacturers' names are given, the manufacturer for which a catalog number is given is the basis for job design and establishes the quality required.
- B. Equivalent equipment manufactured by the other named manufacturers may be used. Contractor shall ensure that all items submitted by these other manufacturers meet all requirements of the drawings and specifications, and fits in the allocated space.
- C. Any material, article or equipment of other unnamed manufacturers which will adequately perform the services and duties imposed by the design and is of a quality equal to or better than the material, article or equipment identified by the drawings and specifications may be used if approval is secured in writing from the Architect/Engineer not later than ten days prior to the bid opening.
- D. This Contractor assumes all costs incurred as a result of using the offered material, article or equipment, on his part or on the part of other Contractors whose work is affected.
- E. This Contractor may list voluntary add or deduct prices for alternate materials on the bid form. These items will not be used in determining the low bidder.
- F. All material substitutions requested later than ten (10) days prior to bid opening must be listed as voluntary changes on the bid form.

1.13 PROJECT COMMISSIONING

- A. The Contractor shall work with the Commissioning Agent (CxA) as described in Section 01 91 00 and 23 08 00, and provide all services as described in the Commissioning Plan.

2. PART PRODUCTS

NOT APPLICABLE

3. PART EXECUTION

3.1 JOBSITE SAFETY

- A. Neither the professional activities of the Architect/Engineer, nor the presence of the Architect/Engineer or his or her employee and subconsultants at a construction site, shall relieve the Contractor and other entity of their obligations, duties and responsibilities including, but not limited to, construction means, methods, sequence, techniques or procedures necessary for performing, superintending or coordinating all portions of the work of construction in accordance with the contract documents and any health or safety precautions required by any regulatory agencies. The Architect/Engineer and his or her personnel have no authority to exercise any control over any construction contractor or other entity or their employees in connection with their work or any health or safety precautions. The Contractor is solely responsible for jobsite safety. The Architect/Engineer and the Architect/Engineer's consultants shall be indemnified and shall be made additional insureds under the Contractor's general liability insurance policy.

3.2 ARCHITECT/ENGINEER OBSERVATION OF WORK

- A. The Contractor shall provide seven (7) calendar days' notice to the Architect/Engineer prior to:
 - 1. Placing fill over underground and underslab utilities.
 - 2. Covering exterior walls, interior partitions and chases.
 - 3. Installing hard or suspended ceilings and soffits.

- B. The Architect/Engineer will have the opportunity to review the installation and provide a written report noting deficiencies requiring correction. The Contractor's schedule shall account for these reviews and show them as line items in the approved schedule.
- C. Above-Ceiling Final Observation
 - 1. All work above the ceilings must be complete prior to the Architect/Engineer's review. This includes, but is not limited to:
 - a. Pipe insulation is installed and fully sealed.
 - b. Pipe and duct wall penetrations are sealed.
 - c. Pipe identification and valve tags are installed.
 - d. Main, branch and flexible ducts are installed.
 - e. Diffusers, registers and grilles are installed and connected to ductwork.
 - 2. In order to prevent the Above-Ceiling Final Observation from occurring too early, the Contractor shall review the status of the work and certify, in writing, that the work is ready for the Above-Ceiling Final Observation.
 - 3. It is understood that if the Architect/Engineer finds the ceilings have been installed prior to this review and prior to 7 days elapsing, the Architect/Engineer may not recommend further payments to the contractor until such time as full access has been provided.

3.3 PROJECT CLOSEOUT

- A. The following paragraphs supplement the requirements of Division 1.
- B. Final Jobsite Observation:
 - 1. In order to prevent the Final Jobsite Observation from occurring too early, the Contractor is required to review the completion status of the project and certify that the job is ready for the final jobsite observation.
 - 2. Attached to the end of this section is a typical list of items that represent the degree of job completeness expected prior to requesting a review.
 - 3. Upon Contractor certification that the project is complete and ready for a final observation, the Contractor shall sign the attached certification and return it to the Architect/Engineer so that the final observation can be scheduled.
 - 4. It is understood that if the Architect/Engineer finds the job not ready for the final observation and that additional trips and observations are required to bring the project to completion, the costs incurred by the Architect/Engineer's additional time and expenses will be deducted from the Contractor's contract retainage prior to final payment at the completion of the job.
- C. Before final payment is authorized, this Contractor must submit the following:
 - 1. Operation and maintenance manuals with copies of approved shop drawings.
 - 2. Record documents including marked-up or reproducible drawings and specifications.
 - 3. A report documenting the instructions given to the Owner's representatives complete with the number of hours spent in the instruction. The report shall bear the signature of an authorized agent of This Contractor and shall be signed by the Owner's representatives.
 - 4. Start-up reports on all equipment requiring a factory installation inspection or start-up.
 - 5. Provide spare parts, maintenance, and extra materials in quantities specified in individual specification sections. Deliver to project site and place in location as directed; receipt by Architect/Engineer required prior to final payment approval.

3.4 OPERATION AND MAINTENANCE MANUALS

A. General:

1. Provide an electronic copy of the O&M manuals as described below for Architect/Engineer's review and approval. The electronic copy shall be corrected as required to address the Architect/Engineer's comments. Once corrected, electronic copies and paper copies shall be distributed as directed by the Architect/Engineer.
2. Approved O&M manuals shall be completed and in the Owner's possession prior to Owner's acceptance and at least 10 days prior to instruction of operating personnel.

B. Electronic Submittal Procedures:

1. Distribution: Email the O&M manual as attachments to all parties designated by the Architect/Engineer.
2. Transmittals: Each submittal shall include an individual electronic letter of transmittal.
3. Format: Electronic submittals shall be in PDF format only. Scanned copies, in PDF format, of paper originals are acceptable. Submittals that are not legible will be rejected. Do not set any permission restrictions on files; protected, locked, or secured documents will be rejected.
4. File Names: Electronic submittal file names shall include the relevant specification section number followed by a description of the item submitted, as follows. Where possible, include the transmittal as the first page of the PDF instead of using multiple electronic files.
 - a. O&M file name: O&M.div23.contractor.YYYYMMDD
 - b. Transmittal file name: O&Mtransmittal.div23.contractor.YYYYMMDD
5. File Size: Electronic file size shall be limited to a maximum of 4MB. Larger files shall be divided into files that are clearly labeled as "1 of 2", "2 of 2", etc.
6. Provide the Owner with an approved copy of the O&M manual on compact discs (CD), digital video discs (DVD), or flash drives with a permanently affixed label, printed with the title "Operation and Maintenance Instructions", title of the project and subject matter of disc/flash drive when multiple disc/flash drives are required.
7. All text shall be searchable.
8. Bookmarks shall be used, dividing information first by specification section, then systems, major equipment and finally individual items. All bookmark titles shall include the nomenclature used in the construction documents and shall be an active link to the first page of the section being referenced.

C. Operation and Maintenance Instructions shall include:

1. Title Page: Include title page with project title, Architect, Engineer, Contractor, all subcontractors, and major equipment suppliers, with addresses, telephone numbers, website addresses, email addresses and point of contacts. Website URLs and email addresses shall be active links in the electronic submittal.
2. Table of Contents: Include a table of contents describing specification section, systems, major equipment, and individual items.
3. Copies of all final approved shop drawings and submittals. Include Architect's/Engineer's shop drawing review comments. Insert the individual shop drawing directly after the Operation and Maintenance information for the item(s) in the review form.
4. Refer to Section 23 09 00 for additional requirements for Temperature Control submittals.

5. Copy of final approved test and balance reports.
6. Copies of all factory inspections and/or equipment startup reports.
7. Copies of warranties.
8. Schematic electrical power/controls wiring diagrams of the equipment that have been updated for field conditions. Field wiring shall have label numbers to match drawings.
9. Dimensional drawings of equipment.
10. Capacities and utility consumption of equipment.
11. Detailed parts lists with lists of suppliers.
12. Operating procedures for each system.
13. Maintenance schedule and procedures. Include a chart listing maintenance requirements and frequency.
14. Repair procedures for major components.
15. List of lubricants in all equipment and recommended frequency of lubrication.
16. Instruction books, cards, and manuals furnished with the equipment.

3.5 INSTRUCTING THE OWNER'S REPRESENTATIVES

- A. Adequately instruct the Owner's designated representatives in the maintenance, care, and operation of all systems installed under this contract.
- B. Provide verbal and written instructions to the Owner's representatives by FACTORY PERSONNEL in the care, maintenance, and operation of the equipment and systems.
- C. The Owner has the option to make a video recording of all instructions. Coordinate schedule of instructions to facilitate this recording.
- D. The instructions shall include:
 1. Explanation of all system flow diagrams.
 2. Explanation of all air handling systems.
 3. Temperature control system operation including calibration, adjustment and proper operating conditions of all sensors.
 4. Maintenance of equipment.
 5. Start-up procedures for all major equipment.
 6. Explanation of seasonal system changes.
- E. The Architect/Engineer shall be notified of the time and place instructions will be given to the Owner's representatives so he or his representative can attend if desired.
- F. Minimum hours of instruction for each item shall be:
 1. Air Handling System(s) - 2 hours.
 2. Split-System(s) - 1 hour.
 3. Dust Collection System(s) - 1 hour.
 4. Exhaust System(s) - 0.5 hours.
 5. Temperature Controls - As defined in Section 23 09 00.

- G. The Contractor shall prepare a detailed, written training agenda and submit it to the Architect/Engineer a minimum of two weeks prior to the formal training for approval. The written agenda shall include specific training points within the items described above. For example: how to adjust setpoints, troubleshooting, proper start-up, proper shut-down, seasonal changes, draining, venting, changing filters, changing belts, etc. Failure to provide and follow an approved training agenda may result in additional training required at the expense of the Contractor.
- H. Operating Instructions:
 - 1. Contractor is responsible for all instructions to the Owner's representatives for the mechanical and control systems.
 - 2. If the Contractor does not have staff that can adequately provide the required instructions he shall include in his bid an adequate amount to reimburse the Owner for the Architect/Engineer to perform these services.

3.6 SYSTEM STARTING AND ADJUSTING

- A. The mechanical systems shall be complete and operating. System startup, testing, adjusting, and balancing to obtain satisfactory system performance is the responsibility of the Contractor. This includes calibration and adjustments of all controls, noise level adjustments and final comfort adjustments as required.
- B. Complete all manufacturer-recommended startup procedures and checklists to verify proper motor rotation, electrical power voltage is within equipment limitations, equipment controls maintain pressures and temperatures within acceptable ranges, all filters and protective guards are in-place, acceptable access is provided for maintenance and servicing, and equipment operation does not pose a danger to personnel or property.
- C. Operate all HVAC systems continuously for at least one week prior to occupancy to bring construction materials to suitable moisture levels. Areas with mechanical cooling shall be maintained below 60% RH.
- D. Contractor shall adjust the mechanical systems and controls at season changes during the one year warranty period, as required, to provide satisfactory operation and to prove performance of all systems in all seasons.
- E. All operating conditions and control sequences shall be tested during the start-up period. Test all interlocks, safety shutdowns, controls, and alarms.
- F. The Contractor, subcontractors, and equipment suppliers shall have skilled technicians to ensure that all systems perform properly. If the Architect/Engineer is requested to visit the job site for trouble shooting, assisting in start-up, obtaining satisfactory equipment operation, resolving installation and/or workmanship problems, equipment substitution issues or unsatisfactory system performance, including call backs during the warranty period, through no fault of the design; the Contractor shall reimburse the Owner on a time and materials basis for services rendered at the Architect/Engineer's standard hourly rates in effect when the services are requested. The Contractor shall pay the Owner for services required that are product, installation or workmanship related. Payment is due within 30 days after services are rendered.

3.7 RECORD DOCUMENTS

- A. The following paragraph supplements Division 1 requirements:

Contractor shall maintain at the job site a separate and complete set of mechanical drawings and specifications on which he shall clearly and permanently mark in complete detail all changes made to the mechanical systems.

- B. Mark drawings to indicate revisions to piping and ductwork, size and location, both exterior and interior; including locations of coils, dampers, other control devices, filters, and other units requiring periodic maintenance or repair; actual equipment locations, dimensioned from column lines; actual inverts and locations of underground piping; concealed equipment, dimensioned from column lines; mains and branches of piping systems, with valves and control devices located and numbered, concealed unions located, and with items requiring maintenance located (e.g., traps, strainers, expansion compensators, tanks, etc.); Change Orders; concealed control system devices.
- C. Refer to Section 23 09 00 for additional requirements for Temperature Control documents.
- D. Before completion of the project, a set of reproducible mechanical drawings will be given to the Contractor for transfer of all as-built conditions from the paper set maintained at the job site. All marks on reproducibles shall be clear and permanent.
- E. Mark specifications to show approved substitutions; Change Orders, and actual equipment and materials used.
- F. Record changes daily and keep the marked drawings available for the Architect/Engineer's examination at any normal work time.
- G. Upon completing the job, and before final payment is made, give the marked-up drawings to the Architect/Engineer.

3.8 PAINTING

- A. This Contractor shall paint the following items:
 - 1. Exposed ductwork, color specified by Architect.
- B. Paint all equipment that is marred or damaged prior to the Owner's acceptance. Paint and color shall match original equipment paint and shall be obtained from the equipment supplier if available.
- C. Equipment in finished areas that will be painted to match the room decor will be painted by others. Should this Contractor install equipment in a finished area after the area has been painted, he shall have the equipment and all its supports, hangers, etc., painted to match the room decor.
- D. Equipment cabinets, casings, covers, metal jackets, etc., in equipment rooms or concealed spaces, shall be furnished in standard or prime finish, free from scratches, abrasions, chips, etc.
- E. Equipment in occupied spaces, or if standard to the unit, shall have a baked primer with baked enamel finish coat free from scratches, abrasions, chips, etc. If color option is specified or is standard to the unit, this Contractor shall, before ordering, verify with the Architect/Engineer his color preference and furnish this color.
- F. Paint all equipment in unfinished areas such as mechanical spaces, storage room, etc., furnished by this Contractor. Equipment furnished with a factory coat of paint and enamel need not be painted, provided the factory applied finish is not marred or spattered. If so, equipment shall be refinished with the same paint as was factory applied.
- G. After surfaces have been thoroughly cleaned and are free of oil, dirt, and other foreign matter; paint all pipes and equipment with the following:
 - 1. Bare Metal Surfaces - Apply one coat of primer suitable for the metal being painted. Finish with two coats of Alkyd base enamel paint.
 - 2. Insulated Surfaces - Paint insulation jackets with two coats of semi-gloss acrylic latex paint.
 - 3. Color of paint shall be as follows:
 - a. As specified by Architect.

3.9 ADJUST AND CLEAN

- A. Thoroughly clean all equipment and systems prior to the Owner's final acceptance of the project. Clean all foreign paint, grease, oil, dirt, labels, stickers, and other foreign material from all equipment.
- B. Clean all drain pans and areas where moisture is present. Immediately report any mold, biological growth, or water damage.
- C. Remove all rubbish, debris, etc., accumulated during construction from the premises.

3.10 SPECIAL REQUIREMENTS

- A. Contractor shall coordinate the installation of all equipment, valves, dampers, operators, etc., with other trades to maintain clear access area for servicing.
- B. All equipment shall be installed in such a way to maximize access to parts needing service or maintenance. Review the final field location, placement, and orientation of equipment with the Owner's designated representative prior to setting equipment.
- C. Installation of equipment or devices without regard to coordination of access requirements and confirmation with the Owner's designated representative will result in removal and reinstallation of the equipment at the Contractor's expense.
- D. Adhesives and Sealants: All sealers, adhesives, and sealants shall comply with the low emitting material limits of the following standards:
 - 1. CDPH Standard Method V1.1-2010 - Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions VOC from Indoor Sources Using Environmental Chambers Version 1.1.
 - 2. South Coast Air Quality Management District Rule 1168 – Adhesive and Sealant Applications. All adhesives and sealants wet-applied on site shall comply with the applicable chemical content requirements of SCAQMD Rule 1168.
 - 3. South Coast Air Quality Management District Rule SCAQMD 1113 – Wet Applied Paints and Coatings. All paints and coatings wet-applied on site must meet the applicable VOC limits of SCAQMD Rule 1113.

END OF SECTION

READINESS CERTIFICATION PRIOR TO FINAL JOBSITE OBSERVATION

To prevent the final job observation from occurring too early, we require that the Contractor review the completion status of the project and, by copy of this document, certify that the job is indeed ready for the final job observation. The following is a typical list of items that represent the degree of job completeness expected prior to your requesting a final job observation.

1. Penetrations fire sealed and labeled in accordance with specifications.
2. All air handling units operating and balanced.
3. All fans shall be operating and balanced.
4. All miscellaneous mechanical systems (unit heaters, fan coil units, cabinet heaters, etc.) operating.
5. All temperature control systems operating, programmed and calibrated.
6. Pipe insulation complete, pipes labeled and valves tagged.
7. Fire damper and fire/smoke damper access doors labeled in accordance with specifications.

Accepted by:

Prime Contractor _____

By _____ Date _____

Upon Contractor certification that the project is complete and ready for a final job observation, we require the Contractor to sign this agreement and return it to the Architect/Engineer so that the final observation can be scheduled.

It is understood that if the Architect/Engineer finds the job not ready for the final observation and that additional trips and observations are required to bring the project to completion, the costs incurred by the Architect/Engineers for additional time and expenses will be deducted from the Contractor's contract retainage prior to final payment at the completion of the job.

* * * * *

SECTION 23 05 03

THROUGH PENETRATION FIRESTOPPING

1. PART GENERAL

1.1 SECTION INCLUDES

- A. Through-Penetration Firestopping.

1.2 QUALITY ASSURANCE

- A. Manufacturer: Company specializing in manufacturing products specified in this Section.
- B. Installer: Individuals performing work shall be certified by the manufacturer of the system selected for installation.

1.3 SUBMITTALS

- A. Submit under provisions of Section 23 05 00.
- B. Submit Firestopping Installers Certification for all installers on the project.
- C. Shop Drawings: Submit for each condition requiring firestopping. Include descriptions of the specific penetrating item, actual wall/floor construction, manufacturer's installation instructions, and UL or Intertek / Warnock Hersey Assembly number.
- D. Through-Penetration Firestop System Schedule: Indicate locations of each through-penetration firestop system, along with the following information:
 - 1. Types of penetrating items.
 - 2. Types of constructions penetrated, including fire-resistance ratings and, where applicable, thicknesses of construction penetrated.
 - 3. Through-penetration firestop systems for each location identified by firestop design designation of qualified testing and inspecting agency.
 - 4. F and T ratings for each firestop system.
- E. Maintain a notebook on the job site at all times that contains copies of approved submittals for all through penetration firestopping to be installed. Notebook shall be made available to the Authority Having Jurisdiction at their request and turned over to the Owner at the end of construction as part of the O&M Manuals.

1.4 DELIVERY, STORAGE, AND HANDLING

- A. Store, protect and handle products on site. Accept material on site in factory containers and packing. Inspect for damage. Protect from deterioration or damage due to moisture, temperature changes, contaminants, or other causes. Follow manufacturer's instructions for storage.
- B. Install material prior to expiration of product shelf life.

1.5 PERFORMANCE REQUIREMENTS

- A. General: For penetrations through the following fire-resistance-rated constructions, including both empty openings and openings containing penetrating items, provide through-penetration firestop systems that are produced and installed to resist spread of fire according to requirements indicated, resist passage of smoke and other gases, and maintain original fire-resistance rating of construction penetrated.
 - 1. Fire-resistance-rated walls including fire partitions, fire barriers, and smoke barriers.

2. Fire-resistance-rated horizontal assemblies including floors, floor/ceiling assemblies, and ceiling membranes of roof/ceiling assemblies.
- B. Rated Systems: Provide through-penetration firestop systems with the following ratings determined per UL 1479:
1. F-Rated Systems: Provide through-penetration firestop systems with F-ratings indicated, but not less than that equaling or exceeding fire-resistance rating of constructions penetrated.
 2. T-Rated Systems: For the following conditions, provide through-penetration firestop systems with T-ratings indicated, as well as F-ratings:
 - a. Floor penetrations located outside wall cavities.
 - b. Floor penetrations located outside fire-resistance-rated shaft enclosures.
 - c. Wall penetrations above corridor ceilings which are not part of a fire-resistive assembly.
 - d. Wall penetrations below any ceiling that are larger than 4" diameter or 16 square inches.
 3. L-Rated Systems: Provide through-penetration firestop systems with L-ratings of not more than 5.0 cfm/sq. ft at both ambient temperature and 400°F for smoke barriers.
- C. For through-penetration firestop systems exposed to light, traffic, moisture, or physical damage, provide products that, after curing, do not deteriorate when exposed to these conditions both during and after construction.
- D. For through-penetration firestop systems exposed to view, provide products with flame-spread and smoke-developed indexes of less than 25 and 450, respectively, as determined per ASTM E 84.
- E. For through-penetration firestop systems in air plenums, provide products with flame-spread and smoke-developed indexes of less than 25 and 50, respectively, as determined per ASTM E 84.
- F. Adhesives and Sealants: All sealers, adhesives, and sealants shall comply with the low emitting material limits of the following standards:
1. CDPH Standard Method V1.1-2010 - Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions VOC from Indoor Sources Using Environmental Chambers Version 1.1.
 2. South Coast Air Quality Management District Rule 1168 – Adhesive and Sealant Applications. All adhesives and sealants wet-applied on site shall comply with the applicable chemical content requirements of SCAQMD Rule 1168.
 3. South Coast Air Quality Management District Rule SCAQMD 1113 – Wet Applied Paints and Coatings. All paints and coatings wet-applied on site must meet the applicable VOC limits of SCAQMD Rule 1113.

1.6 MEETINGS

- A. Pre-installation meeting: A pre-installation meeting shall be scheduled and shall include the Construction Manager, General Contractor, all Subcontractors associated with the installation of systems penetrating fire barriers, Firestopping Manufacturer's Representative, and the Owner.
1. Review foreseeable methods related to firestopping work.
 2. Tour representative areas where firestopping is to be installed; inspect and discuss each type of condition and each type of substrate that will be encountered, and preparation to be performed by other trades.

1.7 WARRANTY

- A. Provide one year warranty on parts and labor.
- B. Warranty shall cover repair or replacement of firestop systems which fail in joint adhesion, cohesion, abrasion resistance, weather resistance, extrusion resistance, migration resistance, stain resistance, general durability, or appear to deteriorate in any manner not clearly specified by the manufacturer as an inherent quality of the material.

2. PART PRODUCTS

2.1 MANUFACTURERS

- A. Products: Subject to compliance with requirements, provide one of the through-penetration firestop systems indicated for each application that are produced by one of the following manufacturers. All firestopping systems installed shall be provided by a single manufacturer.
 - 1. 3M; Fire Protection Products Division.
 - 2. Hilti, Inc.
 - 3. RectorSeal Corporation, Metacaulk.
 - 4. Tremco; Sealant/Weatherproofing Division.
 - 5. Johns-Manville.
 - 6. Specified Technologies Inc. (S.T.I.)
 - 7. Spec Seal Firestop Products
 - 8. AD Firebarrier Protection Systems
 - 9. Dow Corning Corp.
 - 10. Fire Trak Corp.
 - 11. International Protective Coating Corp.

2.2 THROUGH PENETRATION FIRESTOP SYSTEMS

- A. Provide materials and systems classified by or listed by Intertek / Warnock Hersey to provide firestopping equal to time rating of construction being penetrated.
- B. All firestopping materials shall be free of asbestos, lead, PCB's, and other materials that would require hazardous waste removal.
- C. Firestopping shall be flexible to allow for normal penetrating item movement due to expansion and contraction.
- D. Firestopping systems for plumbing and wet pipe sprinkler piping shall be moisture resistant.
- E. Provide firestopping systems capable of supporting floor loads where systems are exposed to possible floor loading or traffic.
- F. Provide firestopping systems allowing continuous insulation for all insulated pipes.

- G. Provide firestopping systems classified by UL or listed by Intertek / Warnock Hersey for penetrations through all fire rated construction. Firestopping systems shall be selected from the UL or listed by Intertek / Warnock Hersey Fire Resistance Directory Category XHEZ based on substrate construction and penetrating item size and material and shall fall within the range of numbers listed:

1. Combustible Framed Floors and Chase Walls - 1 or 2 Hour Rated

F Rating = Floor/Wall Rating

T Rating = Floor/Wall Rating

<u>Penetrating Item</u>	<u>UL System No.</u>
No Penetrating Item	FC 0000-0999*
Metallic Pipe or Conduit	FC 1000-1999
Non-Metallic Pipe or Conduit	FC 2000-2999
Electrical Cables	FC 3000-3999
Cable Trays	FC 4000-4999
Insulated Pipes	FC 5000-5999
Bus Duct and Misc. Electrical	FC 6000-6999
Duct without Damper and Misc. Mechanical	FC 7000-7999
Multiple Penetrations	FC 8000-8999

2. Non-Combustible Framed Walls - 1 or 2 Hour Rated

F Rating = Wall Rating

T Rating = 0

<u>Penetrating Item</u>	<u>UL System No.</u>
No Penetrating Item	WL 0000-0999*
Metallic Pipe or Conduit	WL 1000-1999
Non-Metallic Pipe or Conduit	WL 2000-2999
Electrical Cables	WL 3000-3999
Cable Trays	WL 4000-4999
Insulated Pipes	WL 5000-5999
Bus Duct and Misc. Electrical	WL 6000-6999
Duct without Damper and Misc. Mechanical	WL 7000-7999
Multiple Penetrations	WL 8000-8999

3. Concrete or Masonry Floors and Walls - 1 or 2 Hour Rated

F Rating = Wall/Floor Rating

T Rating (Floors) = Floor Rating

<u>Penetrating Item</u>	<u>UL System No.</u>
No Penetrating Item	CAJ 0000-0999*
Metallic Pipe or Conduit	CAJ 1000-1999
Non-Metallic Pipe or Conduit	CAJ 2000-2999
Electrical Cables	CAJ 3000-3999
Cable Trays	CAJ 4000-4999
Insulated Pipes	CAJ 5000-5999
Bus Duct and Misc. Electrical	CAJ 6000-6999
Duct without Damper and Misc. Mechanical	CAJ 7000-7999
Multiple Penetrations	CAJ 8000-8999

*Alternate method of firestopping is patching opening to match original rated construction.

- H. Any opening in walls or floors not covered by the listed series of numbers shall be coordinated with the firestopping manufacturer.
- I. Any openings in floors or walls not described in the UL or listed by Intertek / Warnock Hersey Fire Resistance Directory, or outlined in manufacturer's information shall be sealed in a manner agreed upon by the Firestopping Manufacturer, Owner, and the Authority Having Jurisdiction.

3. PART EXECUTION

3.1 EXAMINATION

- A. Ensure all surfaces that contact seal materials are free of dirt, dust, grease, oil, rust, or loose materials. Clean and repair surfaces as required. Remove laitance and form-release agents from concrete.
- B. Ensure substrate and penetrating items have been permanently installed prior to installing firestopping systems. Ensure penetrating items have been properly spaced and have proper clearance prior to installing firestopping systems.
- C. Surfaces to which sealing materials are to be installed must meet the selected UL or Intertek / Warnock Hersey system substrate criteria.
- D. Prime substrates where recommended in writing by through-penetration firestop system manufacturer. Confine primer to area of bond.

3.2 INSTALLATION

- A. In existing construction, provide firestopping of openings prior to and after installation of penetrating items. Remove any existing coatings on surfaces prior to firestopping installation. Temporary firestopping shall consist of packing openings with fire resistant mineral wool for the full thickness of substrate, or an alternate method approved by the Authority Having Jurisdiction. All openings shall be temporarily firestopped immediately upon their installation and shall remain so until the permanent UL or listed by Intertek / Warnock Hersey listed firestopping system is installed.
- B. Install penetration seal materials in accordance with printed instructions of the UL or Intertek / Warnock Hersey Fire Resistance Directory and with the manufacturer's printed application instructions.
- C. Install dams as required to properly contain firestopping materials within openings and as required to achieve required fire resistance rating. Remove combustible damming after appropriate curing.

3.3 CLEANING AND PROTECTING

- A. Clean excess fill materials adjacent to openings as Work progresses by methods and with cleaning materials that are approved in writing by through-penetration firestop system manufacturers and that do not cause damage.
- B. Provide final protection and maintain conditions during and after installation that ensure that through-penetration firestop systems are without damage or deterioration at time of Substantial Completion. If, despite such protection, damage or deterioration occurs, remove damaged or deteriorated through-penetration firestop systems immediately and install new materials to produce systems complying with specified requirements.

3.4 IDENTIFICATION

- A. Provide and install labels adjacent to each firestopping location. Label shall be provided by the firestop system supplier and contain the following information in a contrasting color:
 - 1. The words "Warning - Through Penetration Firestop System - Do Not Disturb. Notify Building Management of Any Damage."

2. Firestop System Supplier; UL or listed by Intertek / Warnock Hersey system number; date installed; contractor name and phone number; manufacturer's representative name, address, and phone number.

3.5 INSPECTION

- A. All penetrations shall be inspected by the manufacturer's representative to ensure proper installation.
- B. Access to firestop systems shall be maintained for examination by the Authority Having Jurisdiction at their request.
- C. Proceed with enclosing through-penetration firestop system with other construction only after inspection reports are issued and firestop installations comply with requirements.
- D. The contractor shall allow for visual destructive review of 5% of installed firestop systems (minimum of one) to prove compliance with specifications and manufacturer's instructions and details. Destructive system removal shall be performed by the contractor and witnessed by the Architect/Engineer and manufacturer's factory representative. The Architect/Engineer shall have sole discretion of which firestop system installations will be reviewed. The contractor is responsible for all costs associated with this requirement including labor and material for removing and replacing the installed firestop system. If any firestop system is found to not be installed per manufacturer's specific instructions and details, all firestop systems are subject to destructive review and replacement at the Architect/Engineer's discretion and the contractor's expense.

END OF SECTION

SECTION 23 05 13

MOTORS

1. PART GENERAL

1.1 SECTION INCLUDES

- A. Single Phase and Three Phase Electric Motors.

1.2 SUBMITTALS

- A. Submit shop drawings under provisions of Section 23 05 00. Include nominal efficiency and power factor for all premium efficiency motors. Efficiencies must meet or exceed the nominal energy efficiency levels presented below.
- B. Submit shop drawings for all three phase motors.
- C. Submit motor data with equipment when motor is installed by the manufacturer at the factory.

1.3 DELIVERY, STORAGE, AND HANDLING

- A. Protect motors stored on site from weather and moisture by maintaining factory covers and suitable weatherproof coverings. For extended outdoor storage, follow manufacturer's recommendations for equipment and motor.

1.4 OPERATION AND MAINTENANCE DATA

- A. Submit operation and maintenance data including assembly drawings, bearing data including replacement sizes, and lubrication instructions.

1.5 QUALIFICATIONS

- A. Manufacturer: Company specializing in the manufacture of commercial and industrial motors and accessories, with a minimum of three years documented manufacturing experience.

2. PART PRODUCTS

2.1 MOTORS - GENERAL CONSTRUCTION AND REQUIREMENTS

- A. Refer to the drawings for required electrical characteristics. Voltage is generally specified and scheduled as distribution voltage. Motor submittals may be based on utilization voltage if it corresponds to the correct distribution voltage.

Distribution/Nominal Voltage	Utilization Voltage
120	115
208	200
240	230
277	265
480	460

- B. Design motors for continuous operation in 40°C environment, and for temperature rise in accordance with ANSI/NEMA MG 1 limits for insulation class, service factor, and motor enclosure type.
- C. Explosion-Proof Motors: UL listed and labeled for the hazard classification shown on the drawing, with over-temperature protection.
- D. Visible Nameplate: Indicating horsepower, voltage, phase, hertz, RPM, full load amps, locked rotor amps, frame size, manufacturer's name and model number, service factor, power factor, insulation class.
- E. Electrical Connection: Boxes, threaded for conduit. For fractional horsepower motors where connection is made directly, provide conduit connection in end frame.
- F. Unless otherwise indicated, motors 3/4 HP and smaller shall be single phase, 60 hertz, open drip-proof or totally enclosed fan-cooled type.
- G. Unless otherwise indicated, motors 1 HP and larger shall be three phase, 60 hertz, squirrel cage type, NEMA Design Code B (low current in-rush, normal starting torque), open drip-proof or totally enclosed fan-cooled type.
- H. Each contractor shall set all motors furnished by him.
- I. All motors shall have a minimum service factor of 1.15.
- J. All motors shall have ball or roller bearings with a minimum L-10 fatigue life of 150,000 hours in direct-coupled applications and 50,000 hours for belted applications. Belted rating shall be based on radial loads and pulley sizes called out in NEMA MG1-14.43.
- K. Bearings shall be sealed type for 10 HP and smaller motors. Bearings shall be regreasable type for larger motors.
- L. Aluminum end housings are not permitted on motors 15 HP or larger.
- M. Provide all belted motors with a means of moving and securing the motor to tighten belts. Motors over 2 HP shall have screw type tension adjustment. Motors over 40 HP shall have dual screw adjusters. Slide bases shall conform to NEMA standards.
- N. Motors for fans and pumps 1/12 HP or greater and less than 1 HP shall be electronically-commutated motors or shall have a minimum motor efficiency of 70% when rated in accordance with DOE 10 CFR 431. These motors shall also have the means to adjust motor speed for either balancing or remote control. Belt-driven fans may use sheave adjustments for airflow balancing in lieu of varying motor speed.

2.2 PREMIUM EFFICIENCY MOTORS (INCLUDING MOST 3-PHASE GENERAL PURPOSE MOTORS)

- A. All motors, unless exempted by EPCa legislation that became federal law on December 19, 2010, shall comply with the efficiencies listed in that standard, which are reprinted below. These match the 2010 NEMA premium efficiency ratings. All ratings listed are nominal full load efficiencies, verified in accordance with IEEE Standard 112, Test Method B. Average expected (not guaranteed minimum) power factors shall also be at least the following:

HP	Full-Load Efficiencies %					
	Open Drip-Proof			Totally Enclosed Fan Cooled		
	1200 rpm	1800 rpm	3600 rpm	1200 rpm	1800 rpm	3600 rpm
1.0	82.5	85.5	77.0	82.5	85.5	77.0
1.5	86.5	86.5	84.0	87.5	86.5	84.0
2.0	87.5	86.5	85.5	88.5	86.5	85.5
3.0	88.5	89.5	85.5	89.5	89.5	86.5
5.0	89.5	89.5	86.5	89.5	89.5	88.5
7.5	90.2	91.0	88.5	91.0	91.7	89.5
10.0	91.7	91.7	89.5	91.0	91.7	90.2
15.0	91.7	93.0	90.2	91.7	92.4	91.0
20.0	92.4	93.0	91.0	91.7	93.0	91.0
25.0	93.0	93.6	91.7	93.0	93.6	91.7
30.0	93.6	94.1	91.7	93.0	93.6	91.7
40.0	94.1	94.1	92.4	94.1	94.1	92.4

- B. Motor nameplate shall be noted with the above ratings.

2.3 MOTORS ON VARIABLE FREQUENCY DRIVES

- A. All motors driven by VFDs shall be premium efficiency type.
- B. Motors shall be designed for use with VFDs in variable torque applications with 1.15 service factor. Motors shall not be equipped with auxiliary blowers.
- C. Motors driven by VFDs shall have Class F or H insulation and be designated by the motor manufacturer to be suitable for inverter duty service in accordance with NEMA MG 1 Section IV, "Performance Standards Applying to All Machines," Part 31 "Definite-Purpose Inverter-Fed Polyphase Motors.

2.4 MOTORS FOR WET OR CORROSIVE DUTY

- A. Where noted for wet and/or corrosive duty, motors shall be designed for severe duty with cast-iron frame, epoxy finish, stainless steel nameplate, polymer shaft seal, corrosion resistant fasteners and fan, moisture resistant windings, and non-wicking leads.

2.5 MOTORS FOR HAZARDOUS DUTY

- A. Where noted for hazardous duty, motors shall be designed for the class, group, and T code listed for the application. Frame sizes 143T and larger shall have normally closed winding thermostats to keep surface temperatures below the nameplate T code under all conditions.

2.6 MOTOR DRIVEN EQUIPMENT

- A. No equipment shall be selected or operate above 90% of its motor nameplate rating. Motor size may not be increased to compensate for equipment with efficiency lower than that specified.
- B. If a larger motor than specified is required on equipment, the contractor supplying the equipment is responsible for all additional costs due to larger starters, wiring, etc.

2.7 SHEAVES

- A. All sheaves shall conform to NEMA Standard MG1-14.42, which lists minimum diameters and maximum overhangs. Locate motors to minimize overhang.
- B. When replacing sheaves, use sheaves of at least the originally supplied sizes.
- C. Contractor responsible for motor shall also be responsible for replacement sheaves. Coordinate with testing and balancing of the equipment.

3. PART EXECUTION

3.1 INSTALLATION

- A. All rotating shafts and/or equipment shall be completely guarded from all contact. Partial guards and/or guards that do not meet all applicable OSHA standards are not acceptable. Contractor is responsible for providing this guarding if it is not provided with the equipment supplied.
- B. For flexible coupled drive motors, mount coupling to the shafts in accordance with the coupling manufacturer's recommendations. Align shafts to manufacturer's requirements or within 0.002 inch per inch diameter of coupling hub.
- C. For belt drive motors, mount sheaves on the appropriate shafts per manufacturer's instructions. Use a straight edge to check alignment of the sheaves. Reposition sheaves as necessary so the straight edge contacts both sheave faces squarely. After sheaves are aligned, loosen the adjustable motor base so the belt(s) can be added, and tighten the base so the belt tension is in accordance with the drive manufacturer's recommendations. Frequently check belt tension and adjust if necessary during the first day of operation and again after 80 hours of operation.

END OF SECTION

SECTION 23 05 29

HVAC SUPPORTS AND ANCHORS

1. PART GENERAL

1.1 SECTION INCLUDES

- A. Hangers, Supports, and Associated Anchors.
- B. Equipment Bases and Supports.
- C. Sleeves and Seals.
- D. Flashing and Sealing of Equipment and Pipe Stacks.
- E. Cutting of Openings.
- F. Escutcheon Plates and Trim.

1.2 SUBMITTALS

- A. Submit shop drawings and product data under provisions of Section 23 05 00. Include plastic pipe manufacturers' support spacing requirements.

1.3 WORK FURNISHED BUT INSTALLED UNDER OTHER SECTIONS

- A. Furnish sleeves and hanger inserts to General Contractor for placement into formwork.

2. PART PRODUCTS

2.1 SEISMIC RESTRAINTS

- A. Refer to Section 23 05 50 for additional requirements for seismic restraints.

2.2 HANGER RODS

- A. Hanger rods for single rod hangers shall conform to the following:

Pipe Size	Hanger Rod Diameter	
	Column #1	Column #2
2" and smaller	3/8"	3/8"
2-1/2" through 3-5/8"	1/2"	1/2"

Column #1: Steel pipe.

Column #2: Copper, plastic and fiberglass reinforced pipe.

- B. Rods for double rod hangers may be reduced one size. Minimum rod diameter is 3/8 inches.
- C. Hanger rods and accessories used in mechanical spaces or otherwise dry areas shall have ASTM B633 electro-plated zinc finish.
- D. All hanger rods, nuts, washers, clevises, etc., in damp areas shall have ASTM A123 hot-dip galvanized finish applied after fabrication. This applies to the following areas:
 - 1. Locker Rooms
 - 2. Shower Rooms
 - 3. Kitchen

2.3 PIPE AND STRUCTURAL SUPPORTS

A. General:

1. Pipe hangers, clamps, and supports shall conform to Manufacturers Standardization Society MSS SP-58, 69, 89, and 127 (where applicable).
2. On all insulated piping, provide at each support an insert of same thickness and contour as adjoining insulation, between the pipe and insulation jacket, to prevent insulation from sagging and crushing. Refer to insulation specifications for materials and additional information.

a. Insulation Couplings:

- 1) Insulation Coupling: Molded thermoplastic, -65°F to 275°F, sizes up to 4-1/8" OD, and receive insulation thickness up to 1". Suitable for use indoors or outdoors with UV stabilizers. Vertical insulation riser clamps shall have a 1,000lb vertical load rating. On cold pipes operating below 60°F, cover joint and coupling with vapor barrier mastic to ensure continuous vapor barrier.
- 2) Horizontal Strut Mounted Insulated Pipe:
 - a) Acceptable Manufacturers: Klo-Shure or equal.
- 3) Vertical:
 - a) Acceptable Manufacturers: Klo-Shure Titan or equal.

B. Vertical Supports:

1. Support and laterally brace vertical pipes at every floor level in multi-story structures, unless otherwise noted by applicable codes, but never at intervals over 15 feet. Support vertical pipes with riser clamps installed below hubs, couplings, or lugs. Provide sufficient flexibility to accommodate expansion and contraction to avoid compromising fire barrier penetrations or stressing piping at fixed takeoff locations.

Acceptable Products:

Cooper/B-Line - Fig B3373 Series
Erico - 510 Series
Nibco/Tolco - Fig. 82

2. Place restrained neoprene mounts beneath vertical pipe riser clamps to prevent sweating of cold pipes. Select neoprene mounts based on the weight of the pipe to be supported. Insulate over mounts.

Acceptable Products: Mason RBA, RCA, or BR.

3. Wall supports shall be used where vertical height of structure exceeds minimum spacing requirements. Install wall supports at same spacing as hangers or strut supports along vertical length of pipe runs. Wall supports shall be coordinated with the Structural Engineer.
4. Masonry Anchors: Fasten to concrete masonry units with expansion anchors or self-tapping masonry screws. For expansion anchors into hollow concrete block, use sleeve-type anchors designed for the specific application. Do not fasten in masonry joints. Do not use powder actuated fasteners, wooden plugs, or plastic inserts

C. Hangers and Clamps:

1. Oversize all hangers, clamps, and supports on insulated piping to allow insulation and jacket to pass through unbroken. This applies to both hot and cold pipes.
2. Hangers in direct contact with bare copper pipe shall include plastic pipe insert similar to Unistrut Cush-A-Clamp, Hydra-Zorb, Erico Cushion Clamp or Cooper Vibra-Clamp within their temperature limits of -65°F to +275°F.
3. On all insulated piping, provide a semi-cylindrical metallic shield and vapor barrier jacket.
4. Ferrous hot piping 2-1/2 inches and larger shall have steel saddles tack welded to the pipe at each support with a depth not less than specified for the insulation. Factory fabricated inserts may be used.

Acceptable Products:

Anvil - Fig. 160, 161, 162, 163, 164, 165
 Cooper/B-Line - Fig. 3160, 3161, 3162, 3163, 3164, 3165
 Erico - Model 630, 631, 632, 633, 634, 635
 Nibco/Tolco - Fig. 260-1, 261-1 1/2, 262-2, 263-2 1/2, 264-3, 265-4

5. As an alternative to separate pipe insulation insert and saddle, properly sized integral rigid insulation sections may be used.

Acceptable Products:

Cooper/B-Line - Fig. B3380 through B3384
 Pipe Shields - A1000, A2000
 Erico - Model 124, 127

6. Unless otherwise indicated, hangers shall be as follows:

a. Clevis Type:

Service: Bare Metal Pipe
 Rigid Plastic Pipe
 Insulated Cold Pipe
 Insulated Hot Pipe - 3 inches & Smaller

Acceptable Products:	Bare Steel, Plastic or Insulated Pipe	Bare Copper Pipe
Anvil	Fig. 260	
Cooper/B-Line	Fig. 3100	Fig. B3100C
Erico	Model 400	
Nibco/Tolco	Fig. 1	Fig. 81PVC

b. Continuous Channel with Clevis Type:

Service: Plastic Tubing
 Flexible Hose
 Soft Copper Tubing

Acceptable Products:

Cooper/B-Line - Fig. B3106, with Fig. B3106V
 Erico - Model 104, with Model 104V
 Nibco/Tolco - Fig. 1V

- c. Adjustable Swivel Ring Type:
Service: Bare Metal Pipe - 4 inches and Smaller

Acceptable Products:	Bare Steel Pipe	Bare Copper Pipe
Anvil	Fig. 69	
Cooper/B-Line	Fig. B3170NF	Fig. B3170CTC
Erico	Model FCN	102A0 Series
Nibco/Tolco	Fig. 200	Fig. 203

7. Support may be fabricated from U-channel strut or similar shapes. Piping less than 4" in diameter shall be secured to strut with clamps of proper design and capacity as required to maintain spacing and alignment. Strut shall be independently supported from hanger drops or building structure. Size and support shall be per manufacturer's installation requirements for structural support of piping. Clamps shall not interrupt piping insulation.
- a. Strut used in mechanical spaces or otherwise dry areas shall have ASTM B633 electro-plated zinc finish.
 - b. Strut used in damp areas listed in hanger rods shall have ASTM A123 hot-dip galvanized finish applied after fabrication.

D. Upper (Structural) Attachments:

1. Unless otherwise shown, upper attachments for hanger rods or support struts shall be as follows:

a. Steel Structure Clamps

- 1) C-Type Wide Flange Beam Clamps (for use on top and/or bottom of wide flanges. Not permitted for use with bar-joists):

Acceptable Products:

Anvil	Fig. 92
Cooper/B-Line	Fig. B3033/B3034
Erico	Model 300
Nibco/Tolco	68

- 2) Scissor Type Beam Clamps (For use with bar-joists and wide flange):

Acceptable Products:

Anvil	Fig. 228, 292
Cooper/B-Line	Fig. B3054
Erico	Model 360
Nibco/Tolco	Fig. 329

b. Steel Structure Welding:

- 1) Unless otherwise noted, hangers, clips, and auxiliary support steel may be welded in lieu of bolting, clamping, or riveting to the building structural frame. Take adequate precautions during all welding operations for fire prevention and protecting walls and ceilings from smoke damage.

2.4 OPENINGS IN FLOORS, WALLS AND CEILINGS

- A. Exact locations of all openings for the installation of materials shall be determined by the Contractor and given to the General Contractor for installation or construction as the structure is built.
- B. Coordinate all openings with other Contractors.

- C. Hire the proper tradesman and furnish all labor, material and equipment to cut openings in new structures that were not installed, or additional openings. Repair all spalling and damage to the satisfaction of the Architect/Engineer. Make saw cuts before breaking out concrete to ensure even and uniform opening edges.
- D. Said cutting shall be at the complete expense of each Contractor. Failure to coordinate openings with other Contractors shall not exempt the Contractor from providing openings at his expense.
- E. Do not cut structural members without written approval of the Architect or Structural Engineer.

2.5 ROOF PENETRATIONS

- A. Seal pipes with surface temperature below 150°F penetrating single-ply roofs with conical stepped pipe flashings and stainless steel clamps equal to Portals Plus Pipe Boots. Material shall match roofing membrane.
- B. Break insulation only at the clamp for pipes between 60°F and 150°F. Seal outdoor insulation edges watertight.

2.6 SLEEVES AND LINTELS

- A. Each Contractor shall provide sleeves and lintels for all duct and pipe openings required for the Contractor's work in masonry walls and floors, unless specifically shown as being by others.
- B. Fabricate all lintels for masonry walls from structural steel shapes or as indicated on the drawings. Have all lintels approved by the Architect or Structural Engineer.
- C. Sleeves through the floors on exposed risers shall be flush with the ceiling, with planed squared ends extending 1" above the floor in unfinished areas, and flush with the floor in finished areas, to accept spring closing floor plates.
- D. Sleeves shall not penetrate structural members or masonry walls without approval from the Structural Engineer. Sleeves shall then comply with the Architect/Engineer's design.
- E. Install all sleeves concentric with pipes. Secure sleeves in concrete to wood forms. This Contractor is responsible for sleeves dislodged or moved when pouring concrete.
- F. Size sleeves large enough to allow expansion and contraction movement. Provide continuous insulation wrapping.
- G. Wall Seals ("Link-Seals"):
 - 1. Where shown on the drawings, pipes passing through walls, ceilings, or floors shall have their annular space (sleeve or drilled hole - not tapered hole made with knockout plug) sealed by properly sized sealing elements consisting of a synthetic rubber material compounded to resist aging, ozone, sunlight, water and chemical action.
 - 2. Sleeves, if used, shall be standard weight steel with primed finish and waterstop/anchor continuously welded to sleeve. If piping carries only fluids below 120°F, sleeves may be thermoplastic with integral water seal and textured surface.
 - 3. Sleeves shall be at least 2 pipe sizes larger than the pipes.
 - 4. Pressure shall be maintained by stainless steel bolts and other parts. Pressure plates may be of composite material for Models S and OS.

5. Sealing element shall be as follows:

Model	Service	Element Material	Temperature Range
S	Standard (Stainless)	EPDM	-40°F to 250°F
T	Fire Seals (1 hour)	Silicone	-67°F to 400°F
FS	Fire Seals (3 hours)	Silicone	-67°F to 400°F
OS	Oil Resistant/Stainless	Nitrile	-40°F to 210°F

6. Acceptable Manufacturers: Thunderline Corporation "Link-Seals", O-Z/Gedney Company, Calpico, Inc., Innerlynx, or Metraflex Company (cold service only).

2.7 ESCUTCHEON PLATES AND TRIM

- A. Fit escutcheons to all insulated or uninsulated exposed pipes passing through walls, floors, or ceilings of finished rooms.
- B. Escutcheons shall be heavy gauge, cold rolled steel, copper coated under a chromium plated finish, heavy spring clip, rigid hinge and latch.
- C. Install galvanized steel (unless otherwise indicated) trim strip to cover vacant space and raw construction edges of all rectangular openings in finished rooms. This includes pipe openings.

2.8 PIPE PENETRATIONS

- A. Seal all pipe penetrations. Seal non-rated walls and floor penetrations with grout or caulk. Backing material may be used.
- B. Seal fire rated wall and floor penetrations with fire seal system as specified.

2.9 PIPE ANCHORS

- A. Provide all items needed to allow adequate expansion and contraction of all piping. All piping shall be supported, guided, aligned, and anchored as required.
- B. Repair all piping leaks and associated damage. Pipes shall not rub on any part of the building.

2.10 FINISH

- A. Prime coat exposed steel hangers and supports. Hangers and supports in crawl spaces, pipe shafts, and suspended ceiling spaces are not considered exposed.

3. PART EXECUTION

3.1 HVAC SUPPORTS AND ANCHORS

- A. General Installation Requirements:
 - 1. Install all items per manufacturer's instructions.
 - 2. Coordinate the location and method of support of piping systems with all installations under other Divisions and Sections of the Specifications.
 - 3. Where pipe support members are welded to structural building framing, scrape, brush clean, and apply one coat of zinc rich primer to welding.
 - 4. Supports shall extend directly to building structure. Do not support piping from duct hangers. Do not allow lighting or ceiling supports to be hung from piping supports.

B. Supports Requirements:

1. Install roof pipe supports to resist wind movement per manufacturer's recommendations. Method of securing base to roof shall be compatible with roofing materials.
2. Where building structural steel is fireproofed, all hangers, clamps, auxiliary steel, etc., which attach to it shall be installed prior to application of fireproofing. Repair all fireproofing damaged during pipe installation.
3. Set all concrete inserts in place before pouring concrete.
4. Furnish, install and prime all auxiliary structural steel for support of piping systems that are not shown on the Drawings as being by others.
5. Install hangers and supports complete with lock nuts, clamps, rods, bolts, couplings, swivels, inserts and required accessories.
6. Hangers for horizontal piping shall have adequate means of vertical adjustment for alignment.

C. Pipe Requirements:

1. Support all piping and equipment, including valves, strainers, traps and other specialties and accessories to avoid objectionable or excessive stress, deflection, swaying, sagging or vibration in the piping or building structure during erection, cleaning, testing and normal operation of the systems.
2. Do not, however, restrain piping to cause it to snake or buckle between supports or to prevent proper movement due to expansion and contraction.
3. Support piping at equipment and valves so they can be disconnected and removed without further supporting the piping.
4. Piping shall not introduce strains or distortion to connected equipment.
5. Parallel horizontal pipes may be supported on trapeze hangers made of structural shapes and hanger rods; otherwise, pipes shall be supported with individual hangers.
6. Trapeze hangers may be used where ducts interfere with normal pipe hanging.
7. Provide additional supports where pipe changes direction, adjacent to flanged valves and strainers, at equipment connections and heavy fittings.
8. Provide at least one hanger adjacent to each joint in grooved end steel pipe with mechanical couplings.

D. Provided the installation complies with all loading requirements of truss and joist manufacturers, the following practices are acceptable:

1. Loads of 100 lbs. or less may be attached anywhere along the top or bottom chords of trusses or joists with a minimum 3' spacing between loads.
2. Loads greater than 100 lbs. must be hung concentrically and may be hung from top or bottom chord, provided one of the following conditions is met:
 - a. The hanger is attached within 6" from a web/chord joint.
 - b. Additional L2x2x1/4 web reinforcement is installed per manufacturer's requirements.

3. It is prohibited to cantilever a load using an angle or other structural component that is attached to a truss or joist in such a fashion that a torsional force is applied to that structural member.
 4. If conditions cannot be met, coordinate installation with truss or joist manufacturer and contact Architect/Engineer.
- E. After piping and insulation installation are complete, cut hanger rods back at trapeze supports so they do not extend more than 3/4" below bottom face of lowest fastener and blunt any sharp edges.
- F. Do not exceed 25 lbs. per hanger and a minimum spacing of 2'-0" on center when attaching to metal roof decking (limitation not required with concrete on metal deck). This 25 lbs. load and 2'-0" spacing include adjacent electrical and architectural items hanging from deck. If the hanger restrictions cannot be achieved, supplemental framing off steel framing will need to be added.
- G. Do not exceed the manufacturer's recommended maximum load for any hanger or support.
- H. Spacing of Hangers shall not exceed the compressive strength of the insulation inserts, and in no case shall exceed the following:
1. Hard Drawn Copper & Brass (Liquid Service):

3/4" and under	5'-0"
1"	6'-0"
1-1/4"	7'-0"
1-1/2"	8'-0"
2"	8'-0"
2-1/2"	9'-0"
 2. Hard Drawn Copper & Brass (Vapor Service):

3/4" & under	7'-0"
1"	8'-0"
1-1/4"	9'-0"
1-1/2"	10'-0"
 3. Flexible Plastic Pipe, Flexible Hose, and Soft Copper Tubing:
 - a. Continuous channel with hangers maximum 8'-0" OC.
 4. Rigid Plastic Pipe:
 - a. Hangers shall be spaced based on the piping system manufacturers' instructions or, if no system instructions are available, space hangers at 4'-0" maximum centers.
 5. Installation of hangers shall conform to MSS SP-58, 69, and 89.

END OF SECTION

SECTION 23 05 48

HVAC VIBRATION ISOLATION

1. PART GENERAL

1.1 SECTION INCLUDES

- A. Bases.
- B. Vibration Isolation.
- C. Flexible Connectors.

1.2 SUBMITTALS

- A. Submit shop drawings per Section 23 05 00 and the Vibration Isolation Submittal Form at the end of this section.
- B. Vibration isolation submittals may be included with equipment being isolated, but must comply with this section.
- C. Base submittals shall include equipment served, construction, coatings, weights, and dimensions.
- D. Isolator submittals shall include:
 - 1. Equipment served
 - 2. Type of Isolator
 - 3. Load in Pounds per Isolator
 - 4. Recommended Maximum Load for Isolator
 - 5. Spring Constants of Isolators (for Spring Isolators)
 - 6. Load vs. Deflection Curves (for Neoprene Isolators)
 - 7. Specified Deflection
 - 8. Deflection to Solid (at least 150% of calculated deflection)
 - 9. Loaded (Operating) Deflection
 - 10. Free Height
 - 11. Loaded Height
 - 12. Kx/Ky (horizontal to vertical stiffness ratio – for spring isolators)
 - 13. Materials and Coatings
 - 14. Spring Diameters
- E. Flexible connector shop drawings shall include overall face-to-face length and all specified properties.
- F. Submit certification that equipment, accessories, and components will withstand seismic forces defined in Section 23 05 50. Include the following:
 - 1. Basis for Certification: Indicate whether certification is based on actual test of assembled components or on calculation.
 - a. The term "withstand" means "the unit will remain in place without separation of any parts from the device when subjected to the seismic forces specified."
 - 2. Dimensioned Outline Drawings of Equipment Unit: Identify center of gravity and locate and describe mounting and anchorage provisions.
 - 3. Detailed description of equipment anchorage devices on which the certification is based and their installation requirements.
- G. Manufacturer shall provide special seismic certification per OSHPD CAN 2-1708a.5 with submittal. Submittals without certification will be returned and not reviewed.

- H. Seismic restraint calculations or OSHPD pre-approved seismic restraint tables (ISAT or equal) OSHPD series OPM pre-approval.

2. PART PRODUCTS

2.1 BASIC CONSTRUCTION AND REQUIREMENT

- A. Vibration isolation for this project is subject to seismic restraint requirements of Section 23 05 50.
- B. Vibration isolators shall have either known undeflected heights or other markings so deflection under load can be verified.
- C. All isolators shall operate in the linear portion of their load versus deflection curve. The linear portion of the deflection curve of all spring isolators shall extend 50% beyond the calculated operating deflection [e.g., 3" for 2" calculated deflection]. The point of 50% additional deflection shall not exceed the recommended load rating of the isolator.
- D. The lateral to vertical stiffness ratio (K_x/K_y) of spring isolators shall be between 0.8 and 2.0.
- E. All neoprene shall have UV resistance sufficient for 20 years of outdoor service.
- F. All isolators shall be designed or treated for corrosion resistance. Steel bases shall be cleaned of welding slag and primed for interior use, and hot dip galvanized after fabrication for exterior use. All bolts and washers over 3/8" diameter located outdoors shall be hot dip galvanized per ASTM A153. All other bolts, nuts and washers shall be zinc electroplated. All ferrous portions of isolators, other than springs, for exterior use shall be hot dip galvanized after fabrication. Outdoor springs shall be neoprene dipped or hot dip galvanized. All damage to coatings shall be field repaired with two coats of zinc rich coating.
- G. Equip all mountings used with structural steel bases with height-saving brackets. Bottoms of the brackets shall be 1-1/2" to 2-1/2" above the floor or housekeeping pad, unless shown otherwise on the drawings. Steel bases shall have at least four points of support.
- H. Provide motor slide rails for belt-driven equipment per Section 23 05 13.
- I. All isolators, except M1, shall have provision for leveling.
- J. Construction criteria and standards of seismic restraint design for suspended pipes, ducts and mechanical equipment shall be per the International Seismic Application Technology (ISAT) OSHPD OPM #0485. (877)999-ISAT or Mason.

2.2 MOUNTINGS

- A. Type M4:
 - 1. Use restrained spring mountings for equipment with operating weight different from the installed weight such as chillers and boilers, and equipment exposed to the wind such as cooling towers.
 - 2. Spring isolators shall be free-standing with 1/4" neoprene acoustical friction pads.
 - 3. All units shall have bolt holes and be bolted down. Prevent short circuiting with neoprene bushings and washers between bolts and isolators.
 - 4. All mountings shall have leveling bolts.
 - 5. Housings with vertical resilient limit stops shall prevent spring extension when weight is removed. Housings shall serve as blocking during erection and the installed and operating heights shall be the same.

6. Maintain a minimum clearance of 1/2" around restraining bolts and between the housings and the springs so as not to interfere with the spring action.
7. Limit stops shall be out of contact during normal operation.
8. Select isolators for equipment subjected to wind loads in conformance with ASCE 7-02.
9. Acceptable Manufacturers: Mason "SLRS", Kinetics "FLS", Aeroflex "AWRS", Vibration Eliminator Co. "KW".

2.3 HANGERS

A. Type H1:

1. Vibration hangers shall consist of a double-deflection neoprene element with a projecting bushing or oversized opening to prevent steel-to-steel contact.
2. Static deflection shall be at least 0.15" at calculated load and 0.35" at maximum rated load.
3. Provide hangers with end connections as required for hanging ductwork or piping.
4. Acceptable Manufacturers: Mason "HD" or "WHD", Kinetics "RH", Aeroflex "RHD", Vibration Eliminator Co. "ALH".

B. Type H2:

1. Vibration hangers shall contain a steel spring in a neoprene cup with a grommet to prevent short circuiting the hanger rod.
2. The cup shall have a steel washer to distribute load on the neoprene and prevent its extrusion.
3. Spring diameters and hanger box lower hole sizes shall be large enough to permit the hanger rod to swing through a 30° arc before contacting the grommet and short circuiting the spring.
4. Provide end connections for hanging ductwork or piping.
5. Acceptable Manufacturers: Mason "30" or "W30", Kinetics "SRH", Amber/Booth "BSRA", Aeroflex "RSH", Vibration Eliminator Co. "SNC".

2.4 VIBRATION ISOLATION CURBS

A. Spring Isolated Curbs:

1. Provide factory fabricated vibration isolated curb consisting of an upper floating section resting on a rigid rectangular steel tube structure containing adjustable steel vibration isolation springs.
2. The top of the curb shall be a minimum of 4'-0" above the roof surface.
3. Vibration Isolation:
 - a. Isolators shall consist of free standing, unhoused laterally stable steel springs.
 - b. Springs shall be zinc electroplated.
 - c. Springs shall rest on a minimum of 1/4" neoprene pad.

- d. Springs shall provide a minimum of 1-1/2" (unless otherwise noted on plans.) deflection calculated based on final assembled loads.
- 4. Provide continuous wood nailing strip and counter flashing along entire perimeter of the curb.
- 5. Provide continuous air and water seal, such as an EPDM bellows, around the entire curb.
- 6. Curb assembly shall withstand 125#/sf lateral wind loading against the supported equipment.
- 7. The curb shall be designed with lateral restraint to meet seismic requirements specified in Section 23 05 50.
- 8. Coordinate internal structural cross framing with ductwork and piping routed in the curb.
- 9. Acceptable Manufacturers: MicroMetl, CanFab, and M.W. Sausse Vibrex.

3. PART EXECUTION

3.1 GENERAL INSTALLATION

- A. Install all products per manufacturer's recommendations.
- B. Provide vibration isolation as indicated on the drawings and as described herein.
- C. Clean the surface below all mountings that are not bolted down and apply adhesive cement equal to Mason Type WG between mounting and floor. If movement occurs, bolt mountings down. Isolate bolts from baseplates with neoprene washers and bushings.
- D. All static deflections listed in the drawings and specifications are the minimum acceptable actual deflection of the isolator under the weight of the installed equipment - not the maximum rated deflection of the isolator.
- E. Support equipment to be mounted on structural steel frames with isolators under the frames or under brackets welded to the frames. Where frames are not needed, fasten isolators directly to the equipment.
- F. Where a specific quantity of hangers is noted in these specifications, it shall mean hanger pairs for support points that require multiple hangers, such as rectangular ducts or pipes supported on a strut rack.

END OF SECTION

SECTION 23 05 50

SEISMIC REQUIREMENTS FOR EQUIPMENT AND SUPPORTS

1. PART GENERAL

1.1 SECTION INCLUDES

- A. Seismic Requirements.

1.2 QUALITY ASSURANCE

A. General:

1. Items used for seismic restraint of equipment and systems shall be specifically manufactured for seismic restraint.
2. These requirements are beyond those listed in Section 23 05 29 of these specifications. Where a conflict arises between the seismic requirements of this section and any other section, the Architect/Engineer shall be immediately notified for direction to proceed.

B. Manufacturer:

1. System Supports/Restraints: Company specializing in the manufacture of products specified in this Section.
2. Equipment: Each company providing equipment that must meet seismic requirements shall provide certification included in project submittals the equipment supplied for the project meets or exceeds the seismic requirements of the project.

- C. Testing Agency: An independent testing agency, acceptable to Authorities Having Jurisdiction, with experience and capability to conduct the testing indicated.

- D. Installer: Company specializing in performing the work of this Section.

- E. Suppliers: Following is a partial list of manufacturer/supplier contact information for seismic restraints:

1. B-Line Systems, Inc. (800) 851-7415, www.b-line.com.
2. Unistrut Corporation <http://www.unistrut.us/>
3. Kinetics Noise Control (877) 457-2695, www.kineticsnoise.com.
4. Mason Industries, Inc. www.mason-ind.com.
5. Loos & Co., Inc. (800) 321-5667, www.loosnaples.com.
6. Tolco (909) 737-5599, www.tolco.com
7. ISAT 877.523.6060, www.isatsb.com
8. Vibro-Acoustics (416) 291-7371, <https://virs.vibro-acoustics.com/>

1.3 SUBMITTALS

- A. Submit under provisions of Section 23 05 00.

B. Shop Drawings:

1. Coordination Drawings: Plans and sections drawn to scale, coordinating seismic bracing of mechanical components with other systems and equipment in the vicinity, including other seismic restraints.

2. Manufacturer's Certifications: Professional Structural Engineer licensed in the state where the project is located shall review and approve manufacturer's certifications of compliance.
3. System Supports/Restraints - Submit for each condition requiring seismic bracing:
 - a. Calculations for each seismic brace and detail utilized on the project.
 - b. Plan drawings showing locations and types of seismic braces on contractor fabrication/installation drawings.
 - c. Cross-reference between details and plan drawings to indicate exactly which brace is being installed at each location. Details provided are to clearly indicate attachments to structure, correctly representing the fastening requirements of bracing.
 - d. Clear indication of brace design forces and maximum potential component forces at attachment points to building structure for confirmation of acceptability by the Structural Engineer of Record.
4. Equipment - Submit for each piece of equipment supplied:
 - a. Certification that the equipment supplied for the project meets or exceeds the seismic requirements specified.
 - b. Specific details of seismic design features of equipment and maximum seismic loads imparted to the structural support.
- C. A seismic restraint designer shall be provided whether or not exceptions listed in the applicable building code are met. If seismic restraints are not provided for a system that requires seismic bracing, the seismic designer shall submit a signed and sealed letter to the Architect/Engineer and Authorities Having Jurisdiction stating the exceptions, along with code reference, utilized for each item. Seismic designer shall review system installation for general conformance to the exception requirements stated in the code and document, in writing, the system has been installed in accordance to the exception.

1.4 TESTING AND INSPECTION

- A. Special Inspection and Testing shall be done in accordance with Chapter 17 of the State of California Building Code.
- B. The District shall employ a Special Inspection Agency to perform the duties and responsibilities specified in Section 1704 and 1705.
- C. Work performed on the premises of a fabricator approved by the building official need not be tested and inspected. The fabricator shall submit a certificate of compliance that the work has been performed in accordance with the approved plans and specifications to the building official and the Architect and Engineer of Record.
- D. The Special Inspection Agency shall furnish inspection reports to the building official, the Owner, the Architect, the Engineer of Record, and the General Contractor. The reports shall be completed and furnished within 48 hours of inspected work. A final signed report stating whether the work requiring special inspection was, to the best of the Special Inspection Agency's knowledge, in conformance with the approved plans and specifications shall be submitted.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Deliver, store, protect and handle products to site. Accept material on site in factory containers and packing. Inspect for damage. Protect from damage and contamination by maintaining factory packaging until installation. Follow manufacturer's instructions for storage.

1.6 DESIGN REQUIREMENTS

- A. The following criteria are applicable to this project:
 - 1. Risk Category: III
 - 2. Seismic Factor: $I_E = 1.25$
 - 3. Seismic Design Category: E
 - 4. Component Amplification Factors (a_p) and Component Response Modification Factors (R_p) shall be taken from Table 13.5-1 in ASCE 7-10 for the individual equipment or system being restrained.
 - 5. Component Importance Factors (I_p) shall be taken from Section 1.3 in ASCE 7-10 for the individual equipment or system being restrained.
 - 6. The total height of the structure and the height of the system to be restrained within the structure shall be determined in coordination with architectural plans and the General Contractor.
- B. Forces shall be calculated with the above requirements and Equation 13.1.413.3-1, -2, and -3 of ASCE 7-10, unless exempted by 13.1.4.
- C. Equipment shall meet California Building Code and ASCE 7 seismic qualification requirements in concurrence with ICC ES AC156 Acceptance Criteria for Seismic Qualification by Shake-Table Testing of Nonstructural Components and Systems.

1.7 COORDINATION

- A. Coordinate layout and installation of seismic bracing with building structural systems and architectural features, and with mechanical, fire-protection, electrical and other building features in the vicinity.
- B. Coordinate concrete bases with building structural system.

1.8 WARRANTY

- A. Provide one-year warranty on parts and labor for manufacturer defects and installation workmanship.

2. PART PRODUCTS

2.1 SEISMIC DESIGN CRITERIA

- A. This section describes the requirements for seismic restraint of systems and equipment related to continued operation of the facility after a design seismic event.
- B. Definitions
 - 1. Stay in Place:
 - a. All systems and equipment shall be anchored and restrained such that the anchoring system is intended not to fail and equipment and/or system components will not fall.

2.2 SEISMIC BRACING AND SUPPORT OF SYSTEMS AND COMPONENTS

A. General:

1. Seismic restraint designer shall coordinate all attachments with the Structural Engineer of Record; refer to submittal requirements.
2. The seismic restraint design shall be based on actual equipment data obtained from manufacturer's submittals or the manufacturer. The equipment manufacturer shall verify and provide written certification the attachment points on the equipment can accept the combination of seismic, weight, and other imposed loads.
3. Design analysis shall include calculated dead loads, static seismic loads, and capacity of materials utilized for the connection of the equipment or system to the structure.
4. Analysis shall detail anchoring methods, bolt diameter, embedment, and weld length.
5. All seismic restraint devices shall be designed to accept without failure the forces calculated per the applicable building code.
6. All seismic restraints and combination isolator/restraints shall have verification of their seismic capabilities witnessed by an independent testing agency.

B. Friction from gravity loads shall not be considered resistance to seismic forces.

C. Housekeeping Pads:

1. Reinforced housekeeping pads shall be provided to handle shear, tension, and compression forces with proper reinforcement, doweling, and attachments connecting the pad to the structural slab.

2.3 SEISMIC RESTRAINT AND CONSTRUCTION OF EQUIPMENT

A. Equipment supplied for the project shall be designed to meet the requirements of lateral forces calculated using the applicable code and method described above.

2.4 MATERIALS

A. Use the following materials for restraints:

1. Indoor Dry Locations: Steel, zinc plated.
2. Outdoors and Damp Locations: Galvanized steel.
3. Corrosive Locations: Stainless steel.

2.5 ANCHORAGE AND STRUCTURAL ATTACHMENT COMPONENTS

A. Strength: Defined in reports by ICC Evaluation Service or another agency acceptable to authorities having jurisdiction.

1. Structural Safety Factor: Strength in tension and shear of components used shall be at least two times the maximum seismic forces to which they will be subjected.

B. Concrete and Masonry Anchor Bolts and Studs: Steel-expansion wedge type. Comply with CBC, ACI and ICC ES requirements for cracked concrete anchors.

C. Concrete Inserts: Steel-channel type.

D. Through Bolts: Structural type, hex head, high strength. Comply with ASTM F3125, Grade A 325.

E. Welding Lugs: Comply with MSS SP-69, Type 57.

- F. Beam Clamps for Steel Beams and Joists: Double sided. Single-sided type is not acceptable.
- G. Bushings for Floor-Mounted Equipment Anchors: Neoprene units designed for seismically rated rigid equipment mountings, and matched to the type and size of anchor bolts and studs used.
- H. Bushing Assemblies for Wall-Mounted Equipment Anchorage: Assemblies of neoprene elements and steel sleeves designed for seismically rated rigid equipment mountings, and matched to the type and size of attachment devices used.

2.6 SEISMIC BRACING COMPONENTS

- A. Slotted Steel Channel: 1-5/8-by-1-5/8-inch cross section, formed from 0.1046-inch-thick steel, with 9/16-by-7/8-inch slots at a maximum of 2 inches o.c. in webs, and flange edges turned toward web.
 - 1. Materials for Channel: ASTM A 1011, GR 33.
 - 2. Materials for Fittings and Accessories: ASTM A 635, ASTM A 576, or ASTM A 36.
 - 3. Fittings and Accessories: Products of the same manufacturer as channels and designed for use with that product.
 - 4. Finish: Baked, rust-inhibiting, acrylic-enamel paint applied after cleaning and phosphate treatment, unless otherwise indicated.

3. PART EXECUTION

3.1 INSTALLATION

- A. Refer to the applicable code sections and Authority Having Jurisdiction for the exact seismic restraint requirements of piping, ductwork, conduit, equipment, etc.
- B. Layout of transverse and longitudinal bracing shall follow recommendations of approved design standards listed in Part 1 of this specification section.
- C. All seismic restraint systems shall be installed in strict accordance with the manufacturer's written instructions and all certified submittal data.
- D. Installation of seismic restraints shall not cause any change in position of equipment, piping, or ductwork, resulting in stresses or misalignment.
- E. No rigid connections between equipment and the building structure shall be made that degrade the noise and vibration-isolation system specified.
- F. Do not install any equipment, piping, duct, or conduit that makes rigid connections with the building unless isolation is not specified.
- G. Coordinate work with all other trades to avoid rigid contact with the building. Any conflicts with other trades that will result in rigid contact with equipment or piping due to inadequate space or other unforeseen conditions shall be brought to the Architect/Engineer's attention prior to specific equipment selection.
- H. Prior to installation, bring to the Architect/Engineer's attention any discrepancies between the specifications and the field conditions, or changes required due to specific equipment selection.
- I. Bracing may occur from flanges of structural beams, upper truss cords of bar joists, cast in place inserts, or International Code Council approved seismic anchors for installation in concrete.
- J. Cable restraints shall be installed slightly slack to avoid short-circuiting the isolated suspended equipment, ductwork, piping, or conduit.

- K. Cable assemblies shall be installed taut on non-isolated systems. Solid braces may be used in place of cables on rigidly attached systems only.
- L. Do not install cables over sharp corners.
- M. Brace support rods when necessary to accept compressive loads. Welding of compression braces to the vertical support rods is not acceptable.
- N. Provide reinforced clevis bolts when required.
- O. The vibration isolation manufacturer shall furnish integral structural steel bases as required. Independent steel rails are not acceptable.
- P. Post-Installed anchors shall be provided to meet seismic requirements.
- Q. Seismic restraints shall be mechanically attached to the system. Looping restraints around the system is not acceptable.
- R. Independently brace duct mounted equipment (terminal units, in-line fans, etc.) and the associated suspended ductwork.
- S. Do not brace a system to two different structures such as a wall and a ceiling.
- T. Provide appropriately sized openings in walls, floors, and ceilings for anticipated seismic movement. Provide fire seal systems in fire-rated walls.
- U. Positively attach all roof mounted equipment to roof curbs. Positively attach all roof curbs to building structure.
- V. Exposed seismic supports in occupied areas shall be guarded or covered to protect occupants.
- W. Coordinate seismic bracing of architecturally exposed ductwork with the Architect/Engineer.

3.2 SEISMIC RESTRAINT EXCLUSIONS

- A. Refer to the applicable code sections and Authority Having Jurisdiction for allowable exclusions.

END OF SECTION

SECTION 23 05 53

HVAC IDENTIFICATION

1. PART GENERAL

1.1 SECTION INCLUDES

- A. Identification of products installed under Division 23.

2. PART PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

- A. 3M, Bunting, Calpico, Craftmark, Emedco, Kolbi Industries, Seton, W.H. Brady, Marking Services.

2.2 MATERIALS

- A. Plastic Nameplates: Laminated three-layer phenolic with engraved black, 1/4" minimum letters on light contrasting background.
- B. Aluminum Nameplates: Black enamel background with natural aluminum border and engraved letters furnished with two mounting holes and screws.
- C. Plastic Tags: Minimum 1-1/2" square or round laminated three-layer phenolic with engraved, 1/4" minimum black letters on light contrasting background.
- D. Ductwork Markers:
 - 1. Ductwork systems containing hazardous materials shall be provided with minimum 2"x4" ANSI Z535.2 biohazard warning labels with custom labeling describing hazard. Refer to table in Part 3 for system and label description.
 - 2. Vinyl Markers: Colored vinyl with permanent pressure sensitive adhesive backing suitable for indoor and outdoor application.
- E. Maintenance Access Doors:
 - 1. Doors and roof hatches used to access equipment serving hazardous ductwork systems shall be provided with a minimum 4"x6" ANSI Z535.2 biohazard warning label. Label shall read "WARNING – BIOHAZARD. ONLY AUTHORIZED PERSONNEL BEYOND THIS POINT".
 - 2. Coordinate location of warning label with Owner.

3. PART EXECUTION

3.1 INSTALLATION

- A. Install all products per manufacturer's recommendations.
- B. Degrease and clean surfaces to receive adhesive for identification materials.

C. Ductwork Markers:

1. Apply ductwork markers on ductwork systems containing hazardous materials in the following locations where clearly visible:
 - a. On both sides of walls that ducts penetrate.
 - b. At least every 20 feet along all ducts.
 - c. On each riser and each leg of each branch connection.
 - d. At least once in every room and each story traversed.
 - e. At all ductwork access doors.
 - f. At all fans and equipment serving ductwork system. Markers shall be clearly visible from the normal maintenance access path to the equipment. Coordinate placement location with Owner.

D. Equipment:

1. All equipment not easily identifiable such as controls, relays, gauges, etc.; and all equipment in an area remote from its function such as air handling units, exhaust fans, filters, dampers, etc.; shall have nameplates or plastic tags listing name, function, and drawing symbol. Do not label exposed equipment in public areas.
2. Fasten nameplates or plastic tags with stainless steel self-tapping screws or permanently bonding cement.
3. Mechanical equipment that is not covered by the U.S. National Appliance Energy Conservation Act (NAECA) of 1987 shall carry a permanent label installed by the manufacturer stating that the equipment complies with the requirements of ASHRAE 90.1.

E. Miscellaneous:

1. Attach self-adhesive vinyl labels at all duct access doors used to reset fusible links or actuators on fire, fire/smoke, or smoke dampers. Lettering shall be a minimum of 1/2" high. Labels shall indicate damper type.

3.2 SCHEDULE

- A. Ductwork and Fan Systems: All fans, filters housings, and access doors shall be labeled with the text as shown in the following table:

Ductwork Label and System	Lettering Color	Background Color
WARNING – CHEMICAL FUME EXHAUST	Black	Orange/White

END OF SECTION

SECTION 23 05 93

TESTING, ADJUSTING, AND BALANCING

1. PART GENERAL

1.1 SECTION INCLUDES

- A. Testing, adjusting, and balancing of air systems.
- B. Measurement of final operating condition of HVAC systems.

1.2 QUALITY ASSURANCE

- A. Agency shall be a company specializing in the adjusting and balancing of systems specified in this section with minimum three years' experience. Perform work under supervision of AABC Certified Test and Balance Engineer, NEBB Certified Testing, Balancing and Adjusting Supervisor.
- B. Work shall be performed in accordance with the requirements of the references listed at the start of this section.

1.3 REFERENCES

- A. AABC - National Standards for Total System Balance, 2002.
- B. ADC – Test Code for Grilles, Registers, and Diffusers.
- C. AMCA – Publication 203-90; Field Performance Measurement of Fan Systems.
- D. ASHRAE - 2003 HVAC Applications Handbook; Chapter 37, Testing, Adjusting and Balancing.
- E. ASHRAE/ANSI - Standard 111-1988; Practices for Measurement, Testing, Adjusting and Balancing of Building HVAC&R Systems.
- F. NEBB - Procedural Standards for Testing, Adjusting and Balancing of Environmental Systems, Sixth Edition, 1998.
- G. SMACNA - HVAC Systems; Testing, Adjusting and Balancing, Third Edition, 2002.

1.4 SUBMITTALS

- A. Submit copies of report forms, balancing procedures, and the name and qualifications of testing and balancing agency for approval within 30 days after award of Contract.
- B. Electronic Copies:
 - 1. Submit a certified copy of test reports to the Architect/Engineer for approval. Electronic copies shall be in PDF format only. Scanned copies, in PDF format, of paper originals are acceptable. Copies that are not legible will be returned to the Contractor for resubmittal. Do not set any permission restrictions on files; protected, locked, or secured documents will be rejected.
 - 2. Electronic file size shall be limited to a maximum of 10MB. Larger files shall be divided into files that are clearly labeled as "1 of 2", "2 of 2", etc.
 - 3. All text shall be searchable.
 - 4. Bookmarks shall be used. All bookmark titles shall be an active link to the index page and index tabs.

1.5 REPORT FORMS

- A. Submit reports on AABC or NEBB forms. Use custom forms approved by the Architect/Engineer when needed to supply specified information.

- B. Include in the final report a schematic drawing showing each system component, including balancing devices, for each system. Each drawing shall be included with the test reports required for that system. The schematic drawings shall identify all testing points and cross-reference these points to the report forms and procedures.
- C. Refer to PART 4 for required reports.

1.6 WARRANTY/GUARANTEE

- A. The TAB Contractor shall include an extended warranty of 90 days after owner receipt of a completed balancing report, during which time the Owner may request a recheck of terminals, or resetting of any outlet, coil, or device listed in the test report. This warranty shall provide a minimum of 24 manhours of onsite service time. If it is determined that the new test results are not within the design criteria, the balancer shall rebalance the system according to design criteria.
- B. Warranty/Guarantee must meet one of the following programs: AABC National Project Performance Guarantee, NEBB's Conformance Certification.

1.7 SCHEDULING

- A. Coordinate schedule with other trades. Provide a minimum of seven days' notice to all trades and the Architect/Engineer prior to performing each test.

2. PART PRODUCTS

NOT APPLICABLE

3. PART EXECUTION

3.1 GENERAL REQUIREMENTS

- A. All procedures must conform to a published standard listed in the References article of this section. All equipment shall be adjusted in accordance with the manufacturer's recommendations. Any system not listed in this specification but installed under the contract documents shall be balanced using a procedure from a published standard listed in the References article.
- B. The Balancing Contractor shall incorporate all pertinent documented construction changes (e.g. submittals/shop drawings, change orders, RFIs, ASIs, etc.) and include in the balancing report.
- C. Recorded data shall represent actual measured or observed conditions.
- D. Cut insulation, ducts, pipes, and equipment cabinets for installation of test probes to the minimum extent necessary to allow adequate performance of procedures. After testing and balancing is complete, close probe holes and patch insulation with new materials as specified. Restore vapor barrier and finish as specified.
- E. Permanently mark setting of valves, dampers, and other adjustment devices allowing for settings to be restored. Set and lock memory stops.
- F. Leave systems in proper working order, replacing belt guards, closing access doors, closing doors to electrical switch boxes, plugging test holes, and restoring thermostats to specified settings.
- G. Installations with systems consisting of multiple components shall be balanced with all system components operating.

3.2 EXAMINATION

- A. Before beginning work, verify that systems are complete and operable. Ensure the following:
 - 1. General Equipment Requirements:
 - a. Equipment is safe to operate and in normal condition.
 - b. Equipment with moving parts is properly lubricated.
 - c. Temperature control systems are complete and operable.
 - d. Proper thermal overload protection is in place for electrical equipment.
 - e. Direction of rotation of all fans and pumps is correct.
 - f. Access doors are closed and end caps are in place.
 - 2. Duct System Requirements:
 - a. All filters are clean and in place. If required, install temporary media.
 - b. Duct systems are clean and free of debris.
 - c. Fire/smoke and manual volume dampers are in place, functional and open.
 - d. Air outlets are installed and connected.
 - e. Duct system leakage has been minimized.
- B. Report any defects or deficiencies to Architect/Engineer.
- C. Promptly report items that are abnormal or prevent proper balancing.
- D. If, for design reasons, system cannot be properly balanced, report as soon as observed.
- E. Beginning of work means acceptance of existing conditions.

3.3 PREPARATION

- A. Provide instruments required for testing, adjusting, and balancing operations. Make instruments available to the Architect/Engineer for spot checks during testing.
- B. Instruments shall be calibrated within six months of testing performed for project, or more recently if recommended by the instrument manufacturer.

3.4 INSTALLATION TOLERANCES

- A. $\pm 10\%$ of scheduled values:
 - 1. Adjust air inlets and outlets to $\pm 10\%$ of scheduled values.
- B. $\pm 5\%$ of scheduled values:
 - 1. Adjust fume exhaust systems to $\pm 5\%$ of scheduled values.
 - 2. Adjust supply and exhaust air-handling systems for space pressurization to $\pm 5\%$ of scheduled values, and to provide proper pressurization.
- C. $+ 5\%$ of scheduled values
 - 1. Adjust outdoor air intakes to within $+ 5\%$ of scheduled values.
- D. Adjust supply, return, and exhaust air-handling systems to $+10\%$ / -5% of scheduled values.

3.5 ADJUSTING

- A. After adjustment, take measurements to verify balance has not been disrupted or that disruption has been rectified.

- B. Once balancing of systems is complete, at least one damper or valve must be 100% open.
- C. After testing, adjusting and balancing are complete, operate each system and randomly check measurements to verify system is operating as reported in the report. Document any discrepancies.
- D. Contractor responsible for each motor shall also be responsible for replacement sheaves. Coordinate with contractor.

3.6 SUBMISSION OF REPORTS

- A. Fill in test results on appropriate forms.

4. PART SYSTEMS TO BE TESTED, ADJUSTED AND BALANCED

4.1 GENERAL REQUIREMENTS

A. Title Page:

1. Project name.
2. Project location.
3. Project Architect.
4. Project Engineer (IMEG Corp.).
5. Project General Contractor.
6. TAB Company name, address, phone number.
7. TAB Supervisor's name and certification number.
8. TAB Supervisor's signature and date.
9. Report date.

B. Report Index

C. General Information:

1. Test conditions.
2. Nomenclature used throughout report.
3. Notable system characteristics/discrepancies from design.
4. Test standards followed.
5. Any deficiencies noted.
6. Quality assurance statement.

D. Instrument List:

1. Instrument.
2. Manufacturer, model, and serial number.
3. Range.
4. Calibration date.

4.2 AIR SYSTEMS

A. Air Moving Equipment:

1. General Requirements:
 - a. Drawing symbol.
 - b. Location.
 - c. Manufacturer, model, arrangement, class, discharge.
 - d. Fan RPM.
 - e. Multiple RPM fan curve with operating point marked. (Obtain from equipment supplier).
 - f. Final frequency of motor at maximum flow rate (on fans driven by VFD).

2. Flow Rate:
 - a. Supply flow rate (cfm): specified and actual.
 - b. Return flow rate (cfm): specified and actual.
 - c. Outside flow rate (cfm): specified and actual.
 - d. Exhaust flow rate (cfm): specified and actual.
 3. Pressure Drop and Pressure:
 - a. Filter pressure drop: specified and actual.
 - b. Total static pressure: specified and actual. (Indicate if across fan or external to unit).
 - c. Inlet pressure.
 - d. Discharge pressure.
- B. Fan Data:
1. Drawing symbol.
 2. Location.
 3. Manufacturer and model.
 4. Flow rate (cfm): specified and actual.
 5. Total static pressure: specified and actual. (Indicate measurement locations).
 6. Inlet pressure.
 7. Discharge pressure.
 8. Fan RPM.
- C. Electric Motors:
1. Drawing symbol of equipment served.
 2. Manufacturer, Model, Frame.
 3. Nameplate: HP, phase, service factor, RPM, operating amps, efficiency.
 4. Measured: Amps in each phase.
- D. Duct Traverse:
1. System zone/branch/location.
 2. Duct size.
 3. Free area.
 4. Velocity: specified and actual.
 5. Flow rate (cfm): specified and actual.
 6. Duct static pressure.
 7. Air temperature.
 8. Air correction factor.
- E. Air Terminal (Inlet or Outlet):
1. Drawing symbol.
 2. Room number/location.
 3. Terminal type and size.
 4. Velocity: specified and actual.
 5. Flow rate (cfm): specified and actual.
 6. Percent of design flow rate.
- F. Fume Hood:
1. Drawing symbol.
 2. Location.
 3. Manufacturer and Model.
 4. Total flow rate (cfm): specified and actual.
 5. Test velocities.
 6. Hood opening dimensions.

G. Fire, Smoke, and Fire/Smoke Dampers:

1. Damper ID #.
2. System identification.
3. Type.
4. Size.
5. UL assembly number.
6. Location of damper and access door.
7. Fusible link temperature rating.
8. Manufacturer and model.
9. Operation pass/fail/reset.

END OF SECTION

SECTION 23 07 13

DUCTWORK INSULATION

1. PART GENERAL

1.1 SECTION INCLUDES

- A. Ductwork Insulation.
- B. Insulation Jackets.

1.2 QUALITY ASSURANCE

- A. Applicator: Company specializing in ductwork insulation application with five years minimum experience. When requested, installer shall submit manufacturer's certificate indicating qualifications.
- B. Materials: UL listed in Category HNKT; flame spread/smoke developed rating of 25/50 in accordance with ASTM E84, NFPA 255, or UL 723.
- C. Adhesives: UL listed, meeting NFPA 90A/90B requirements.

2. PART PRODUCTS

2.1 MATERIALS

- A. Type A: Flexible Fiberglass - Outside Wrap; ANSI/ASTM C553; commercial grade; 0.28 / 0.26 (Out-Of-Package/Installed-Compressed 25%) maximum 'K' value at 75°F; foil scrim Kraft facing, 1.0 lb./cu. ft. density.
- B. Submit both "Out of Package" and "Installed-Compressed 25%" K and R-values.
- C. Type C: Flexible Fiberglass Liner; ANSI/ASTM C1071; 0.28 maximum 'K' value at 75°F; 1.5 lb/cu ft minimum density; coated air side for 4000 fpm air velocity.
- D. Type F: Flexible High Temperature Wrap; ASTM E2336 rating as 2-hour separation with zero clearance to combustible materials over the full length. Material to be totally scrim encapsulated. Material to be a minimum 1-1/2" thick with a minimum core density of 6 pcf. Wrap system should offer zero clearance to combustibles per ASTM E2336 at all locations, comply with all applicable codes, and be approved by AHJ. If system is not rated for zero clearance per ASTM E2336 at all locations with single layer, a two-layer system shall be provided with zero clearance per ASTM E2336 at all locations. Material must be tested and listed for installation on grease ducts and installed per listed design. Refer to Section 23 33 00 for prefabricated, pre-insulated access doors required for grease duct systems.
- E. Type G: Preformed rigid fiberglass acoustical liner. ANSI/ASTM C1071; 0.23 maximum 'K' value at 75°F mean temperature; Noise Reduction Coefficient (NRC) per ASTM C423 Type "A" mounting of 0.70 for 1" thickness, 0.90 for 1.5" thickness. Liner shall be factory coated with an anti-microbial agent to prevent fungus and bacteria growth per ASTM G-21 and G-22. Max flame spread/smoke developed rating of 25/50 in accordance with ASTM E84, NFPA 255, or UL 723.

2.2 JACKETS

- A. Vapor Barrier Jackets: Kraft reinforced foil scrim vapor barrier with self-sealing adhesive joints. Beach puncture resistance ratio of at least 25 units. Tensile strength: 35 psi minimum. Single, self-seal acrylic adhesive on longitudinal jacket laps and butt strips.

2.3 JACKET COVERINGS

- A. Aluminum Jackets: ASTM B209; 0.016" thick; smooth or embossed stucco finish with Z edge seams and aluminum bands for outdoor use. Where colored jacket covers are called for, provide factory-applied hard film acrylic paint in color selected by Architect.

3. PART EXECUTION

3.1 INSTALLATION

- A. Install materials in accordance with manufacturer's instructions, codes, and industry standards.
- B. Install materials after ductwork has been tested.
- C. Clean surfaces for adhesives.
- D. Provide insulation with vapor barrier when air conveyed may be below ambient temperature.
- E. Exterior Duct Wrap - Flexible, Type A:
 - 1. Apply with edges tightly butted.
 - 2. Cut slightly longer than perimeter of duct to insure full thickness at corners. Do not wrap excessively tight.
 - 3. Seal joints with adhesive backed tape.
 - 4. Apply so insulation conforms uniformly and firmly to duct.
 - 5. Provide high-density insulation inserts at trapeze duct hangers and straps to prevent crushing of insulation. Maintain continuous vapor barrier through the hanger.
 - 6. Seal all penetrations of the vapor barrier by strap hangers or slip cable hangers with adhesive backed tape.
 - 7. Tape all joints with Royal Tapes #RT 350 (216-439-7229), Venture Tape 1525CW, or Compac Type FSK. No substitutions will be accepted without written permission from the Architect/Engineer.
 - 8. Press tape tightly to the duct covering with a squeegee for a tight continuous seal. Fish mouths and loose tape edges are not acceptable.
 - 9. Staples may be used, but must be covered with tape.
 - 10. Vapor barrier must be continuous.
 - 11. Mechanically fasten on 12" centers at bottom of ducts over 24" wide and on all sides of vertical ducts.
- F. Interior Insulation - Flexible Duct Liner, Type C:
 - 1. Observation of Duct Lining:
 - a. After installation of ductwork, Architect/Engineer may select random observation points in each system.
 - 1) At each observation point, cut and remove an 18" x 18" section of ductwork and liner for verification of installation.

- 2) Random observation points based on one opening per 75 lineal ft. of total duct run.
 - b. When any of the observation points shows non-compliance, additional points will be designated by the Architect/Engineer, and observation repeated.
 - c. If 20% of points observed do not comply, remove and replace all lined ducts and repeat tests. Where replacement is not required, correct all non-compliances.
 - d. At end of observation, repair all duct lining and observation holes by installing standard, insulated, hinged access doors per Section 23 33 00.
 - e. Paint or finish to match adjacent duct surfaces.
2. Impale on spindle anchors welded or mechanically fastened to the duct. Adhesive or glue fastened anchors are not acceptable. Maximum anchor spacing per SMACNA Duct Construction Standards or manufacturer's recommendations, whichever is more restrictive. Locate pins less than 3" from corners and at intervals not over 6" around the perimeter at leading and trailing edges. Locate pins within 3" of transverse joints and at intervals not over 16" long the length of the duct. Pins must be long enough to prevent compressing the insulation.
 3. In addition to anchors, secure liner with UL listed adhesive covering over 90% of the duct surface.
 4. Install per the latest edition of the SMACNA Manual.
 5. Leading edges shall be covered as follows:
 - a. For duct velocities below 3000 fpm, coat leading edges with adhesive. Neatly butt liner without gaps at transverse joints. Cut liner flush with end of the duct section for tight joints with no exposed duct. If adhesive is shop installed, field apply additional adhesive to the end of each duct section for complete adhesion of the liner. Protect edges from dirt and debris.
 - b. For duct velocities above 3000 fpm, cover leading edges with metal nosing. Use nosing on upstream edges of each section of duct. If the duct can be installed in either direction, provide nosing on each end or clearly mark the duct to allow visual verification after installation. Verify duct velocities based on the scheduled air flow rates and determine where metal nosing is required.
 - c. Install metal nosing in the following locations (regardless of velocity):
 - 1) The first three fittings downstream of all fans.
 - 2) At all duct liner interruptions. This includes fire dampers, access doors, branch connections, and all other locations where the edge of the liner is exposed.
 - 3) Trailing edges of transverse joints do not require metal nosings.
 6. Overlap liner at longitudinal joints. Make longitudinal joints at corners of the duct unless the duct size does not allow this. Coat longitudinal joints with adhesive at velocities over 2500 fpm.
 7. Seal all damaged duct liner with adhesive and glass cloth. Do not damage duct liner surface coatings.
 8. Duct dimensions given are net inside dimensions. Increase sheet metal to allow for insulation thickness.

- G. Exterior Fire Protection, Flexible Type - Type F:
1. Cut and secure duct wrap around ductwork, support angles, and hangers per manufacturer's recommendations.
 2. Seal all joints as required to maintain enclosure rating.
 3. Installation shall be rated for 2 hours, unless otherwise noted.
 4. Provide manufacturer's recommended assembly to protect all access doors to maintain enclosure rating and to permit easy replacement of insulation.
- H. Preformed Fiberglass Acoustical Liner, Rigid - Type G:
1. Cut and secure duct liner inside duct.
 2. Install insulation pins or adhesives in locations as recommended by the manufacturer.
 3. Seal all damaged duct liner and fill all gaps with manufacturer approved sealant. Do not damage duct liner surface coatings.
 4. Where edges show evidence of delamination, the damaged areas shall be secured by manufacturer approved sealant.
 5. Duct dimensions given are net inside dimensions. Increase sheet metal to allow for insulation thickness.
- I. Continue insulation with vapor barrier through penetrations unless code prohibits.
- J. Provide 2" wide, 24" high, 26 gauge, galvanized sheet metal corner protection angles for all externally insulated ductwork extending to a floor or curb.

3.2 SCHEDULE

- A. Refer to Section 23 31 00 for scheduling of insulation.
- B. Unless noted otherwise, ductwork and sheet metal plenums exposed to view (ductwork in the mechanical rooms): Insulate to California Title 24 requirements. If space is unconditioned, provide 3 inch thick, 3/4 pounds per cubic foot density glass fiber blanket with Kraft reinforced foil scrim vapor barrier. If space is indirectly conditioned, provide 1-1/2 inch thick 3/4 pounds per cubic foot density glass fiber blanket Kraft reinforced foil scrim vapor barrier. Tightly butt joints. Secure with 18 gauge tie wire. Corner angles shall overlap at least two sheet metal screws at each side.
- C. Unless noted otherwise, HVAC plenums and unit housings not pre-insulated at factory shall be insulated to geographical R-value requirements based on California Title 24, R-4.2, R-6 or R-8.

END OF SECTION

SECTION 23 07 19

HVAC PIPING INSULATION

1. PART GENERAL

1.1 SECTION INCLUDES

- A. Piping Insulation.
- B. Insulation Jackets.

1.2 QUALITY ASSURANCE

- A. Applicator: Company specializing in piping insulation application with five years minimum experience.
- B. Materials: Flame spread/smoke developed rating of 25/50 in accordance with ASTM E84, NFPA 255, or UL 723 (where required).
- C. Adhesives and Sealants: All sealers, adhesives, and sealants shall comply with the low emitting material limits of the following standards:
 - 1. CDPH Standard Method V1.1-2010 - Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions VOC from Indoor Sources Using Environmental Chambers Version 1.1.
 - 2. South Coast Air Quality Management District Rule 1168 – Adhesive and Sealant Applications. All adhesives and sealants wet-applied on site shall comply with the applicable chemical content requirements of SCAQMD Rule 1168.
 - 3. South Coast Air Quality Management District Rule SCAQMD 1113 – Wet Applied Paints and Coatings. All paints and coatings wet-applied on site must meet the applicable VOC limits of SCAQMD Rule 1113.

2. PART PRODUCTS

2.1 INSULATION

- A. Type B: EPDM (NBR/PVC Blend is not permitted) elastomeric cellular foam; ANSI/ASTM C534; flexible plastic; 0.25 maximum 'K' value at 75°F, 25/50 flame spread/smoke developed rating when tested in accordance with ASTM E84 (UL 723). Maximum 1" thick per layer where multiple layers are specified.

2.2 VAPOR BARRIER JACKETS

- A. Kraft reinforced foil vapor barrier with self-sealing adhesive joints. Beach puncture resistance ratio of at least 50 units. Tensile strength: 35 psi minimum. Single, self-seal acrylic adhesive on longitudinal jacket laps and butt strips.
- B. Polyvinylidene Chloride (PVDC or Saran) film and tape: Durable and highly moisture and moisture vapor resistant. Please refer to manufacturer's recommended installation guidelines.

2.3 JACKET COVERINGS

- A. Aluminum Jackets: ASTM C1729; 0.016" thick (thicker where required by ASTM C1729); stucco embossed finish with Z edge seams and aluminum bands for outdoor use. Where colored jacket covers are called for, provide factory-applied hard film acrylic paint in color selected by Architect.

3. PART EXECUTION

3.1 PREPARATION

- A. Install insulation after piping has been tested. Pipe shall be clean, dry and free of rust before applying insulation.

3.2 INSTALLATION

- A. General Installation Requirements:

1. Install materials per manufacturer's instructions, building codes and industry standards.
2. Continue insulation with vapor barrier through penetrations. This applies to all insulated piping. Maintain fire rating of all penetrations.
3. On all insulated piping, provide at each support an insert of same thickness and contour as adjoining insulation, between the pipe and insulation jacket, to prevent insulation from sagging and crushing. The insert shall be suitable for planned temperatures, be suitable for use with specific pipe material, and shall be a 180° cylindrical segment the same length as metal shields. Inserts shall be a cellular glass (for all temperature ranges) or molded hydrous calcium silicate (for pipe with operating temperatures above 70°F, with a minimum compressive strength of 50 psi. Polyisocyanurate insulation with a minimum compressive strength of 24 psi is acceptable for pipe sizes 3" and below, minimum 60 psi for pipe sizes 4" and above, and operate below 300°F. Factory fabricated inserts may be used. Rectangular blocks, plugs, or wood material are not acceptable. Temporary wood blocking may be used by the Piping Contractor for proper height; however, these must be removed and replaced with proper inserts by the Insulation Contractor. Refer to Supports and Anchors specification section for additional information.
4. Neatly finish insulation at supports, protrusions, and interruptions.
5. Install metal shields between all hangers or supports and the pipe insulation. Shields shall be galvanized sheet metal, half-round with flared edges. Adhere shields to insulation. On cold piping, seal the shields vapor-tight to the insulation as required to maintain the vapor barrier, or add separate vapor barrier jacket.
6. Shields shall be at least the following lengths and gauges:

	Pipe Size	Shield Size
a.	1/2" to 3"	12" long x 18 gauge
b.	4"	12" long x 16 gauge
c.	5" to 6"	18" long x 16 gauge
d.	8" to 14"	24" long x 14 gauge
e.	16" to 24"	24" long x 12 gauge

7. All piping and insulation that does not meet 25/50 that is in an air plenum shall have written approval from the Authority Having Jurisdiction and the local fire department for authorization and materials approval. If approval has been allowed, the non-rated material shall be wrapped with a product that has passed ASTM E84 and/or NFPA 255 testing with a rating of 25/50 or below.

B. Refrigerant Piping:

1. On refrigerant piping (25°F and above) and **not** required to meet the 25/50 flame/smoke, provide at each strut or clevis support an insulation coupling to support pipe and to accept insulation thickness of adjoining insulation, to prevent insulation from sagging and crushing. The coupling shall be suitable for planned temperatures, use with specified pipe material, and shall be a 360°, one-piece cylindrical segment. Use mechanical fasteners where coupling cannot be installed on pipe during installation. Contractor shall apply adhesive to ends of insulation entering insulation coupling to maintain vapor barrier.

C. Exposed Piping:

1. Locate and cover seams in least visible locations.
2. Where exposed insulated piping extends above the floor, provide a sheet metal guard around the insulation extending 12" above the floor. Guard shall be 0.016" cylindrical smooth or stucco aluminum and shall fit tightly to the insulation.

3.3 INSULATION

A. Type B Insulation:

1. Elastomeric Cellular Foam: Where possible, slip insulation over the open end of pipe without slitting. Seal all butt ends, longitudinal seams, and fittings with adhesive. At elbows and tees, use mitered connections. Do not compress or crush insulation at cemented joints. Joints shall be sealed completely and not pucker or wrinkle. Paint the outside of outdoor insulation with two coats of latex enamel paint recommended by the manufacturer.
2. Self-seal insulation may be used on pipes operating below 170°F.

3.4 JACKET COVER INSTALLATION

A. Metal Covering:

1. Provide vapor barrier as specified for insulation type. Cover with aluminum jacket covering with seams located on the bottom of horizontal piping. Include fittings, joints and valves.
2. Seal all interior and exterior butt joints with metal draw bands and sealant. Seal all exterior joints watertight.
3. Interior joints do not need to be sealed.
4. Use metal covering on the following pipes:
 - a. All exterior piping.

END OF SECTION

SECTION 23 08 00

COMMISSIONING OF HVAC

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings, Agreement, Part 0, Special Conditions and Forms and Division 01 Specifications Sections, apply to this Section
- B. Related Sections include the following:
 - 1. Section 01 91 13 - General Commissioning Requirements.
 - 2. Section 22 08 00 - Commissioning of Plumbing.
 - 3. Section 26 08 00 - Commissioning of Electrical Systems.
 - 4. All other Division 22, 23, and 26 Sections.

1.2 SUMMARY

- A. Commissioning work shall be a team effort to ensure that all HVAC equipment and systems have been completely and properly installed, function together correctly to meet the design intent, and document system performance. Commissioning shall coordinate system documentation, equipment start-up, and performance testing.
- B. The Commissioning Agent (CA) shall have responsibility for coordinating and directing each step of the commissioning process.
- C. Commissioning work of Division 23 shall include, but not be limited to:
 - 1. Testing and start-up of the equipment.
 - 2. Completion of pre-functional/startup checklists.
 - 3. Testing, adjusting and balancing of air and water systems.
 - 4. Cooperation with the CA.
 - 5. Providing qualified personnel for participation in commissioning tests.
 - 6. Completion of Contractor directed functional testing and associated forms.

7. Completion of CA witnessed functional testing.
 8. Providing equipment, materials, and labor as necessary to correct construction and/or equipment deficiencies found during the commissioning process.
 9. Providing training and demonstrations for the systems specified in this Division of the specifications.
- D. The work included in the commissioning process involves a complete and thorough evaluation of the operation and performance of all components, systems, and sub-systems. The following equipment and systems shall be included:
1. Rooftop Airhandling Units
 2. Exhaust Fans
 3. Exhaust Hoods
 4. Make-up Air Units
 5. Split System Air Condition Units
 6. Split System Heat Pumps
 7. Various Grilles, Registers and Diffusers
 8. DDC Temperature Controls
- E. Timely and accurate documentation is essential for the commissioning process to be effective. Documentation required as part of the commissioning process shall be as specified in Section 01 91 13 - General Commissioning Requirements.
- F. Detailed testing shall be performed on all installed equipment and systems to ensure that operation and performance conform to contract documents. The following testing is required as part of the commissioning process:
1. Pre-functional/startup checklists are comprised of a full range of checks and tests to determine that all components, equipment, systems, and interfaces between systems operate in accordance with contract documents. These checks and tests are completed by the Division 23 sub-contractors and documented using pre-functional/startup checklists.
 2. Functional performance tests (FPT) shall determine if the HVAC system is operating in accordance with the design intent. This includes all operating modes, interlocks, control responses, and specific responses to abnormal or emergency conditions. FPT shall be done by Contractor as "Contractor directed" testing and then tested again during CA witnessed testing.

- G. Acceptance testing of the mechanical and covered processes, as required by Title 24, is not the responsibility of the CA. The Acceptance Tests and associated certificate of acceptance documentation are to be complete by the installing contractor and submitted to the local enforcement agency. The CA may witness the acceptance tests.
- H. Comprehensive training of O&M personnel shall be performed by the mechanical sub-contractor, and where appropriate, by other sub-contractors, and vendors prior to turnover of building to the Owner. The training shall include classroom instruction, along with hands-on instruction on the installed equipment and systems.

1.3 ROLES AND RESPONSIBILITIES

- A. Refer to Section 01 91 13 - General Commissioning Requirements for CxT roles and responsibilities. Division 23 subcontractors are members of the CxT.

PART 2 - PRODUCTS

2.1 TEST EQUIPMENT

- A. See Section 01 9113 – General Commissioning Requirements.

2.2 TEST EQUIPMENT - PROPRIETARY

- A. See Section 01 9113 – General Commissioning Requirements.

PART 3 - EXECUTION

3.1 GENERAL

- A. A commissioning kick-off meeting of all commissioning team members shall be held at a time and place designated by the Owner. The purpose shall be to familiarize all parties with the commissioning process, and to ensure that the responsibilities of each party are clearly understood.
- B. The Contractor shall complete all phases of work so the systems can be started, tested, balanced, and commissioning procedures undertaken. This includes the complete installation of all equipment, materials, fixtures, pipe, valves, wire, insulation, controls, etc., per the contract documents and related directives, clarifications, and change orders.
- C. A commissioning plan shall be developed by the CA. The Contractor shall assist the CA in preparing the commissioning plan by providing all necessary information pertaining to the actual equipment and installation. If Contractor initiated system changes have been made that alter the commissioning process, the CA shall notify the Owner.
- D. Acceptance procedures are normally intended to begin prior to completion of a system and/or sub-systems, and shall be coordinated with the Division 23 subcontractor. Start of acceptance procedures before system completion does not relieve the Contractor from completing those systems as per the schedule.

3.2 PARTICIPATION IN COMMISSIONING

- A. The Contractor shall provide skilled personnel to start-up and debug all systems within Division 23. These same personnel shall be made available to assist the CA in completing the commissioning program. Work schedules, time required for testing, etc., shall be requested by the CA and coordinated by the Contractor. Contractor shall ensure that the qualified personnel are available and present during the agreed upon schedules and of sufficient duration to complete the necessary tests and/or problem resolutions.
- B. System performance problems and discrepancies may require additional personnel time, CA time, reconstruction of systems, and/or replacement of system components. The additional Contractor personnel time shall be made available for subsequent commissioning periods until the required system performance is obtained at no additional cost to the Owner.
- C. The CA reserves the right to question the appropriateness and qualifications of the personnel relative to each item of equipment, system, and/or sub-system. Qualifications of personnel shall include expert knowledge relative to the specific equipment involved and a willingness to work with the CA. Contractor shall provide adequate documentation and tools to start-up and test the equipment, system, and/or sub-system.

3.3 DEFICIENCY RESOLUTION

- A. In some systems, maladjustments, misapplied equipment, and/or deficient performance under varying loads will result in additional work being required to commission the systems. This work shall be completed under the direction of the Owner, with input from the Contractor, equipment supplier, and CA. Whereas all members shall have input and the opportunity to discuss, debate, and work out problems, the Owner shall have final jurisdiction over any additional work done to achieve performance.
- B. Corrective work shall be completed in a timely fashion to permit the completion of the commissioning process. Experimentation to demonstrate system performance may be permitted. If the CA deems the experimentation work to be ineffective or untimely as it relates to the commissioning process, the CA shall notify the Owner, indicating the nature of the problem, expected steps to be taken, and suggested deadline(s) for completion of activities. If the deadline(s) pass without resolution of the problem, the Owner reserves the right to obtain supplementary services and/or equipment to resolve the problem. If a retest of a functional test fails, any costs incurred for further retesting shall be the Contractor's responsibility, including the CA's labor and travel expenses.

END OF SECTION

SECTION 23 09 00

CONTROLS

PART 1 - GENERAL

1.1 SUMMARY

- A. The Direct-Digital Control (DDC) System specified herein shall include materials, operator workstation, building controllers, sensors, control valves, wiring, installation, start-up, testing, documentation and training for a complete operable system as required for this project.
- B. Controls Engineering shall be provided by the local controls manufacture representative.
- C. Work specified under this section shall be performed by, or under the direct supervision of the local controls manufacture representative, or by a contractor that is certified by the controls manufacture to perform all work within Section 23 09 00 Instrumentation and Control for HVAC and those sections of 23 09 00 that have been specified herein.
- D. Alternate techniques, modifications or changes to any aspect of these specifications may be submitted as a voluntary alternate no later than (15) days prior to the bid date and with sufficient information for a complete evaluation. This information shall include product data sheets, a UL508A Standard for Industrial Control Panels statement of compliance for any locally manufactured control panels, a detailed sequence of operation and engineered shop drawing. Shop drawings shall include the following as a minimum. Point to point wiring diagrams for each piece of equipment to be controlled, a network riser diagram that will depict quantity and location of all operator workstation, controllers, routers and repeaters required for this project.

1.2 SUBMITTALS

- A. Submit engineered shop drawings, sequences of operation, third party equipment and controls integration points and product data sheets covering all items of equipment for the proposed system prior to installation for approval. Any deviation from the contract documents shall be noted and the drawings signed and dated by the Contractor. Additionally, submit a UL508A Standard for Industrial Control Panels statement of compliance for any locally manufactured control panels.
- B. After completion of the installation and commissioning, a full set of as-built documentation shall be turned over to the Owner. The as-built shall include operation and maintenance manuals, sequence of operation, shop drawings and digital copies of the following.
 - 1. Complete DDC System databases backup
 - 2. Source files for all custom written controller applications
 - 3. Source files for graphics if required for this project

1.3 WARRANTY

- A. Components, system software, and parts shall be guaranteed against defects in materials, fabrication, and execution for (1) year from date of system acceptance. Provide labor and materials to repair, reprogram, or replace components at no charge to the Owner during the warranty period.
- B. Provide a list of applicable warranties for components, this list shall include warranty information, names, addresses, telephone numbers, and procedures for filing a claim and obtaining warranty services.
- C. Respond to the Owner's request for warranty service within (24) hours during normal business hours. Submit records of the nature of the call, the work performed, and the parts replaced or service rendered.

- D. Contractor shall request VPN access from owner and provide remote maintenance, software updates and repair service for the duration of the warranty period.

1.4 TRAINING

- A. Provide a competent instructor who is factory trained and has comprehensive knowledge of system components and operations to provide full instructions to designated personnel in the system operation, maintenance, and programming. Training shall be specifically oriented to installed equipment and systems.
- B. Provide (8) hours of onsite owner familiarization and training for the installed system. Training shall include system overview, time schedules, emergency operation, and programming and report generation.
- C. Owner employees attending this training session shall be provided with the following documentation:
 - 1. System layout point to point connection diagram.
 - 2. System components cut sheets.
 - 3. Operations and maintenance data.

1.5 PRODUCT DELIVERY, STORAGE AND HANDLING

- A. Do not store or install electronic hardware on the project until non-condensing environmental conditions have been established.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

- A. DDC Equipment: Carrier OPEN BACnet Controls. No substitutions will be accepted.
- B. Controls installation will be by Carrier Controls Expert Dealer.
- C. The local manufacture representative will operate a free 40 hour a week, toll free customer support hotline for additional user support services that are required.

2.2 SYSTEM LISTING COMPLIANCE

- A. Locally manufactured control panels shall meet all requirements as outlined by UL 508A standard and shall be both approved and listed by Underwriters Laboratories, Inc.

2.3 COMMUNICATION

- A. Controller and operator interface communication shall conform to ANSI/ASHRAE Standard 135, BACnet.
- B. Each controller shall have a communication port for temporary connection to a laptop computer or other operator interface. Connection shall support memory downloads and other commissioning and troubleshooting operations.
- C. Use owner provided Ethernet backbone for network segments.

2.4 OPERATOR INTERFACE

- A. Description. The control system shall be as shown and consist of a high-speed, peer-to-peer network of DDC controllers and a stand-alone web server operator interface. Depict each mechanical system and building floor plan by a point-and-click graphic. A web server shall gather data from this system and generate web pages accessible through a conventional web browser on each PC connected to the network. Operators with sufficient access level shall have an ability to make changes to all system and equipment graphics in the web server in addition to having full DDC system access to make configuration changes to the control system. Any tools required for making graphic changes shall be provided with web server.
- B. Operator Interface. Shall be a Carrier i-Vu Pro Unlimited Web Server User Interface. Furnish new Software Package or connect to existing i-Vu Pro if applicable.
 - 1. With the use of an owner provided remote SMTP email server the operators interface web server shall notify personnel of an alarm and record information about an alarm in the DDC system.
 - 2. Any required installation or commissioning software shall be provided to the owner.
- C. Operator Functions. Operator interface shall allow each authorized operator to execute the following functions as a minimum:
 - 1. Log In and Log Out
 - 2. Point-and-click Navigation
 - 3. View and Adjust Equipment Properties
 - 4. View and Adjust Operating Schedules
 - 5. View and Respond to Alarms
 - 6. View and Configure Trends
 - 7. Manage Control System Hardware
 - 8. Manage Operator Access
- D. System Graphics. Operator interface shall be graphical and shall include at least one graphic per piece of equipment and graphics that summarize conditions on each floor of each building included in this contract. Indicate thermal comfort on floor plan summary graphics using dynamic colors to represent zone temperature relative to zone setpoint.
- E. Trend Configuration. Operator shall be able to configure trend sample or change of value (COV) interval, start time, and stop time for each system data object and shall be able to retrieve data for use in spreadsheets and standard database programs.
- F. Reports and Logs. Operator shall be able to select, to modify, to create, and to print reports and logs. Furnish the following standard system reports:
 - 1. Alarm Reports
 - 2. Schedule Reports
 - 3. Security Reports
 - 4. Commissioning Reports
 - 5. Equipment Reports
- G. Energy Conservation
 - 1. Outside Air Lockout. Lock out heating or cooling modes based on configurable outside air temperature limits.
 - 2. Optimal Start. The system shall bring the conditioned space to within occupied set points prior to the occupied time period to ensure occupant comfort.

2.5 CONTROLLERS

- A. General. The control system shall be available as a complete package with the required input sensors and devices readily available. Provide BACnet Building Controllers (BC), Advanced Application Controllers (AAC), Application Specific Controllers (ASC), and Sensors (SEN) as required.
- B. Stand-Alone Operation. Each piece of equipment shall be controlled by a single controller to provide stand-alone control in the event of communication failure.
- C. Serviceability. Controllers shall have diagnostic LEDs for power, communication, and processor.
- D. Rooftop Unit Controller (RTC). Defined as Application Specific Controllers (ASC), shall be factory installed by the HVAC manufacturer and shall control all associated HVAC rooftop equipment functions in a single zone application or as part of a zoning system application.
 - 1. Capacity control shall be based by the RTC internal time clock and setpoints (cooling and heating) coupled with a communicating room sensor. The controls shall provide separate occupied and unoccupied cooling and heating setpoints.
 - 2. RTC shall utilize up to 2 speed of fan control, up to 3 stages of cooling, and up to 4 stages of heating.
 - 3. RTC shall provide economizer control that has been certified for Fault Detection and Diagnostics (FDD) by California Energy Commission (CEC). The FDD system shall detect the following faults:
 - a. Air temperature sensor failure/fault
 - b. Not economizing when it should
 - c. Economizing when it should not
 - d. Damper not modulating
 - e. Excess outdoor air
- E. General Purpose Controller. Defined as Advanced Application Controller (AAC) shall be a solid state micro-controller with pre-tested and factory configured software designed for controlling building equipment using DDC algorithms and facility management routines. The controller shall be capable of operating in either a stand-alone mode or as part of a network.

2.6 FIELD INSTALLED SENSORS

- A. Space Temperature Sensors shall communicate to the controller over a 4-wire communication network and have setpoint adjustment, after hours override, LCD display and a communication service port.
- B. Status indication for fans or pumps shall be provided by a split core design current sensing sensor. The sensor shall be installed at the motor starter or motor to provide load indication. The unit shall consist of a current transformer, a solid state current sensing circuit (with adjustable set point) and a solid state switch. A light emitting diode (LED) shall indicate the on off status of the unit.

2.7 CONTROL PANELS

- A. Provide single-door, UL 508A Listed; Type 4, wall-mount enclosures for each system under automatic control. Mount relays, switches, and controllers in cabinet and indicators, pilot lights, push buttons and switches flush on enclosure exterior face as required.
- B. Fabricate panels from 16 gauge steel with ANSI 61 gray finish and shall include (1) black padlock handle that will accommodate a padlock with up to a 5/16-in. locking bar for secure access to the enclosure contents. All additional latches shall be black non-locking handle type.
- C. Provide engraved name plates that identify each control panel and for each component mounted to the exterior of the enclosure.

- D. Provide a complete wiring diagram, bill of material for all components and markings with the following information:
 - 1. Manufacturer's name or trademark
 - 2. Supply voltage, number of phases, frequency, and full-load current for each incoming supply circuit
 - 3. Enclosure type number

PART 3 - EXECUTION

3.1 ELECTRICAL WIRING

- A. This contractor is responsible for all low voltage electrical installation and wiring for a fully operational DDC System as shown on the drawings and shall perform electrical installation in accordance with local and national electrical codes and in accordance with Division 26.
- B. Install all HVAC control wiring, 24vdc or less, in electrical metallic tubing (EMT) when wire is concealed in walls and in exposed areas. Plenum wire may be used in ceilings where anchored support is provided every 10 feet.
- C. Electrical Contractor is responsible for providing power from local electrical panels to the DDC System control panels.
- D. When transitioning between buildings above or below ground level, provide a pull box with necessary surge suppression hardware to transition exterior rated wiring to interior applications.

3.2 ACCEPTANCE PROCEDURE

- A. Upon completion of the installation, the contractor shall start-up the system and perform all necessary calibration and testing to ensure the proper operation of the DDC System.
- B. After all calibration and testing have been completed, the contractor shall schedule a hardware demonstration and system acceptance test to be performed in the presence of the designated owner's representatives.
- C. The contractor shall be a member of the designated District Commissioning Team and shall be responsible for performing procedures presented in specification and contract drawings as detailed in the Functional Performance Tests (FPT).

END OF SECTION

SECTION 23 31 00

DUCTWORK

1. PART GENERAL

1.1 SECTION INCLUDES

- A. Galvanized Ductwork
- B. Aluminum Ductwork
- C. Stainless Steel Ductwork
- D. PVC Coated Ductwork
- E. Ductwork Reinforcement
- F. Ductwork Sealants
- G. Rectangular Ductwork
- H. Round and Flat Oval Ductwork
- I. Exposed Ductwork (Rectangular, Round, or Oval)
- J. Flexible Duct
- K. Grease Exhaust Duct
- L. Fume Exhaust Duct
- M. Acoustical Lagging
- N. Leakage Testing
- O. Ductwork Penetrations
- P. Painting

1.2 SUBMITTALS

- A. Submit shop drawings per Section 23 05 00.
- B. The Architect/Engineer may require field verification of sheet metal gauges and reinforcing to verify compliance with these specifications. At the request of the Architect/Engineer, the contractor shall remove a sample of the duct for verification. The contractor shall repair as needed.
- C. Duct Layout Drawings: Submit detailed duct layout drawings at 1/4" minimum scale complete with the following information:
 - 1. Actual duct routing, ductwork fittings, actual sheet metal dimensions including insulation liner and wrap, duct hanger and support types, ductwork accessories, etc. with lengths and weights noted.
 - 2. Differentiate ducts that are wrapped. Include insulation thickness, type of insulation, and acoustical lagging.
 - 3. Room names and numbers, ceiling types, and ceiling heights.
 - 4. Indicate location of all beams, bar joists, etc. along with bottom of steel elevations for each member.
 - 5. Verify clearances and interferences with other trades prior to preparing drawings. IMEG will provide electronic copies of ventilation drawings for contractor's use if the contractor signs and returns the "Electronic File Transfer" waiver. IMEG will not consider blatant reproductions of original file copies an acceptable alternative for this submittal. Refer also to Section 23 05 00.

1.3 DEFINITIONS

- A. Duct Sizes shown on drawings are inside clear dimensions. Maintain clear dimensions inside any lining.
- B. Transitions are generally not shown in single-line ductwork. Where sizes change at a divided flow fitting, the larger size shall continue through the fitting.

1.4 COORDINATION DRAWINGS

- A. Reference Coordination Drawings article in Section 23 05 00 for required duct systems electronic CAD drawings to be provided to Coordinating Contractor for inclusion into composite coordination drawings.
- B. Duct drawings shall be at 1/4" minimum scale complete with the following information:
 - 1. Actual duct routing, ductwork fittings, actual sheet metal dimensions including insulation liner and wrap, duct hanger and support types, ductwork accessories, etc. with lengths and weights noted.
 - 2. Differentiate ducts that are lined or wrapped. Include insulation thickness, type of insulation, and acoustical lagging.
 - 3. Location and size of all duct access doors.
 - 4. Room names and numbers, ceiling types, and ceiling heights.
 - 5. Indicate location of all beams, bar joists, etc. along with bottom of steel elevations for each member.
- C. IMEG will provide electronic file copies of ventilation drawings for contractor's use if the contractor signs and returns an "Electronic File Transfer" waiver provided by IMEG. IMEG will not consider blatant reproductions of original file copies an acceptable alternative for coordination drawings. Architectural plans will need to be obtained from the Architect.

2. PART PRODUCTS

2.1 GALVANIZED DUCTWORK

- A. General Requirements:
 - 1. Duct and reinforcement materials shall conform to ASTM A653 and A924.
 - 2. Interior Ductwork and reinforcements: G60 galvanized (0.60 ounces per square foot total zinc coating for two sides per ASTM A90) unless noted otherwise.
 - 3. Exterior Ductwork: G90 galvanized (0.90 ounces per square foot total zinc coating for two sides per ASTM A90) unless noted otherwise. G60 is not acceptable for exterior use.
 - 4. Ductwork reinforcement shall be of galvanized steel.
 - 5. Ductwork supports shall be of galvanized or painted steel.
 - 6. Strap hanger shall be a minimum of 1 inch, 18 gauge galvanized steel attached to the bottom of ducts at 8'-0" OC and as required by CMC and SMACNA guidelines.
 - 7. All fasteners shall be galvanized or cadmium plated.

2.2 ALUMINUM DUCTWORK

A. General Requirements:

1. Material: ASTM B209; aluminum sheet, Alloy 3003-H14. Aluminum connectors and bar stock: Alloy 6061-T6. Aluminum or stainless steel fasteners are acceptable.
2. All duct gauges and reinforcement shall be as called for in Tables 2-50, 2-51, 2-52, and 3-14 of the SMACNA HVAC Duct Construction Standards.
3. Ductwork reinforcement shall be of aluminum.
4. Ductwork supports shall be of aluminum, galvanized steel or painted steel. Slip cable hangers are acceptable. Acceptable manufacturers are Gripple, Ductmate, Duro Dyne, or Architect/Engineer approved.
5. All other requirements are as noted for galvanized rectangular sheet metal duct.

2.3 STAINLESS STEEL DUCTWORK

A. General Requirements:

1. For Grease Exhaust Ductwork: Ductwork shall be Type 304L stainless steel, 16 gauge minimum.
2. For Fume Exhaust Ductwork: Ductwork shall be Type 316L stainless steel, 16 gauge minimum.
3. Exposed ductwork shall have a #3 finish. Concealed ductwork may have milled finish.
4. Ductwork reinforcement shall be of stainless steel.
5. Ductwork supports shall be of stainless steel. Slip cable hangers are acceptable. Acceptable manufacturers are Gripple, Ductmate, Duro Dyne, or Architect/Engineer approved.
6. All fasteners shall be cadmium plated or stainless steel.

2.4 PVC COATED DUCTWORK

A. General Requirements:

1. G-60 galvanized steel sheet with prime coat and a 4 mil polyvinyl chloride film on both sides. Where any duct surface is scratched, marred, or otherwise damaged, coat with PVC paint as recommended by the manufacturer to provide a complete PVC coating for the entire duct surface. Aerosol-based PVC spray paint is not acceptable.
2. Ductwork reinforcement shall be of galvanized steel. All ductwork reinforcement shall be external.
3. Ductwork supports shall be of galvanized or painted steel. Supports shall not require penetrations of the PVC coating. Slip cable hangers are acceptable. Acceptable manufacturers are Gripple, Ductmate, Duro Dyne, or Architect/Engineer approved.
4. All fasteners shall be of 316 stainless steel.

2.5 DUCTWORK REINFORCEMENT

A. General Requirements:

1. All reinforcement shall be external to the duct except that tie rods may be used with the following limitations.
 - a. Ducts must be over 18" wide.
 - b. Duct dimensions must be increased 2" in one dimension (h or w) for each row of tie rods installed.
 - c. Tie rods must not exceed 1/2" diameter.
 - d. Manufacturer of tie rod system must certify pressure classifications of various arrangements, and this must be in the shop drawings.

2.6 DUCTWORK SEALANTS

- A. One-part joint sealers shall be water-based mastic systems that meet the following requirements: maximum 48-hour cure time, service temperature of -20°F to +175°F, resistant to mold, mildew and water, flame spread rating below 25 and smoke-developed rating below 50 when tested in accordance with ASTM E84, suitable for all SMACNA seal classes and pressure classes. Mastic used to seal flexible ductwork shall be marked UL 181B-M. Joint sealers for use on exterior weather exposed ductwork shall be rated for -30°F to +175°F and 2000-hour minimum UV resistance per ASTM G-53.
- B. Pressure sensitive tape used for sealing ductwork shall be minimum 2.5-inch wide, listed and marked UL 181A-P, having minimum 60 oz/inch peel adhesion to steel, and service temperature range from -20°F to +250°F.
- C. Adhesives and Sealants: All sealers, adhesives, and sealants shall comply with the low emitting material limits of the following standards:
 1. CDPH Standard Method V1.1-2010 - Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions VOC from Indoor Sources Using Environmental Chambers Version 1.1.
 2. South Coast Air Quality Management District Rule 1168 – Adhesive and Sealant Applications. All adhesives and sealants wet-applied on site shall comply with the applicable chemical content requirements of SCAQMD Rule 1168.
 3. South Coast Air Quality Management District Rule SCAQMD 1113 – Wet Applied Paints and Coatings. All paints and coatings wet-applied on site must meet the applicable VOC limits of SCAQMD Rule 1113.
- D. Where pressure sensitive tape is called for on drawings and specifications for sealing flexible ductwork, tape shall be minimum 2.5-inch wide, UL 181 B-FX listed, and marked tape having minimum 60 oz/inch peel adhesion to steel and service temperature range from -20°F to +250°F. Acceptable manufacturers include: Venture Tape 1581A, Compac #340, Scotch Foil Tape 3326, Polyken 339.

2.7 RECTANGULAR DUCT - SINGLE WALL

A. General Requirements:

1. All ductwork gauges and reinforcements shall be as listed in SMACNA Duct Construction Standards Chapter 2. Where necessary to fit in confined spaces, furnish heaviest duct gauge and least space consuming reinforcement.
2. Transitions shall not exceed the angles in Figure 4-7.

B. Exceptions and modifications to the 2005 HVAC Duct Construction Standards are:

1. All ducts shall be cross-broken or beaded.
2. Snap lock seams are not permitted.
3. Turning vanes shall be used in all 90° mitered elbows, unless clearly noted otherwise on the drawings. Vanes shall be as follows:
 - a. Type 1:
 - 1) **Description:** Single wall type with 22-gauge (0.029") or heavier vanes, 3-1/4" blade spacing, and 4" to 4-1/2" radius. Vanes hemmed if recommended by runner manufacturer. Runners shall have extra-long locking tabs. C-value independently tested at below 0.26. EZ Rail II by Sheet Metal Connectors or equal.
 - 2) **Usage:** Limited to 3,000 fpm and vane lengths 36" and under.
 - b. Type 2:
 - 1) **Description:** Double wall type with 3-1/4" blade spacing, 4-1/2" radius, 24-gauge minimum, and SMACNA Type 1 runners. C-value below 0.27.
 - 2) **Usage:** No limits other than imposed by the manufacturer. Provide intermediate support for vanes over 48" long.
 - c. Type 3 (acoustical - where acoustical lagging is located or as noted on drawings):
 - 1) **Description:** Same as Type 2, except filled with fiberglass and with slotted or perforated inner curve. Minimum insertion loss of 9 dB at 250 Hz and 6 dB at 1 KHz.
 - 2) **Usage:** No limits other than imposed by the manufacturer. Provide intermediate support for vanes over 48" long.
 - d. Turning vanes shall operate quietly. Repair or replace vanes that rattle or flutter.
 - e. Runners must be installed at a 45° angle. Elbows with different size inlet and outlet must be radius type.
 - f. Omitting every other vane is prohibited.
4. Where smooth radius rectangular elbows are shown, they shall be constructed per SMACNA Figure 4-2. Type RE1 shall be constructed with a centerline duct radius R/W of 1.0. Where shown on drawings, Type RE3 elbows with 3 vanes shall be used with centerline duct radius R/W of 0.6 (SMACNA r/W=0.1). RE1 or RE3 elbows may be used where mitered elbows are shown if space permits. **Mitered elbows (with or without turning vanes) may not be substituted for radius elbows.** Do not make branch takeoffs within 4 duct diameters on the side of the duct downstream from the inside radius of radius elbows.

5. Rectangular branch and tee connections in ducts over 1" pressure class shall be 45° entry type per Figs. 4-5 and 4-6. Rectangular straight taps are not acceptable above 1" pressure class.
6. Bellmouth fittings shown on return duct inlets shall expand at a 60-degree total angle horizontally and vertically (space permitting) and have length of at least 25% of the smallest duct dimension.
7. Round taps off rectangular unlined ducts shall be flanged conical or bellmouth type (equal to Buckley Bellmouth or Sheet Metal Connectors E-Z Tap), or 45° rectangular with transition to round (equal to Sheet Metal Connectors Inc. High Efficiency Takeoff). Straight taps are acceptable if pressure class is 1" or less, round duct is 12" diameter or less, and the tap is not located between fans and TAB devices.
8. Duct offsets shall be constructed as shown on drawings. Additional offsets required in the field shall be formed of mitered elbows without turning vanes for offsets up to 30° maximum angle in accordance with SMACNA offset Type 2. Offsets of greater than 30° angle shall be formed of radius elbows with centerline radius R/W=1.0 or greater. SMACNA Type 1 offsets are not permitted.
9. All lined duct shall utilize dovetail joints where round or conical taps occur. The dovetail joints shall extend past the liner before being folded over.
10. Cushion heads are acceptable only downstream of TAB devices in ducts up to ± 2" pressure class, and must be less than 6" in length.
11. Slide-on flanged transverse joint systems are acceptable provided they are a manufactured product that has been tested for conformance with Chapter 2 of the SMACNA HVAC Duct Construction Standards for sheet and joint deflection at the specified pressure class.
 - a. Apply sealant to all inside corners. Holes at corners are not acceptable.
 - b. Acceptable Manufacturers: Ductmate Industries - 25/35/45, Nexus, Mez, or WDCI. Other manufacturers must submit test data and fabrication standards and receive Architect/Engineer's approval before any fabrication begins.

2.8 ROUND AND FLAT OVAL DUCTWORK - SINGLE WALL

- A. Conform to applicable portions of Rectangular Duct Section. Round or flat oval ductwork may be substituted for rectangular ductwork where approved by the Architect/Engineer. The spiral seam ductwork shall meet the standards set forth in this specification. The ductwork shall meet or exceed the specified cross-sectional area and insulation requirements. The substitution shall be coordinated with all other trades prior to installation.
- B. Snap lock seams are not permitted.
- C. Flat oval duct in negative pressure applications shall have flat sides reinforced as required for rectangular ducts of the same gauge with dimensions equal to the flat span of the oval duct.
- D. 90° elbows shall be smooth radius or have a minimum of five sections with mitered joints and R/D of at least 1.5.
- E. Duct and fittings shall meet the required minimum gauges listed in chapter 3 of the SMACNA requirements for the specified pressure class. Ribbed and lightweight duct are not permitted.
- F. Ductwork shall be suitable for velocities up to 5,000 fpm.
- G. Divided flow fittings may be made as separate fittings or factory installed taps with sound, airtight, continuous welds at intersection of fitting body and tap.

- H. Spot weld and bond all fitting seams in the pressure shell. Coat galvanizing damaged by welding with corrosion resistant paint to match galvanized duct color.
- I. Ducts with minor axis less than 22" shall be spiral seam type. Larger ducts may be rolled, longitudinal welded seam type. SMACNA seams RL-2 and RL-3 are not permitted.
- J. Reinforce flat oval ducts with external angles. Internal tie rods are permitted only as indicated for rectangular ductwork.
- K. Transverse Joint Connections:
 - 1. Crimped joints are not permitted.
 - 2. Ducts and fittings 36" in diameter and smaller shall have slip joint connections. Size fitting ends to slip inside mating duct sections with minimum 2-inch insertion length and a stop bead. Use inside slip couplings for duct-to-duct joints, and outside slip couplings for fitting-to-fitting joints.
 - 3. Ducts and fittings larger than 36" shall have flanged connections.
 - 4. Secure all joints with at least 3 sheet metal screws before sealing.
 - 5. Slide-on flanges as manufactured by Ductmate Industries - SpiralMate, Accuflange, or Sheet Metal Connectors are acceptable. Self-sealing duct systems are also acceptable (Lindab, Ward "Keating Coupling").

2.9 EXPOSED DUCTWORK (RECTANGULAR, ROUND, AND FLAT OVAL)

- A. The following applies to all ductwork exposed in finished areas in addition to requirements noted above:
 - 1. Provide extra shipping protection. Use Cardboard or other protective means to prevent dents and deformed ends.
 - 2. Provide cardboard or other means of protection during field fabrication. Protect from scratches. Provide stiffeners to retain shape during fabrication.
 - 3. Remove all identification stickers and thoroughly clean exterior of all ducts.
 - 4. Locate fitting seams on least visible side of duct.
 - 5. Provide exterior finish suitable for field painting without further oil removal.
 - 6. Provide ramp-type internal joint couplings. Provide bead of sealant around the inside of the duct about 1/2" from the end of the duct. Slide-on flanges as manufactured by Ductmate Industries, Accuflange or Sheet Metal Connectors are acceptable. Self-sealing duct system is also acceptable (Lindab, Ward "Keating Koupling").
 - 7. The system shall be free of visible dents and scratches when viewed from normal occupancy.
 - 8. All insulation shall be internal.
- B. In addition to the paragraphs above, this section applies to all ductwork specified or shown as "Architecturally Exposed":
 - 1. All spiral ductwork fittings shall be carbon arc welded.
 - 2. Grind all welds to remove irregularities.

3. Conical taps shall be one piece. Taps for grilles and takeoffs shall be factory installed with a continuous weld and ground smooth.
 4. Welds shall be ground smooth and painted.
 5. All architecturally exposed ducts shall be round or flat oval except where not possible (grilles, etc.).
- C. Alternate manufacturers, including shop fabricated duct, must be reviewed before installation. The following information is required:
1. Metal gauge of duct and fittings.
 2. Fitting type and construction.
 3. Type and size of reinforcement.

2.10 FLEXIBLE DUCT

- A. Flexible duct shall be listed and labeled as UL 181 Class 1 Air Duct Material, and shall comply with NFPA 90A and 90B, and meet GSA, FHA and other U.S. Government agency standards. Flexible duct shall bear the ADC Seal of Certification.
- B. Flame Spread/Smoke Developed: Not over 25/50.
- C. Flexible duct shall have corrosion-resistant wire helix, bonded to an inner liner that prevents air from contacting the insulation, covered with minimum 1-1/2", 3/4 lb/cf density fiberglass insulation blanket, sheathed in a vapor barrier of metalized polyester film laminated to glass mesh.
- D. Inner liner shall be airtight and suitable for 6" WC static pressure through 10" diameter and shall be airtight and suitable for 4" WC static pressure 12" through 16" diameter. Outer jacket shall act as a vapor barrier only with permeance not over 0.1 perm per ASTM E96, Procedure A. "R" value shall not be less than 4.0 ft²*°F*hr/Btuh. Temperature range of at least 0-180°F. Maximum velocity of 4,000 fpm.
- E. Usage:
 1. Take-offs from supply ducts to inlets of terminal air boxes. Do not exceed 36" in length.
 2. Connections to air inlets and outlets. Do not exceed 6'-0" in length.
- F. Stretch all flexible duct to prevent sags and reduce air friction. Shorten and reinstall all sagging or loose flexible duct. Avoid sharp elbows. Elbows shall maintain 1.5 diameter centerline turning radius.
- G. Install per the SMACNA Flexible Duct Manual. Secure inner layer with draw band. Wrap with pressure sensitive tape for protection prior to installing draw band. Pressure sensitive tape alone is not acceptable.

2.11 GREASE EXHAUST DUCT FIELD FABRICATED

- A. All ductwork shall be 16 gauge minimum, Type 304L stainless steel. Concealed ductwork may be 16 gauge black steel.
- B. Concealed Ductwork:
 1. Range hood/grease exhaust ducts having an area of 4 sf or less shall be 16 gauge carbon steel.
 2. Range hood/Grease exhaust ducts having an area greater than 4 sf shall be 14 gauge carbon steel.

- C. All joints and fittings shall be continuously welded and liquid-tight.
- D. Exposed ductwork shall have a #3 finish. Concealed ductwork may have a mill finish.
- E. Do not penetrate fire rated partitions, unless protected as required by applicable codes.
- F. Provide pre-fabricated access doors and labels required by NFPA 96 and California Mechanical Code on sides of duct at least 1.5" from bottom. Provide access at each change in direction and at maximum 20-foot intervals in horizontal ducts. Provide access at every floor for vertical ducts.
- G. Install grease traps in kitchen grease ducts at base of all vertical risers and low points in the system.
- H. Where grease ducts are 20" x 20" or larger, install access for personnel to enter duct. Duct supports must be sized to support the duct weight and an additional 800 lbs per NFPA 96.
- I. Install ducts with proper clearance to combustible and limited-combustible materials.
- J. Grease ducts installed with volume dampers shall conform to the damper specified in ductwork accessories.
- K. Grease exhaust duct doors shall be grease and airtight, UL 1978 listed, meet NFPA 96 standards, and all mechanical codes. Grease duct access doors can be sandwich type or with a weld-on frame, with/without hinge.
 - 1. Approved Manufacturer: Ductmate Industries "Ultimate I" or "Ultimate II" Style door or approved equal.
- L. All grease duct access doors used must be accompanied by independent testing in conjunction with each manufacturer's respective wrap system for high temperature applications.
- M. Refer to Section 23 07 13 for duct insulation material and insulated access door when required to provide proper enclosure of ductwork.

2.12 FUME EXHAUST DUCT

- A. Unless shown otherwise on the drawings, all fume exhaust ductwork shall be 14 gauge Type 316L stainless steel with continuously welded joints. Ductwork shall meet all requirements of SMACNA Class 5-6" pressure class industrial ductwork. Use heavier gauge and/or transverse reinforcements if required.
- B. Elbows up to 30° shall be mitered two-piece type. Elbows 31° to 50° shall be mitered three-piece type. Elbows 51° to 90° shall be mitered five-piece type. All elbows shall have a minimum centerline R/D of 1.5. Elbows 10" in diameter and smaller may be die-formed.
- C. Expanders in horizontal ducts shall be eccentric type with a minimum length of (diameter change x 10) and shall maintain a positive pitch for drainage to the fume hood or exhaust outlet. Expanders in ducts over 30° from horizontal shall be concentric with a minimum length of (diameter change x 5).
- D. Ducts shall maintain the maximum possible pitch toward their inlets unless a different drainage location is indicated on the drawings. If at least 1/8" per foot pitch cannot be maintained, notify the Architect/Engineer before installing ductwork or other items with which ductwork may conflict.
- E. All welds shall conform to AWS D9.1M. Welds shall be Gas Tungsten Arc Weld (TIG) or Gas Metal Arc Weld (MIG) type. All filler metal shall conform to AWS A5.9 or A5.22 and be AWS Classification ER308L or ER308LSi with a carbon content of not over 0.03%.
- F. Supports shall not penetrate duct surfaces. Ductwork shall be completely leak-tight from the inlet to the discharge to the atmosphere, at pressures up to 10" WG. Install caps to seal the ductwork for pressure testing. Plug all spray and drain connections when testing ductwork.

- G. Where flanged joints are indicated, they shall have 1/4" "Gore-Tex Joint Sealant" gaskets (W. L. Gore & Associates, Industrial Products Division, 100 Airport Road, Box 1550, Elkton, MD 21921 (410) 392-4440 or (410) 392-3200). PTFE gaskets are also acceptable.
- H. All ducts indicated as "316SS" shall be constructed of Type 316L stainless steel. The specification above for 304L stainless steel ductwork also applies to 316L stainless steel ductwork except all filler metal shall be AWS Classification ER316L with a carbon content of not over 0.03%.
- I. Do not penetrate fire rated partitions, unless protected as required by applicable codes.
- J. Hot-lab exhaust duct shall meet CMC material requirements.

2.13 AUTOMOTIVE EXHAUST DUCT

- A. Ductwork shall be spiral seam single wall type. Construct to requirements of SMACNA Class I Industrial Duct with a pressure rating of 7" negative. Flexible ducts shall be high temperature fiberglass with wire reinforcing.
- B. Provide tailpipe adaptors, winches and all other required accessories.
- C. Do not penetrate fire rated partitions, unless protected as required by applicable codes.
- D. Acceptable Manufacturers for Tubing: Car-Mon Products, Inc., Engwald, or National.

2.14 ACOUSTICAL LAGGING

- A. Type A: Lagging shall be a loaded vinyl noise barrier, fiberglass scrim facing, and 1" thick quilted fiberglass decoupling layer. Lagging shall have a minimum STC of 28, and Class A flammability (maximum 25/50) rating per ASTM E-84. Install lagging per manufacturer's recommendations.
 - 1. Acceptable Products: Sound Seal B-10 Lag/QFA-3, McGill Air Pressure PDL-3, Kinetics KNM 100ALQ-1.
- B. Type B: Lagging shall be a loaded vinyl noise barrier, fiberglass scrim facing, and 2" thick quilted fiberglass decoupling layer. Lagging shall have a minimum STC of 30, and Class A flammability (maximum 25/50) rating per ASTM E-84. Install lagging per manufacturer's recommendations.
 - 1. Acceptable Products: Sound Seal B-10 Lag/QFA-9, McGill Air Pressure PDL-9.
- C. Refer to drawings for acoustical lagging locations.

3. PART EXECUTION

3.1 INSTALLATION

- A. Provide openings in ducts for thermometers and controllers.
- B. Locate ducts with space around equipment for normal operation and maintenance.
- C. Do not install ducts or other equipment above electrical switchboards or panelboards. This includes a dedicated space extending 25 feet from the floor to the structural ceiling with width and depth equal to the electrical equipment. Unless intended to serve these rooms, do not install any ductwork or equipment in electrical rooms, transformer rooms, electrical closets, telephone rooms or elevator machine rooms.
- D. During construction provide temporary closures of metal or taped polyethylene on open ducts to prevent dust from entering ductwork.
- E. Repair all duct insulation and liner tears.

- F. Install manual volume dampers in branch supply ducts so all outlets can be adjusted. Do not install dampers at air terminal device or in outlets, unless specifically shown.
- G. Install flexible duct in accordance with the ADC Flexible Duct Performance and Installation Standards.
- H. Flexible duct shall NOT be joined to flat-oval connections. Provide sheet metal oval-to-round transitions where required, to include, but not limited to, all connections to air inlets, air outlets, and terminal air boxes.
- I. Install all exterior ductwork per SMACNA Fig. 6-3. Where drawings do not indicate otherwise, ductwork seams and joints shall be sealed watertight and pitched to shed water.
- J. Support all duct systems in accordance with the SMACNA HVAC Duct Construction Standards: Metal and Flexible and the SMACNA Seismic Restraint Manual: Guidelines for Mechanical Systems, where applicable. Refer to Section 23 05 50 for seismic requirements.
- K. Install ducts with hangers and braces designed to withstand, without damage to equipment, seismic force required by California Building Codes.
- L. Adhesives, sealants, tapes, vapor retarders, films, and other supplementary materials added to ducts, plenums, housing panels, silencers, etc. shall have flame spread/smoke developed ratings of under 25/50 per ASTM E84, NFPA 255, or UL 723.
- M. All duct support shall extend directly to building structure. Do not support ductwork from pipe hangers. Do not allow lighting or ceiling supports to be hung from ductwork or ductwork supports.
- N. Kitchen Grease:
 - 1. All kitchen grease shall be installed with a continuous slope and grease tight welds on all seams and joints.

3.2 DUCTWORK APPLICATION SCHEDULE

USAGE	MATERIAL	PRESSURE CLASS	SEAL CLASS †	INSULATION (Refer to Section 23 07 13 for insulation types) ±
Constant Volume and Variable Air Volume (VAV) from Fan to Outlet	Galvanized Sheet Metal - Rectangular	+2"	A	1-1/2" thick Type A (R=4.5)
Constant Volume and Variable Air Volume (VAV) from Fan to Outlet	Galvanized Sheet Metal - Round	+2"	A	1-1/2" thick Type A (R=4.5)
Return Duct	Galvanized Sheet Metal	-2"	A	1-1/2" thick Type A (R=4.5)
Exterior Return Duct	Galvanized Sheet Metal	-2"	A	2" thick Type C (R=8.0)
General Exhaust Duct	Galvanized Sheet Metal	-1"	A	None
Grease Exhaust Duct	Refer to "Grease Exhaust Duct"	-2"	---	1-1/2" thick Type F (2 layers)
Fume Exhaust Duct	Refer to "Fume Exhaust Duct"	---	---	1-1/2" thick Type A (R=4.5)
Transfer Ducts	Galvanized Sheet Metal	-1/2"	---	1" thick Type C (R=3.6)

USAGE	MATERIAL	PRESSURE CLASS	SEAL CLASS †	INSULATION (Refer to Section 23 07 13 for insulation types) ±
Ductwork Accessories (Fabric Flex Connectors, Equipment Flanges, etc.)	---	---	---	1-1/2" thick Type A (R=4.5)
Linear Diffuser Supply Plenum	-	-	-	1" thick Type C (R=4.2)
† Seal Class is per SMACNA HVAC Air Duct Leakage Test Manual ± Type A insulation (Flexible Fiberglass Wrap) R-values noted are based on installed values (25% compression).				

3.3 DUCTWORK SEALING

A. General Requirements:

1. Openings, such as rotating shafts, shall be sealed with bushings or similar.
2. Pressure sensitive tape shall not be used as the primary sealant unless it has been certified to comply with UL-181A or UL-181B by an independent testing laboratory and the tape is used in accordance with that certification.
3. All connections shall be sealed including, but not limited to, taps, other branch connections, access doors, access panels, and duct connections to equipment. Sealing that would void product listings is not required. Spiral lock seams need not be sealed.
4. Mastic-based duct sealants shall be applied to joints and seams in minimum 3 inch wide by 20 mil thick bands using brush, putty knife, trowel, or spray, unless manufacturer's data sheet specifies other application methods or requirements.

- B. For Seal Class A ducts, all transverse joints, longitudinal seams, and duct wall penetrations shall be sealed. Joints are inclusive of, but not limited to, girth joints, branch and sub-branch intersections, duct collar tap-ins, fitting subsections, louver and air terminal connections to ducts, access door and access panel frames and jambs, duct, plenum, and casing abutments to building structures.

3.4 TESTING

A. Duct - 2" WG or Less (positive or negative):

1. Systems shall not leak more than shown in Table 4-1 of SMACNA HVAC Air Duct Leakage Test Manual for Seal Class A.
2. Leak testing of these systems is not normally required for interior ductwork. However, leak tests will be required if, in the opinion of the Architect/Engineer, the leakage appears excessive. All exterior ductwork shall be tested. If duct has outside wrap, testing shall be done before it is applied.
3. Leak test shall be at the Contractor's expense and shall require capping and sealing all openings.
4. Seal ducts to bring the air leakage into compliance.
5. Contractor shall notify the Architect/Engineer five business days prior to pressurizing ductwork for testing.

B. Fume Exhaust Duct:

1. Testing shall be done before any exterior insulation is applied.
2. Cap each exhaust system at all inlets and at the discharge to atmosphere. Fans, dampers and flexible connections shall be included in the testing.
3. Pressurize each duct system to 7" water column. Leakage shall not exceed 4 cfm regardless of system size.
4. Where several fans discharge into a large collection duct, the collection duct and each individual exhaust duct may be treated as separate systems.

C. Grease Exhaust Duct:

1. A light test shall be performed by passing a lamp having a power rating of not less than 100 watts through the entire section of ductwork to be tested. The lamp shall be open to emit light equally in all four directions.
2. Testing of the entire exhaust duct system including the hood-to-duct connection shall be performed. Ductwork shall be permitted to be tested in sections provided every joint is tested.
3. Leakage testing shall occur prior to use or concealment of the duct system. Ducts shall be considered concealed where installed in shafts or covered by insulation or wrap that prevents ductwork from being visibly inspected on all sides. The test shall be performed in the presence of the code official.

3.5 DUCTWORK PENETRATIONS

- A. All duct penetrations of firewalls shall have fire or fire/smoke dampers where required by code.
- B. Dampers shall be compatible with fire rating of wall assembly. Verify actual rating of any wall being penetrated with Architect/Engineer.
- C. Seal all duct penetrations of walls that are not fire rated by caulking or packing with fiberglass. Install galvanized steel (unless otherwise indicated) trim strip to cover vacant space and raw construction edges of all rectangular openings in finished rooms.

3.6 ACOUSTICAL LAGGING

- A. Where indicated on drawings, completely wrap ductwork with lagging and seal all joints airtight with tape recommended by the lagging manufacturer to prevent acoustical leakage at joints. Overlap lagging 2" at any wall, floor, or structural deck penetration to prevent acoustical leakage.

3.7 PAINTING

- A. Paint interior of ducts black within twice the largest duct dimension of inlets and outlets where interior of duct is visible.

END OF SECTION

SECTION 23 33 00

DUCTWORK ACCESSORIES

1. PART GENERAL

1.1 SECTION INCLUDES

- A. Manual Volume Dampers.
- B. Fire/Smoke Dampers.
- C. Backdraft Dampers.
- D. Fabric Connectors.
- E. Drip Pans.
- F. Duct Access Doors.
- G. Duct Test Holes.
- H. Duct Silencers.
- I. Remote Volume Control Devices.

1.2 SUBMITTALS

- A. Submit shop drawings under provisions of Section 23 05 00.
- B. Submit manufacturer's installation instructions.
- C. Include UL ratings, California State Fire Marshal approval and NFPA 90A, dynamic ratings, leakage, pressure drop and maximum pressure data.
- D. Submit certification that ductwork accessories will withstand seismic forces defined in Section 23 05 50. Include the following:
 - 1. Basis for Certification: Indicate whether certification is based on actual test of assembled components or on calculation.
 - a. The term "withstand" means "the unit will remain in place without separation of any parts from the device when subjected to the seismic forces specified."
 - 2. Dimensioned Outline Drawings of Equipment Unit: Identify center of gravity and locate and describe mounting and anchorage provisions.
 - 3. Detailed description of equipment anchorage devices on which the certification is based and their installation requirements.
- E. Manufacturer shall provide special seismic certification per OSHPD CAN 2-1708a.5 with submittal. Submittals without certification will be returned and not reviewed.

2. PART PRODUCTS

2.1 MANUAL VOLUME DAMPERS

- A. Fabricate in accordance with SMACNA Duct Construction Standards, and as indicated.
- B. Fabricate single blade dampers for duct sizes to 9-1/2 x 30 inches.
- C. Fabricate multi-blade damper of opposed blade pattern with maximum blade sizes 12" x 72". Assemble center and edge crimped blades in prime coated or galvanized channel frame with suitable hardware.

- D. Except in round ductwork 12 inches and smaller, provide end bearings. On multiple blade dampers, provide molded synthetic or oil-impregnated nylon or sintered bronze bearings.
- E. Provide locking quadrant regulators on single and multi-blade dampers.
- F. On insulated ducts, mount quadrant regulators on stand-off mounting brackets, bases, or adapters.
- G. If blades are in open position and extend into the main duct, mount damper so blades are parallel to airflow.

2.2 FIRE/SMOKE DAMPERS (FSD)

- A. Furnish and install California State Fire Marshal approved combination smoke/fire dampers where shown on plans. The units shall incorporate a low friction design that provides overlapping. The blade edge seals shall be silicone and provide a minimum Class 2 seal at 350°F as per UL 555S. The damper shall be capable of being remotely controlled and reset for pressurization and smoke evacuation. The fire releasing device shall be a UL 33 listed HS10. Provide PI50 end switch and wire to RCP-1 (remote control panel) mounted on ceiling below respective fire smoke damper. The fire releasing device must also be listed by the CSFM for use with the damper assembly. Melting fusible links are not acceptable. The dampers shall be provided in sleeves with pre-mounted motor actuators and dual position indicators for remote annunciation. The damper must be able to fail open or close for smoke, depending on the system requirements. The motors must be FSLF120 Belimo, and both damper and motor are to have a minimum 5-year warranty. The motors must be mounted on a bracket that allows for use of slip joint connections or "Duct-mate" type connections without modification. Provide Belimo Air Controls FSNF 120 actuator. Actuator operating time shall be 15 seconds or less to drive open or spring closed from 32°F to 350°F and have UL 555S listing. Actuator shall draw no more than 27 VA running or 10 VA holding for 70 inch/# torque. Actuator shall carry a manufacturer's 5-year warranty. Motor must reopen damper fully even if power failed for less than 2 seconds. Inexpensive stall motors will not be accepted. The complete assembly must be factory cycled and tested prior to shipment. Provide suitable access for inspection and servicing of each damper. All smoke/fire dampers shall be tested by the Contractor in the presence of the field inspector and the State Fire Marshal. This test shall be performed prior to the installation of the ceilings.
- B. Where dampers are located in aluminum or stainless steel duct, provide stainless steel dampers.
- C. FSD shall be held open by electric resettable link rated at 165°F unless otherwise called for on the drawings or by local codes.
- D. Dampers shall be rated for at least 20,000 complete cycles.
- E. Locate access door in ductwork for visual inspection and on the latch side to replace link easily. Each access door shall have a label with letters at least 1/2" high reading "FIRE DAMPER".
- F. All operators shall be located with easy access for servicing.
- G. Dampers shall be installed in sleeves of sufficient thickness to comply with the UL555 Standard for Safety Fire Dampers listing of the damper. Where UL555 permits sleeve thickness to be the same as that of the duct gauge, such thickness shall not be less than that specified in NFPA 90A for breakaway style sleeves. If a breakaway style duct/sleeve connection is not used, the sleeve shall be a minimum of 16 gauge for dampers up to 36" wide by 24" high and 14 gauge for dampers exceeding 36" wide by 24" high. Damper sleeve shall not extend more than 6" beyond the firewall or partition unless damper is equipped with an actuator or factory installed access door. Sleeve may extend up to 16" beyond the firewall or partition on sides equipped with the actuator or factory installed access door.
- H. FSD shall be held open by 120V single phase operator. Motors shall be direct coupled gear type with power open and spring return. Torque type (stall) motors are not acceptable. Wiring by Electrical Contractor.

- I. Damper shall have airfoil type blades and the static pressure drop shall not exceed 0.15" at 2,000 FPM in a 24" x 24" damper.
- J. Contractor to field verify actuator installation and clearance requirements prior to ordering. Actuator should not be taller than duct height. Rotate or turn over the actuator if this is the case.

2.3 BACKDRAFT DAMPERS

- A. Gravity backdraft dampers, size 18 inches x 18 inches or smaller, furnished with air moving equipment, may be air moving equipment manufacturer's standard construction.
- B. Fabricate multi-blade, parallel action gravity balanced backdraft dampers of extruded aluminum, with blades of maximum 6 inch width, with felt or flexible vinyl sealed edges, linked together in rattle-free manner with 90° stop, and plated steel pivot pin; adjustment device to permit setting for varying differential static pressure.
- C. Acceptable Models: Ruskin CBD4, Arrow 655, Safe-Air/Dowco BRL, Greenheck EM.

2.4 FABRIC CONNECTORS

- A. Fabric connectors shall be installed between all fans or fan units and metal ducts or casings to prevent transfer of fan or motor vibration.
- B. The fabric connectors shall be completely flexible material which shall be in folds and not drawn tight.
- C. Fabric connectors shall be of glass fabric double coated with neoprene, with UL approval. Weight = 30 oz. per square yard minimum. Fabric shall not be affected by mildew and shall be absolutely waterproof, airtight and resistant to acids, alkalis, grease and gasoline, and shall be noncombustible.
- D. Fabric connections shall not exceed 6" in length on ductwork that has a positive pressure. On ductwork that has a negative pressure, the length shall not exceed 2" in length.
- E. All corners shall be folded, sealed with mastic and stapled on 1" centers.
- F. Fabric connectors shall not be painted.
- G. Unless otherwise shown on the drawings, the fabric connection at the inlet to centrifugal fans shall be at least one duct diameter from the fan to prevent inlet turbulence.
- H. Acceptable Materials: Durodyne MFN-4-100, Vent Fabrics, Inc. "Ventglas", or Proflex PFC3NGA.
- I. Fabric connectors exposed to sunlight and weather shall be as described above, except the coating shall be hypalon in lieu of neoprene.
- J. Acceptable Materials: Durodyne "Duralon MFD-4-100", Vent Fabrics, Inc. "Ventlon", or Proflex PFC3HGA.

2.5 DRIP PANS

- A. Install drip pans under all rooftop exhaust fans, intake hoods, exhaust hoods and other roof penetrations that do not have ductwork below them to intercept dripping water.
- B. Drip pans shall be 22 gauge minimum cross-broken or reinforced sheet metal with 2" welded upturned lips.
- C. Pans shall extend 6" in all directions beyond the opening and shall have the top of the lip located 25% of the maximum throat dimension below the opening.

- D. Insulate interior of drip pan with 1" thick elastomeric foam insulation. Adhere foam to drip pan with standard foam adhesive.

2.6 DUCT ACCESS DOORS

- A. Fabricate per Fig. 7-2 and 7-3 of the SMACNA HVAC Duct Construction Standards and as indicated.
- B. Review locations prior to fabrication. Install access doors at fire dampers, smoke dampers, motorized dampers, fan bearings, filters, automatic controls, humidifiers, louvers, duct coils and other equipment requiring service inside the duct.
- C. Construction shall be suitable for the pressure class of the duct. Fabricate rigid, airtight, and close-fitting doors of materials identical to adjacent ductwork with sealing gaskets butt or piano hinges, and quick fastening locking devices. For insulated ductwork, install minimum one inch thick insulation with sheet metal cover.
- D. Access doors with sheet metal screw fasteners are not acceptable.
- E. Minimum size for access doors shall be 24" x16" or full duct size, whichever is less.
- F. Provide quantity of access doors such that two hands can fit inside ductwork to manually reset fire dampers. This will typically require one access door on the bottom and one access door on an accessible side of the duct for sizes 12x12 and smaller.

2.7 GREASE DUCT ACCESS DOORS

- A. Provide pre-fabricated and pre-insulated duct access doors by the same manufacturer as the fire resistive duct wrap.

2.8 DUCT TEST HOLES

- A. Cut or drill temporary test holes in ducts as required. Cap with neat patches, neoprene plugs, threaded plugs, or threaded or twist-on metal caps.

2.9 DUCT SILENCERS

- A. Straight Silencer
 - 1. All silencers shall be factory fabricated by the same manufacturer, except that 'No-Loss' silencers (thicker than normal double-wall ducts) may be Contractor fabricated.
 - 2. Duct silencers shall have length, air pressure drop, and self-generated sound ratings not to exceed the values scheduled on the drawings. Dynamic insertion ratings shall not be less than those scheduled on the drawings. Silencer inlet and outlet dimensions must match the sizes on the drawings. Transitions are not acceptable unless shown on the drawings.
 - 3. All silencer ratings shall be determined in accordance with the ASTM E477-06a test standard. The test set-up, procedure and facility shall eliminate all effects due to flanking, directivity, end reflection, standing waves and reverberation room absorption.
 - 4. Silencers shall be constructed of galvanized steel, have 26 gauge minimum perforated interior (22 gauge for transitional silencers), be able to withstand 8" of positive and 4" of negative pressure, and shall have inorganic, bacteria, and fungus resistant glass fiber filler with not less than 5% compression. Silencers shall meet SMACNA standards for the duct pressure class specified.
 - 5. Fiberglass cloth or other scheduled liners shall completely separate the media from the airstream. No-media silencers shall not contain absorptive packing of any kind.

6. Silencers shall not exceed 25/50 flame spread/smoke developed per ASTM E84, NFPA 255, or UL 723.
7. Acceptable Manufacturers: Vibro-Acoustics, VAW, United McGill, Semco, Ruskin Sound Control (Rink), Dynasonics, Price. All silencers shall be by the same manufacturer.

B. Elbow Silencer

1. All silencers shall be factory fabricated by the same manufacturer, except that 'No-Loss' silencers (thicker than normal double-wall ducts) may be Contractor fabricated.
2. Duct silencers shall have length, air pressure drop, and self-generated sound ratings not to exceed the values scheduled on the drawings. Dynamic insertion ratings shall not be less than those scheduled on the drawings. Silencer inlet and outlet dimensions must match the sizes on the drawings. Transitions are not acceptable unless shown on the drawings
3. All silencer ratings shall be determined in accordance with the ASTM E477-06a test standard. The test set-up, procedure and facility shall eliminate all effects due to flanking, directivity, end reflection, standing waves and reverberation room absorption.
4. Silencers shall be constructed of galvanized steel with an 18 gauge galvanized steel outer casing and 22 gauge galvanized perforated steel. All acoustical splitters shall be internally radiused and aerodynamically designed for efficient turning of the air. Half and full splitters are required as necessary to achieve the scheduled insertion loss. All elbow silencers with a turning cross-section dimension greater than 48 shall have at least two half splitters and one full splitter. Silencers shall be able to withstand 8" of positive and 4" of negative pressure, and shall have inorganic, bacteria, and fungus resistant glass fiber filler with not less than 5% compression. Silencers shall meet SMACNA standards for the duct pressure class specified.
5. Fiberglass cloth or other scheduled liners shall completely separate the media from the airstream. No-media silencers shall not contain absorptive packing of any kind.
6. Silencers shall not exceed 25/50 flame spread/smoke developed per ASTM E84, NFPA 255, or UL 723.
7. Acceptable Manufacturers: Vibro-Acoustics, VAW, United McGill, Semco, Ruskin Sound Control (Rink), Dynasonics, Price. All silencers shall be by the same manufacturer.

2.10 REMOTE VOLUME CONTROL DEVICES

- A. Volume control devices shall be supplied with either miter gears or right angle worm gears. Provide all damper shafts, gearboxes, couplings, U-joints, bearings, shafts, offsets, adapters, and adjustable concealed covers as required.
- B. When distances, angles, or offsets prevent installing solid rods, the cable control system may be utilized. Provide all damper shafts, rack and pinion gear operator, cables and sleeves, and adjustable ceiling mounting cups.
- C. Acceptable Manufacturers: Young Regulator Company, Metropolitan Air Technology.

2.11 DUCTWORK ACCESSORY SEALANTS

- A. Ductwork accessory sealants and adhesives shall conform to Section 23 31 00.
- B. Adhesives and Sealants: All sealers, adhesives, and sealants shall comply with the low emitting material limits of the following standards:
 1. CDPH Standard Method V1.1-2010 - Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions VOC from Indoor Sources Using Environmental Chambers Version 1.1.

2. South Coast Air Quality Management District Rule 1168 – Adhesive and Sealant Applications. All adhesives and sealants wet-applied on site shall comply with the applicable chemical content requirements of SCAQMD Rule 1168.
3. South Coast Air Quality Management District Rule SCAQMD 1113 – Wet Applied Paints and Coatings. All paints and coatings wet-applied on site must meet the applicable VOC limits of SCAQMD Rule 1113.

3. PART EXECUTION

3.1 INSTALLATION

A. General Installation Requirements:

1. Install accessories in accordance with manufacturer's instructions.
2. Where duct access doors are located above inaccessible ceilings, provide ceiling access doors. Coordinate location with the Architect/Engineer.
3. Coordinate and install access doors provided by others.
4. Provide access doors for all equipment requiring maintenance or adjustment above an inaccessible ceiling. Minimum size shall be 24" x 24".
5. Grease duct access doors shall be installed per approvals from manufacturer's ICC-ES Evaluation Report.
6. Provide duct test holes where indicated and as required for testing and balancing purposes.

B. Manual Volume Damper:

1. Provide manual volume dampers at points on low pressure supply, return, and exhaust systems where branches are taken from larger ducts where indicated on drawings and as required for air balancing.
2. Provide ceiling access doors for manual volume dampers. When manual volume dampers are located above an inaccessible ceiling and an access door cannot be installed, provide a remote-controlled volume control device for operation of the damper. Coordinate location with the Architect/Engineer.

C. Fire Smoke Damper:

1. Provide combination fire and smoke dampers at locations indicated, where ducts and outlets pass through fire rated components, and where required by authorities having jurisdiction. Install with required perimeter mounting angles, sleeves and duct connections.
2. Provide ceiling access doors for smoke and/or fire dampers. Coordinate location with the Architect/Engineer.
3. Demonstrate resetting of fire dampers to authorities having jurisdiction and Owner's representative.
4. At combination fire smoke damper where duct is:
 - a. Internally insulated, exterior duct wrap shall be installed from the wall out to 1 foot from the wall. All edges shall be taped.
 - b. Externally insulated, the exterior duct wrap shall extend up to the wall.

D. Drain Pan:

1. Drain pans shall be installed per ASHRAE 62.1.
 - a. All drain pans shall be field tested under normal operating conditions to ensure proper drainage.
 - b. Field testing of drain pans is not required if units with factory installed drain pans have been certified (attested in writing) by the manufacturer for proper operation when installed as recommended.

END OF SECTION

SECTION 23 34 16

CENTRIFUGAL FANS

1. PART GENERAL

1.1 SECTION INCLUDES

- A. Fume Exhaust Fans.

1.2 QUALITY ASSURANCE

- A. Sound Ratings: Bear the AMCA Certified Rating Seal - Sound and Air Performance.
- B. Fabrication: Conform to AMCA 99.

1.3 SUBMITTALS

- A. Submit shop drawings per Section 23 05 00. Include all centrifugal fans and accessories. Provide fan curves with specified operating point clearly plotted. Submit sound power levels for both fan inlet and outlet at rated capacity. Submit motor ratings and electrical characteristics, plus motor and electrical accessories.
- B. Submit operation and maintenance data. Include instructions for lubrication, motor and drive replacement, and spare parts list.
- C. Submit certification that centrifugal fans, accessories, and components will withstand seismic forces defined in Section 23 05 50. Include the following:
 - 1. Basis for Certification: Indicate whether certification is based on actual test of assembled components or on calculation.
 - a. The term "withstand" means "the unit will remain in place without separation of any parts from the device when subjected to the seismic forces specified."
 - 2. Dimensioned Outline Drawings of Equipment Unit: Identify center of gravity and locate and describe mounting and anchorage provisions.
 - 3. Detailed description of equipment anchorage devices on which the certification is based and their installation requirements.
- D. For Connection to Structural:
 - 1. Structural calculations performed, prepared and signed by a State of California registered Structural Engineer.

1.4 EXTRA STOCK

- A. Provide one extra belt set for each fan unit.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Protect motors, shafts, and bearings from weather and construction dust.

2. PART PRODUCTS

2.1 FUME EXHAUST FAN

- A. Heavy gauge steel all welded construction with corrosion coating (all metal).
- B. Suitable for exhaust streams from -40° to +200°F and ambient temperatures from -40° to +120°F.
- C. Belts and sheaves sized for a minimum 1.3 of motor horsepower.
- D. Motor per the drawings and Section 23 05 13.
- E. AMCA Type B spark resistant construction including aluminum wheel and non-ferrous shaft closure plate.
- F. Regreasable bearings rated for 100,000 hour L-10 life at specified operating point.
- G. Heavy-duty gas-tight shaft seals.
- H. A high velocity conical discharge nozzle shall be supplied by the fan manufacturer. Discharge nozzles shall be steel with corrosion resistant coating or chemical resistant medium density polyethylene with UV inhibitors to prevent chalking and have smooth interior surfaces. Discharge stack caps or hinged covers, impeding exhaust flow shall not be permitted.
- I. Backward inclined airfoil wheels suitable for handling fumes and gases at minimum noise levels, or backward inclined flat blades suitable for handling particulates. Refer to drawings for type required.
- J. Furnish factory mounted and wired disconnect switch, non-fusible type with thermal overload protection in a NEMA 3R enclosure.
- K. All steel fan and system components (Fan, Nozzle, and Windband) and all surfaces in contact with the airstream shall be cleaned and chemically prepared for coating. The coating shall include zinc rich epoxy primer (no less than 70% zinc) powder coat, and a second powder coat of polyester resin. Coat entire face of all flanges and entire length of inlet collars on both sides.
- L. Positive screw-type belt tensioning mechanism.
- M. Factory tested before shipment.
- N. Belt guards with tachometer knockouts on indoor fans. Removable weather covers on outdoor fans.
- O. 1" drain connections in housing bottoms.
- P. A bolted and gasketed access door shall be supplied in the fan housing.
- Q. Acceptable Products: Greenheck 'Vektor-H', Cook, Twin City.

3. PART EXECUTION

3.1 INSTALLATION

- A. General Installation Requirements:
 - 1. Do not operate fans for any purpose until ductwork is clean, filters are in place, bearings lubricated, and fan has been test run under observation.

END OF SECTION

SECTION 23 34 23

POWER VENTILATORS

1. PART GENERAL

1.1 SECTION INCLUDES

- A. Roof Exhaust Fans.
- B. Rooftop Fan Curbs.
- C. Room Exhaust Fan.
- D. HVLS (High Volume Low Speed) Ceiling Fans.

1.2 QUALITY ASSURANCE

- A. Performance Ratings: Conform to AMCA 210 and bear AMCA Certified Rating Seal.
- B. Sound Ratings: AMCA 301, tested to AMCA 300.
- C. Fabrication: Conform to AMCA 99.

1.3 SUBMITTALS

- A. Submit shop drawings per Section 23 05 00. Include product data on wall and roof exhausters, and ceiling and cabinet fans.
- B. Provide multi-rpm fan curves with specified operating point clearly plotted.
- C. Submit manufacturer's installation instructions.
- D. Submit electrical power/controls wiring diagrams and product data indicating general assembly, components, safety controls, and service connections.
- E. Submit certification that power ventilators, accessories, and components will withstand seismic forces defined in Section 23 05 50. Include the following:
 - 1. Basis for Certification: Indicate whether certification is based on actual test of assembled components or on calculation.
 - a. The term "withstand" means "the unit will remain in place without separation of any parts from the device when subjected to the seismic forces specified."
 - 2. Dimensioned Outline Drawings of Equipment Unit: Identify center of gravity and locate and describe mounting and anchorage provisions.
 - 3. Detailed description of equipment anchorage devices on which the certification is based and their installation requirements.
- F. Manufacturer shall provide special seismic certification per OSHPD CAN 2-1708a.5 with submittal. Submittals without certification will be returned and not reviewed.

1.4 EXTRA STOCK

- A. Provide one (1) extra belt set for each fan unit.

2. PART PRODUCTS

2.1 ROOFTOP EXHAUST FAN - BELT DRIVEN

- A. Fan Wheel: Centrifugal type, aluminum hub and wheel with backward inclined blades, statically and dynamically balanced.
- B. Housing: Removable, spun aluminum dome or rectangular top, with square, one piece, aluminum base and curb cap with Venturi inlet cone.
- C. Fan Shaft: Turned, ground and polished steel; keyed to wheel hub.
- D. All steel parts galvanized or epoxy coated. Non-corrosive fasteners.
- E. V-belt drive with adjustable pitch drive sheave and adjustable motor mountings for belt tensioning.
- F. Motor mounted outside of air stream and ventilated with outside air. Motor not less than 1/3 HP.
- G. Aluminum or brass bird screen. Plastic mesh will not be allowed.
- H. Disconnect provided by Electrical Contractor.
- I. Furnish normally closed, electric motorized damper. Provide step down transformer if required. Install and wire damper to open when fan runs.
- J. Dampers shall be aluminum with brass bushings, blade seals and blade tie rods. Leakage shall not exceed 4 cfm/sq.ft @1" SP (or shall be AMCA Class 1 certified).
- K. Mill aluminum finish.
- L. Permanently lubricated, permanently sealed, self-aligning ball bearings.
- M. Acceptable Manufacturers: Greenheck (Basis of Design), PennBarry, or Fantech.

2.2 ROOFTOP EXHAUST FAN - DIRECT DRIVEN

- A. Fan Wheel: Centrifugal type, aluminum hub and wheel with backward inclined blades, statically and dynamically balanced.
- B. Housing: Removable, spun aluminum dome or rectangular top, with square, one piece, aluminum base and curb cap with Venturi inlet cone.
- C. Fan Shaft: Turned, ground and polished steel; keyed to wheel hub.
- D. All steel parts galvanized or epoxy coated. Non-corrosive fasteners.
- E. Direct drive, motor mounted outside of air stream and ventilated with outside air.
- F. Aluminum or brass bird screen. Plastic mesh will not be allowed.
- G. Disconnect provided by Electrical Contractor.
- H. Furnish solid-state dial speed controller. Mount and wire inside fan unless shown otherwise on the drawings. Provide permanent marking at balanced point.
- I. Furnish normally closed, electric motorized damper. Provide step-down transformer if required. Install and wire damper to open when fan runs.
- J. Dampers shall be aluminum with brass bushings, blade seals and blade tie rods. Leakage shall not exceed 4 cfm/sq.ft @1" SP (or shall be AMCA Class 1 certified).

- K. Mill aluminum finish.
- L. Furnish permanently lubricated sealed ball type motor and drive shaft bearings. Motor and wheel supported by vibration isolators.
- M. Acceptable Manufacturers: Greenheck (Basis of Design), PennBarry, or Fantech.

2.3 ROOFTOP FAN CURBS

- A. Furnish and install prefabricated roof curbs for all rooftop fans.
- B. Size curb to match the curb cap of fan.
- C. Top of all curbs shall be at least 12" above the top of the roof. Increase curb height to allow for roof insulation.
- D. Unitized construction, continuous arc welded corner seams. Insulated with 1-1/2" thick, 3 lb. density rigid fiberglass board. Damper support angle. Pressure treated wood nailer.
- E. If called for in the drawings, curbs shall be of the sound attenuation type. Sound attenuation curbs shall reduce the fan sone rating by at least 40% and not decrease fan cfm more than 8% (which is accounted for in the scheduled fan cfm). Baffles shall be removable for access to the dampers.
- F. 18-gauge galvanized steel construction.
- G. Curb without cant.
- H. Acceptable Manufacturers: Same manufacturer as the fan, Pate, RPS or Thy.

2.4 ROOM EXHAUST FAN

- A. Fiberglass lined sheet metal housing.
- B. Rubber torsion motor mounts.
- C. Plug type disconnect.
- D. Built-in backdraft damper.
- E. Centrifugal fan.
- F. Molded white plastic or aluminum ceiling grille.
- G. Provide variable speed controller if called for on the drawings.
- H. Acceptable Manufacturers: Greenheck (Basis of Design), PennBarry, Panasonic, Fantech.

2.5 HVLS (HIGH VOLUME LOW SPEED) - 6 OR 8-BLADE CEILING FANS (CF-2)

- A. Ceiling mounted, with enclosed motor, eight blades, and mounting accessories.
- B. Housing: Die cast aluminum with ventilation air space and permanently sealed ball bearings. Suspended with rubber isolated shackle, 3ft steel pipe, and steel yoke connection to housing. Electrostatically applied white epoxy enamel finish.
- C. Motor: Energy efficient fixed-stator with copper windings, steel laminated core, and internal thermal overload protection.
- D. Blades: Anodized airfoils matched in weight.

- E. Extension Tube: Minimum 3ft long
- F. Color: Motor housing and anodized airfoils as specified by Architect.
- G. Balance: Components balanced to prevent wobble or vibration.
- H. Accessories: Wired wall speed controller; internal automatic fire sprinkler relay. If the manufacturer does not provide relay, the supplying contractor shall include relay.
- I. Acceptable Manufacturer: Big Ass Fan – Essence, MacroAir AVD3 or AVD 370.

3. PART EXECUTION

3.1 INSTALLATION

- A. Install in accordance with manufacturer's instructions.
- B. Secure roof exhausters with cadmium plated lag screws to roof curb.
- C. If manufacturer has no recommendations, secure roof exhaust fans to curbs with 1/4" lag bolts on 8" maximum centers.
- D. MC shall install and wire factory provided damper to open when the fan runs if the manufacturer does not provide an option to pre-wire the damper.

END OF SECTION

SECTION 23 37 00

AIR INLETS AND OUTLETS

1. PART GENERAL

1.1 SECTION INCLUDES

- A. Grilles And Registers.
- B. Architectural Square Panel Diffusers.
- C. Square Stepdown Cone Diffusers.
- D. Linear Diffusers.
- E. Linear Diffuser Supply Plenum.
- F. Roof Hoods.
- G. Roof Curbs.

1.2 QUALITY ASSURANCE

- A. Test and rate performance of air inlets and outlets per ASHRAE 70.
- B. Test and rate performance of louvers per AMCA 500L-99.
- C. All air handling and distribution equipment mounted outdoors shall be designed to prevent rain intrusion into the airstream when tested at design airflow and with no airflow, using the rain test apparatus described in Section 58 of UL 1995.

1.3 SUBMITTALS

- A. Submit product data under provisions of Section 23 05 00.
- B. Submit schedule of inlets and outlets indicating type, size, location, application, and noise level.
- C. Review requirements of inlets and outlets as to size, finish, and type of mounting prior to submitting product data and schedules of inlets and outlets.
- D. Submit manufacturer's installation instructions.

1.4 REGULATORY REQUIREMENTS

- A. Conform to ANSI/NFPA 90A.
- B. Conform to ASHRAE 90.1.

1.5 EXTRA STOCK

- A. Provide clean filters in all filter return grilles at time of installation.
- B. Provide one additional set of replacement filters for all filter return grilles. Deliver to Owner at job site.

2. PART PRODUCTS

2.1 GRILLES AND REGISTERS

- A. Reference to a grille means an air supply, exhaust or transfer device without a damper.
- B. Reference to a register means an air supply, exhaust or transfer device with a damper.
- C. The type of unit, margin, material, finish, etc., shall be as shown on the drawing schedule and suitable for the intended use.

- D. All margins shall be compatible with ceiling types specified (including 'Thin-Line' T-bar lay-in grid system). Any discrepancies in contract documents shall be brought to the attention of the Architect/Engineer, in writing, prior to Bid Date. Submission of Bid indicates ceiling and air inlet and outlet types have been coordinated.
- E. The capacity and size of the unit shall be as shown on the drawings.
- F. All units shall handle the indicated cfm as shown on the drawings while not exceeding an NC level of 25, referenced to 10⁻¹² watts with a 10 dB room effect. Noise in classrooms may not exceed 35 dBA or 55 dBC per ANSI Standard S12.60-2002 and ASHRAE 70.
- G. Refer to the drawings for construction material, color and finish, margin style, deflection, and sizes of grilles and registers.
- H. Provide with 3/4" blade spacing. Blades shall have steel friction pivots to allow for blade adjustment, plastic pivots are not acceptable.
- I. Corners of steel grilles and registers shall be welded and ground smooth before painting. Aluminum grilles and registers shall have staked corners.
- J. Where specified to serve registers, provide opposed blade volume dampers operable from the face of the register.
- K. Screw holes for surface fasteners shall be countersunk for a neat appearance. Provide concealed fasteners for installation in lay-in ceilings and as specified on the drawings.
- L. Acceptable Manufacturers: Price, Titus, Krueger.

2.2 MODULAR CORE DIFFUSER

- A. Reference to a diffuser means an air supply device, ceiling mounted, that shall diffuse air uniformly throughout the conditioned space.
- B. The type of unit, margin, material, finish, etc., shall be as shown on the drawing schedule. Flat-oval inlets are not acceptable for connection to flexible ducts.
- C. All margins shall be compatible with ceiling types specified (including 'Thin-Line' T-bar lay-in grid system). Any discrepancies in contract documents should be brought to the attention of the Architect/Engineer, in writing, prior to Bid Date. Submission of Bid indicates ceiling and air inlet and outlet types have been coordinated.
- D. The capacity and size of the unit shall be as shown on the drawings.
- E. All units shall handle the indicated cfm as shown on the drawings while not exceeding an NC level of 25, referenced to 10⁻¹² watts with a 10 dB room effect. Noise in classrooms may not exceed 35 dBA or 55 dBC per ANSI Standard S12.60-2002 and ASHRAE 70.
- F. Diffusers shall be constructed of minimum 24 gauge steel.
- G. Acceptable Manufacturers: Price, Titus, Krueger.

2.3 LINEAR DIFFUSERS

- A. Plenum Slot Diffusers (Lay-In):
 - 1. The type of unit, margin size, material, finish, etc., shall be as shown on the Drawing Schedule. Flat-oval inlets are NOT acceptable for connection to flexible ducts. Provide sheet metal oval-to-round transition if required.
 - 2. The capacity and size of the unit shall be as shown on the drawings.

3. All units shall handle the indicated cfm as shown on the drawings while not exceeding an NC level of 25, referenced to 10^{-12} watts with a 10 dB room effect. Noise in classrooms may not exceed 35 dBA or 55 dBC per ANSI Standard S12.60-2002 and ASHRAE 70.
4. Install T-bars on both sides of diffusers for lay-in ceiling system, install manufacturer frame for sheetrock or plaster ceiling system. Diffuser margins system shall be compatible with ceiling types specified, color to match ceiling system. Contractor shall coordinate margin types with ceilings prior to submitting shop drawings.
5. Linear diffusers and mounting frames shall be furnished as one piece up to 5' in length.
6. Diffusers shall be furnished with factory installed adjustable "ice tong" style pattern deflectors capable of providing 180° pattern adjustment, or gasket edged blade deflector.
7. A manual volume damper shall be furnished and installed by the Contractor in branch ductwork to each slot diffuser. Balancing dampers shall not be installed in supply plenum or at air outlet unless otherwise indicated on the drawings.
8. Number and width of slots shall be as shown on the drawings.
9. Provide integral insulated plenum for each linear diffuser. Refer to linear diffuser supply plenum specification section for details.
10. Acceptable Manufacturers: Price TBD, Krueger PTBS, Titus TBD.

B. Linear Slot Diffusers (Continuous):

1. The type of unit, margin size, material, finish, etc., shall be as shown on the Drawing Schedule. Flat-oval inlets are NOT acceptable for connection to flexible ducts. Provide sheet metal oval-to-round transition if required.
2. The capacity and size of the unit shall be as shown on the drawings.
3. All units shall handle the indicated cfm as shown on the drawings while not exceeding an NC level of 25, referenced to 10^{-12} watts with a 10 dB room effect. Noise in classrooms may not exceed 35 dBA or 55 dBC per ANSI Standard S12.60-2002 and ASHRAE 70.
4. Install T-bars on both sides of diffusers for lay-in ceiling system, install manufacturer frame for sheetrock or plaster ceiling system. Diffuser margins system shall be compatible with ceiling types specified, color to match ceiling system. Contractor shall coordinate margin types with ceilings prior to submitting shop drawings.
5. Provide with concealed fasteners for installation in the field.
6. Linear diffusers and mounting frames shall be furnished as one piece up to 6' in length. Provide auxiliary support per manufacturer's recommendations for slot diffusers greater than 4' in length.
7. Diffusers shall be furnished with adjustable pattern deflectors capable of providing 180° pattern adjustment.
8. A manual volume damper shall be furnished and installed by the Contractor in branch ductwork to each slot diffuser. Balancing dampers shall not be installed in supply plenum or at air outlet unless otherwise indicated on the drawings.
9. Number and width of slots shall be as shown on the drawings.
10. Provide insulated plenum for each linear diffuser. Refer to linear diffuser supply plenum specification section for details.

11. Acceptable Manufacturers: Price SDS, Krueger 1900, Titus ML.

C. Linear Slot Diffusers (High Performance):

1. The type of unit, margin size, material, finish, etc., shall be as shown on the Drawing Schedule. Flat-oval inlets are NOT acceptable for connection to flexible ducts. Provide sheet metal oval-to-round transition if required.
2. The capacity and size of the unit shall be as shown on the drawings.
3. All units shall handle the indicated cfm as shown on the drawings while not exceeding an NC level of 25, referenced to 10^{-12} watts with a 10 dB room effect per ANSI/ASHRAE 70.
4. Install T-bars on both sides of diffusers for lay-in ceiling system, install manufacturer frame for sheetrock or plaster ceiling system. Diffuser margins system shall be compatible with ceiling types specified, color to match ceiling system. Contractor shall coordinate margin types with ceilings prior to submitting shop drawings.
5. Provide with concealed fasteners for installation in the field.
6. Linear slot diffusers and mounting frames shall be furnished as one piece up to 6' in length. Provide auxiliary support per manufacturer's recommendations for slot diffusers greater than 4' in length.
7. Diffusers shall be furnished with adjustable pattern deflectors.
8. A manual volume damper shall be furnished and installed by the Contractor in branch ductwork to each slot diffuser. Balancing dampers shall not be installed in supply plenum or at air outlet unless otherwise indicated on the drawings.
9. Number and width of slots shall be as shown on the drawings.
10. Provide insulated plenum for each linear diffuser. Refer to linear diffuser supply plenum specification section for details.
11. Acceptable Manufacturers: Price JS, Titus FL, Krueger DF.

2.4 LINEAR DIFFUSER SUPPLY PLENUM

- A. Linear diffusers shall be provided with field fabricated or prefabricated supply plenums. Plenum shall be a minimum of 2-1/2" wider than total slot width, minimum length of slot, and minimum height of 10". Plenums with end fed duct connections shall not exceed 8' in length. The cross sectional area of the plenum shall be designed for a maximum velocity of 500 fpm and the aspect ratio shall be limited to a width-to-height ratio of less than 1.5. Plenums with side outlets shall be designed for a maximum velocity of 600 fpm and inlet ducts to plenum shall be spaced 5' on center maximum. Inlet ducts to plenums shall have a maximum velocity of 900 fpm. Flat-oval inlets are NOT acceptable for connection to flexible ducts. Provide sheet metal oval-to-round transition if required.
- B. Plenum shall be constructed with 24 gauge galvanized steel and shall have side inlets unless shown otherwise on the drawings. Refer to Ductwork Application Schedule in Section 23 31 00 for insulation requirements.
- C. End caps and required accessories shall be integral with the plenum or furnished and installed by the Mechanical Contractor.
- D. A manual volume damper shall be furnished and installed by the Mechanical Contractor in branch ductwork to each slot diffuser. Balancing dampers shall not be installed in supply plenum or at air outlet unless otherwise indicated on the drawings.
- E. Prefabricated plenums shall be by the same manufacturer as the linear diffuser or Kees Inc.

2.5 ROOF HOODS

- A. Hoods shall be constructed of all-welded aluminum.
- B. Curb cap shall be of 14 gauge formed aluminum with mitered corners continuously heliarc-welded. Hood shall be of the same material and cross-broken for added strength. Underside of hood shall be coated with insulating mastics.
- C. Hoods shall be furnished with aluminum bird screen.
- D. Hood and throat shall be reinforced with extruded aluminum angle and have a minimum snow load rating of 30 lbs. per square foot.
- E. Size, cfm, finish and pressure drop for hoods shall be as scheduled on the drawings.
- F. Inlet area shall be minimum 150% of throat area for intake hoods. Outlet area shall be minimum 125% of throat area for exhaust hoods and relief vents.
- G. Hoods shall be furnished with 12" high curb (above top of roof) and be of the size and type as shown on the drawings.
- H. Hood shall be furnished with motorized damper unless otherwise noted on the drawings.
- I. Acceptable Manufacturers: Greenheck, PennBarry, Fantech.

2.6 ROOF CURBS

- A. Furnish and install, where shown on the drawings, prefabricated roof curbs for all rooftop hood openings.
- B. Curbs shall be sized to match curb cap of the hood. The top of all curbs shall be 12" above the top of the roof.
- C. Curbs shall be unitized construction, 18 gauge galvanized steel, with continuous arc welded corner seams, insulated with 1-1/2" thick, 3 lb. density rigid fiberglass board and damper support angle.
- D. Curb with built-in cant with step for roof insulation.
- E. Acceptable Manufacturers: Same manufacturer as the equipment it serves or Pate, RPS, or Thy.

3. PART EXECUTION

3.1 INSTALLATION

- A. General Installation Requirements:
 - 1. Install items in accordance with manufacturers' instructions.
 - 2. Check location of inlets and outlets and make necessary adjustments in position to conform to architectural features, symmetry, and lighting arrangement.
 - 3. Install diffusers to ductwork with air tight connections.
 - 4. Flexible ducts shall NOT be joined to flat-oval connections. Provide sheet metal oval-to-round transitions where required.
 - 5. Supply grille and register blades shall be aimed in the field to provide adequate air distribution in the space. All return grilles and registers blades shall be oriented to minimize sight distance beyond installed device.

B. Volume Damper:

1. Provide manual volume dampers on duct take-off to diffusers when there are multiple connections to a common duct. Locate volume dampers as far as possible from the air inlet or outlet.

C. Roof Hood:

1. If manufacturer has no recommendations, secure roof hoods and louvered penthouses to curbs with 1/4" lag bolts on 8" maximum centers.
2. Provide 20 gauge sheet metal duct blank-off behind louvers at unused portions of louver openings in exterior walls. Back with 2" rigid 3# density fiberglass board insulation with foil scrim facing the room. Seal watertight.

END OF SECTION

SECTION 23 40 00

AIR CLEANING

1. PART GENERAL

1.1 SECTION INCLUDES

- A. Filters and Filter Media.
- B. Activated Carbon Filters.
- C. Filter Frames.
- D. Filter Gauges.

1.2 QUALITY ASSURANCE

- A. Filter media shall be tested under ANSI/UL 900 and labeled.
- B. Provide all filters and filter banks by one manufacturer.
- C. Air filters shall be State Fire Marshal approved and of a listed type. Preformed filters having combustible framing shall be tested as a complete assembly. Air filters in all occupancies shall be Class 2 or better (as shown in the State Fire Marshal listing). Air filters shall be accessible for cleaning or replacement.

1.3 EXTRA STOCK

- A. Provide a total of three (3) sets of filters for all units.
 - 1. Provide clean filters in all units at time of installation.
 - 2. Provide clean filters in all units at project final completion after all interior finishes are complete.
 - 3. Provide one additional set of replacement filters for all units. Deliver to Owner at job site.

2. PART PRODUCTS

2.1 MEDIUM EFFICIENCY - DISPOSABLE - TYPE D

- A. Non-woven cotton fabric, pleated media, disposable type with welded wire grid support bonded to the filter media.
- B. Heavy duty, paper board frame with diagonal support members bonded to inlet and exit sides of each pleat. Bond frame to media periphery to eliminate air bypass.
- C. 2" thick media with at least 4.6 square feet of media per square foot of face area. Maximum initial resistance of 0.30" WG at 500 fpm face velocity.
- D. 25-30% efficiency and 90-92% arrestance per ASHRAE 52.1 or MERV 8 per ASHRAE 52.2.

2.2 FILTER GAUGES

- A. Inclined Manometer: One-piece molded plastic with epoxy coated aluminum scale, inclined-vertical indicating tube and built-in spirit level, 0-2" WG range, 3% of full scale accuracy.
- B. Accessories: Static pressure tips with integral compression fittings, 1/4" plastic tubing, 2- or 3-way vent valves, indicating fluid.

- C. Acceptable Manufacturers: Dwyer "Mark II", Meriam Instrument.
- D. Accessories: Static pressure tips with integral compression fittings and 1/8" NPT plastic tubing.
- E. Acceptable Manufacturers: Dwyer "Minihelic II" 2-5000, Marshalltown Instrument "Series 85C".

2.3 HIGH EFFICIENCY FILTER TEST HOLE

- A. 1-1/2" gasketed instrument type test hole with heavy screw cap.
- B. Acceptable Manufacturers: Ventlok 699 or equivalent.

3. PART EXECUTION

3.1 INSTALLATION

- A. Install all products per manufacturers' instructions.
- B. Seal filter media to prevent passage of unfiltered air around filters with felt, rubber, or neoprene gaskets.
- C. Do not operate fan systems without filters.
- D. Install static pressure tips upstream and downstream of filters. Mount filter gauges on outside of filter housing or filter plenum, in accessible position. Adjust and calibrate. Every filter bank, including packaged units, shall have a filter gauge.

END OF SECTION

SECTION 23 74 11

PACKAGED ROOFTOP AIR CONDITIONING UNITS

1. PART GENERAL

1.1 SECTION INCLUDES

- A. Packaged Rooftop Unit.
- B. Unit Controls.
- C. Roof Mounting Frame and Base.
- D. Economizers.
- E. Power Exhaust.

1.2 QUALITY ASSURANCE

- A. All insulation inside the unit and in the air stream must comply with the requirement of NFPA 90A (maximum flame spread of 25 and maximum smoke developed of 50).
- B. All units must be UL or ETL listed and must contain UL labeled components.
- C. Fans shall be tested and rated in cabinet in accordance with AMCA Standard 210. All fan assemblies shall be dynamically balanced in cabinet at final assembly.
- D. Conform to ASHRAE 90.1.
- E. All air handling and distribution equipment mounted outdoors shall be designed to prevent rain intrusion into the airstream when tested at design airflow and with no airflow, using the rain test apparatus described in Section 58 of UL 1995.

1.3 SUBMITTALS

- A. Submit shop drawings and product data under provisions of Section 23 05 00.
- B. Indicate electrical service and duct connections on shop drawings or product data.
- C. Submit manufacturer's installation instructions.
- D. Submit electrical power/controls wiring diagrams and product data indicating general assembly, components, safety controls, and service connections.
- E. Submit certification that the packaged rooftop air conditioning units, accessories, and components will withstand seismic forces defined in Section 23 05 50. Include the following:
 - 1. Basis for Certification: Indicate whether certification is based on actual test of assembled components or on calculation.
 - a. The term "withstand" means "the unit will remain in place without separation of any parts from the device when subjected to the seismic forces specified."
 - 2. Dimensioned Outline Drawings of Equipment Unit: Identify center of gravity and locate and describe mounting and anchorage provisions.
 - 3. Detailed description of equipment anchorage devices on which the certification is based and their installation requirements.
- F. Manufacturer shall provide special seismic certification per OSHPD CAN 2-1708a.5 with submittal. Submittals without certification will be returned and not reviewed.

1.4 DELIVERY, STORAGE, AND HANDLING

- A. Protect units from physical damage by storing off site until roof mounting frames are in place, ready for immediate installation of units.

1.5 OPERATION AND MAINTENANCE DATA

- A. Submit operation and maintenance data.
- B. Include manufacturer's descriptive literature, installation instructions, maintenance and repair data, and parts listing.

1.6 WARRANTY

- A. Provide five (5) year manufacturer's warranty for compressors.
- B. Provide five (5) year manufacturer's warranty for heat exchanger.
- C. Provide one (1) year manufacturer's warranty for parts.

1.7 MAINTENANCE SERVICE

- A. Furnish complete service and maintenance of packaged roof top units for one year from Date of Substantial Completion.
- B. Provide maintenance service with a two-month interval as maximum time period between calls. Provide 24-hour emergency service on breakdowns and malfunctions.
- C. Include maintenance items as outlined in manufacturer's operating and maintenance data, including minimum of six filter replacements, minimum of one fan belt replacement, and controls check-out, adjustments, and recalibrations.
- D. Submit copy of service call work order or report, and include description of work performed.

2. PART PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

- A. Carrier (Basis of Design)
- B. Lennox
- C. Trane

2.2 MANUFACTURED UNITS

- A. Provide roof-mounted units having gas burner, and electric refrigeration.
- B. Unit shall be self-contained, packaged, factory assembled, pre-wired and tested, consisting of cabinet and frame, supply fan, heat exchanger and burner, controls, air filters, refrigerant cooling coil and compressor, condenser coil, condenser fan, and a full refrigerant charge.
- C. Unit shall be furnished with non-fused disconnect switch, short fuse protection of all internal electrical components, and all necessary motor starters, contactors, and over-current protection.

2.3 FABRICATION

- A. Cabinet: Galvanized steel with baked enamel finish, access doors or removable access panels with quick fasteners locking door handle type with piano hinges. Access doors shall be provided at each section (e.g., filter section, supply fan section, etc.). All exterior access panels must be permanently labeled on the outside indicating what is behind the panel. Structural members shall be minimum 18 gauge, with access doors or removable panels of minimum 20 gauge.

- B. Outside Air Intakes: The outside air intakes shall be located a minimum of 15 inches above the roof mounting curb to minimize the effect of heat pickup from the roof during the natural cooling cycle and the effects of snow on the roof during winter operation. Each air intake shall be furnished with rain eliminators.
- C. Insulation: Minimum of 1/2" thick, 1.5 lb./cu.ft. density coated glass fiber insulation on surfaces where conditioned air is handled. Protect edges from erosion.
- D. Heat Exchangers: Aluminized steel, of welded construction.
- E. Air Filters: Two inch thick glass fiber disposable media in metal frames.
- F. Roof Mounting Curb: Minimum 12 inches, minimum 14 gauge galvanized steel, one-piece construction, insulated, all welded, wood nailer. Refer to Plans.

2.4 FANS/MOTORS

- A. Supply Fan: Forward curved centrifugal type, resiliently mounted with V-belt drive, adjustable variable pitch motor sheave, and rubber isolated hinge mounted motor. All fan bearings must be capable of being lubricated by easily accessible grease fittings.
- B. Belt drive fans must be within $\pm 10\%$ of scheduled RPM.
- C. All fans must be statically and dynamically balanced.
- D. Belt drive fans shall have slide rails, adjusting screws, anchor bolts, and bedplates.
- E. Motors shall be open drip-proof with grease lubricated bearings.
- F. Drives shall be V-belt type with adjustable pitch sheaves for units 20 HP and below. On units over 20 HP, use fixed sheaves. This Contractor shall provide replacement sheaves and belts as required to allow final air balancing.
- G. Units used with variable speed drives shall have fixed sheaves. This Contractor shall provide replacement sheaves and belts as required to allow final air balancing.
- H. No equipment shall be selected or operate above 90% of its motor nameplate rating.
- I. Motor shall have 1.15 service factor.

2.5 BURNER

- A. Gas Burner: Induced draft type burner with adjustable combustion air supply, pressure regulator, gas valves, manual shutoff, intermittent spark or glow coil ignition, flame sensing device, and automatic 100 percent shutoff pilot. Single stage or Two stage.
- B. Gas Burner Safety Controls: Energize ignition, limit time for establishment of flame, prevent opening of gas valve until pilot flame is proven, stop gas flow on ignition failure, energize blower motor, and after airflow proven and slight delay, allow gas valve to open.
- C. High Limit Control: Temperature sensor with fixed stop at maximum permissible setting, de-energize burner on excessive bonnet temperature and energize burner when temperature drops to lower safe value.
- D. Supply Fan Control: Temperature sensor sensing bonnet temperatures and independent of burner controls, or adjustable time delay relays with switch for continuous fan operation.

2.6 EVAPORATOR COIL

- A. Provide copper tube with aluminum fin coil assembly.

- B. Install a drain pan under each cooling coil meeting requirements as outlined in ASHRAE 62.1. The drain pans shall extend the entire width of each coil, including piping and header if in the air stream. The length shall be as necessary to limit water droplet carryover beyond the drain pan to 0.0044oz per ft² of face area per hour under peak sensible and peak dew point design conditions, considering both latent load and coil face velocity. Pitch drain pans in two directions towards the outlet, with a slope of at least 1/8" per foot.
- C. Provide capillary tubes or thermostatic expansion valves for units of 6 tons capacity and less, and thermostatic expansion valves and alternate row circuiting for units 7.5 tons cooling capacity and larger.
- D. Provide insulation on liquid refrigerant and suction piping between compressor and evaporator coil where not protected by drain pans. Insulation shall be elastomeric cellular foam; ANSI/ASTM C534; flexible plastic; 0.27 maximum 'K' value at 75°F, 25/50 flame spread/smoke developed rating when tested in accordance with ASTM E84 (UL 723). Maximum 1" thick per layer where multiple layers are specified.

2.7 COMPRESSOR

- A. Provide hermetic or semi-hermetic compressors (quantity as scheduled on drawings), 3600 rev/min maximum, resiliently mounted with positive lubrication, high and low pressure safety controls, motor overload protection, suction and discharge service valves and gauge ports, and filter drier.
- B. Five minute timed off circuit shall delay compressor start.
- C. Outdoor thermostat shall energize compressor above 50°F ambient.
- D. The use of chlorofluorocarbon (CFC)-based refrigerants is prohibited.

2.8 CONDENSER

- A. Provide copper tube aluminum fin coil assembly with sub-cooling rows.
- B. Provide direct drive propeller fans, resiliently mounted with fan guard, motor overload protection, wired to operate with compressor.
- C. Provide refrigerant pressure switches to cycle condenser fans.

2.9 MIXING SECTION

- A. Dampers: Provide outside and return, with damper operator and control package to automatically vary outside air quantity. Outside air damper shall fail to closed position.
- B. Gaskets: Provide tight fitting dampers with edge gaskets, maximum leakage 5 percent at 2 inches pressure differential. Gaskets must be mechanically fastened (use of adhesive alone shall not be acceptable).
- C. Damper Operator: 24 volt with gear train sealed in oil, with spring return on units 7.5 tons cooling capacity and larger.

2.10 ECONOMIZERS

- A. Factory installed by approved rooftop unit manufacturer with fully modulating motorized outside air and return air dampers.
- B. To be controlled by differential enthalpy controller with minimum position setting.
- C. Shall be equipped with 100% capable relief barometric damper relieving up to 100% return air and sealed to meet ASHRAE 90.1 requirements.

- D. Shall be capable of introducing up to 100% outside air.
- E. Shall maintain minimum airflow into the building during occupied period and provide design ventilation rate for full occupancy.
- F. Dampers shall be capable of completely closing when unit is in unoccupied mode.
- G. Outside air damper normally closed and return air damper normally open.
- H. Provide economizer components and controls in accordance with ICC IECC.

2.11 POWER EXHAUST

- A. Factory installed by economizer supplier or compatible equivalent.
- B. Controlled by economizer controls.
- C. Power exhaust shall be factory wired to electrical section complete with conduit, feeders, disconnect, and overcurrent protection. Power exhaust shall be energized when dampers open past the adjustable setpoint of the economizer control.
- D. Must comply with ASHRAE 90.1 Fan Power Limitation formula.

2.12 ELECTRICAL

- A. Provide with single point power connection to service all controls, dampers, outlet, and fans, complete with non-fused disconnect switch, short circuit protection of all internal electrical components, and all necessary motor starters, contactors, and over-current protection, transformer, and convenience outlet. All units must be so constructed that when the electrical section access panel is opened, all electrical power to the unit (with the exception of the 120 volt duplex convenience outlet) is disconnected by means of a single disconnect.
- B. All wiring must be labeled, numbered, and terminate in "spade clips". All terminal strips must be keyed to the wiring numbers. Each control device must be permanently labeled to indicate its function.
- C. Wiring diagrams for all circuits must be permanently affixed to the inside of the electrical section access panel. The markings of terminal strips and wiring must agree with the numbering on the wiring diagrams.
- D. All units shall include a transformer for controls and convenience outlet.
- E. Only one power cable connection to the unit shall be necessary.
- F. Provide separate power connection to power exhaust.

2.13 DDC TEMPERATURE CONTROLS

- A. Install standalone control module providing communication between unit controls and DDC temperature control system. Control module shall be compatible with temperature control system specified in Section 23 09 00.

2.14 COATINGS:

- A. Apply marine coating by certified licensed applicator.
- B. The coating product manufacturer shall be able to document a class 5B result on a cross hatch adhesion test (ASTM D5339) and the testing for a minimum 4000 hours in both salt spray (ASTM B117) and acid salt spray (ASTM G85) test.

- C. The coating service provider shall also be able to offer a 3-year conditioned warranty for coating applied on finned-tube coils.
- D. The coating shall be applied insuring total penetration and coverage without bridging or significantly affecting the heat transfer ability of the coil.
- E. The total dry film thickness of the coating shall be 1mil.
- F. The coating shall provide inherent protection against ultra-violet radiation and have a dry temperature resistance from -4°F to 302°F.
- G. The following components shall be coated:
 - 1. Evaporator coils
 - 2. Condenser coils
 - 3. Cabinet

3. PART EXECUTION

3.1 EXAMINATION

- A. Verify that roof is ready to receive work and opening dimensions are as indicated on shop drawings and illustrated by the manufacturer.
- B. Verify that proper power supply is available.

3.2 INSTALLATION

- A. Install in accordance with manufacturer's instructions.
- B. Mount units on factory built roof mounting frame providing watertight enclosure to protect ductwork and utility services. Install roof mounting frame level.
- C. All field wiring shall be in accordance with the National Electrical Code.
- D. P-traps must be provided for all drain pans.
- E. Comb all coils to repair bent fins.
- F. Install on vibration isolation as scheduled on drawings.
- G. Contractor shall coordinate unit access stair and walkway placement to ensure compliance with OSHA requirements.

3.3 MANUFACTURER'S FIELD SERVICES

- A. Provide initial start-up and shutdown during first year of operation, including routine servicing and check-out.

END OF SECTION

SECTION 23 81 26

SPLIT SYSTEM AIR CONDITIONING UNITS

1. PART GENERAL

1.1 SECTION INCLUDES

- A. Split system air conditioning wall, ceiling-mounted, and/or ceiling-concealed units.

1.2 SUBMITTALS

- A. Submit shop drawings under provisions of Section 23 05 00.
- B. Indicate drain, electrical, and refrigeration rough-in connections on shop drawings or product data.
- C. Submit manufacturer's installation instructions.
- D. Submit certification that split system air conditioning equipment, accessories, and components will withstand seismic forces defined in Section 23 05 50. Include the following:
 - 1. Basis for Certification: Indicate whether certification is based on actual test of assembled components or on calculation.
 - a. The term "withstand" means "the unit will remain in place without separation of any parts from the device when subjected to the seismic forces specified."
 - 2. Dimensioned Outline Drawings of Equipment Unit: Identify center of gravity and locate and describe mounting and anchorage provisions.
 - 3. Detailed description of equipment anchorage devices on which the certification is based and their installation requirements.
- E. Manufacturer shall provide special seismic certification per OSHPD CAN 2-1708a.5 with submittal. Submittals without certification will be returned and not reviewed.

1.3 DELIVERY, STORAGE, AND HANDLING

- A. Accept units and components on site in factory protective containers, with factory shipping skids and lifting lugs. Inspect for damage.
- B. Comply with manufacturer's installation instruction for rigging, unloading, and transporting units.
- C. Protect units from weather and construction traffic by storing in dry, roofed location until units are ready for immediate installation.

1.4 REGULATORY REQUIREMENTS

- A. Conform to ANSI/NFPA 90A for the installation of computer room air conditioning units.
- B. Conform to ASHRAE 90.1 (latest published edition) - Energy Standard for Buildings Except Low-Rise Residential Buildings.

1.5 OPERATION AND MAINTENANCE DATA

- A. Submit operation and maintenance data.
- B. Include manufacturer's descriptive literature, operating instructions, installation instructions, and maintenance and repair data.

1.6 WARRANTY

- A. Provide five (5) year manufacturer's warranty on all compressors.

2. PART PRODUCTS

2.1 SPLIT SYSTEM WALL AND CEILING-MOUNTED UNITS

A. Acceptable Manufacturers:

1. Carrier
2. Mitsubishi
3. Trane

B. Manufactured Units:

1. Provide packaged, air-cooled, factory assembled, pre-wired and pre-piped unit consisting of cabinet, fans, filters, remote condensing unit, and controls. Wall-mounted units shall be furnished with integral wall mounting bracket and mounting hardware.
2. Assemble unit for wall-mounted or ceiling installation with service access required.
3. Performance shall be as scheduled on the drawings.
4. Unit shall be rated per AHRI Standards 210/240 and listed in the AHRI directory as a matched system.
5. Provide unit with factory-supplied cleanable air filters.
6. The units shall be listed by Electrical Laboratories (ETL) in accordance with UL-1995 certification and bear the ETL label.
7. All wiring shall be in accordance with the National Electric Code (NEC).

C. Evaporator Cabinet and Frame:

1. Cabinet:
 - a. Refer to schedule on drawings for mounting type (wall-mounted, or ceiling-recessed cassette).
 - b. Exposed units shall have a finished appearance with concealed refrigerant piping, condensate drain piping, and wiring connections.
2. Air Distribution Panel (for ceiling-mounted units): Heavy molded plastic 4-way discharge plenum with return air grille and unit filter. Designed for installation into T-bar ceiling system, 24" x 24" size.

D. Evaporator Fans and Motors:

1. Fans:
 - a. The evaporator fan shall be direct drive with a single motor having permanently lubricated bearings.
 - b. The fan shall be statically and dynamically balanced.
 - c. The indoor fan shall have at least three speeds.

2. Motor:
 - a. Direct driven, digitally controlled with multiple speeds. Permanently lubricated with internal overload protection.
- E. Evaporator Coils (Direct Expansion):
 1. Direct expansion cooling coil of seamless copper tubes expanded into aluminum fins.
 2. Single refrigeration circuit with externally equalized expansion valve.
 3. Coils shall be pressure tested at the factory.
 4. A sloped, corrosion-resistant condensate pan with drain shall be provided under the coil.
- F. Electrical Panel:
 1. Service Connections, Wiring, and Disconnect Requirements: Conform to the National Electrical Code and local electrical codes.
- G. Control:
 - a. The unit shall have a hard-wired 7-day programmable remote controller to operate the system. Provide wall mounting bracket for controller.
 - b. Remote controller shall have "automatic", "dry" (dehumidification), and "fan only" operating modes.
 - c. The remote controller shall have the following features:
 - 1) *On/Off* power switch.
 - 2) *Mode Selector* to operate the system in auto, cool, heat, fan, or dehumidification (dry) operation.
 - 3) *Fan Setting* to provide multiple fan speeds.
 - 4) *Swing Louver* for adjusting supply louver discharge.
 - 5) *On/Off Timer* for automatically switching the unit off or on.
 - 6) *Temperature Adjustment* allows for the increase or decrease of the desired temperature.
 - 7) *Powerful Operation* to allow quick cool down or heating up in the desired space to achieve maximum desired temperature in the shortest allowable time.
 - d. The remote controller shall perform fault diagnostic functions that may be system related, indoor or outdoor unit related depending on the fault code.
 - e. Temperature range on the remote controller shall be 64°F to 90°F in cooling mode and 50°F to 86°F in heating mode.
 - f. The indoor unit microprocessor shall have the capability to receive and process commands via return air temperature and indoor coil temperature sensors enabled by commands from the remote controller.
- H. Outdoor Unit:
 1. General:
 - a. The outdoor unit shall be specifically matched to the corresponding indoor unit size. The outdoor unit shall be completely factory assembled and pre-wired with all necessary electronic and refrigerant controls.

2. Cabinet:
 - a. The outdoor unit shall be fabricated of galvanized steel, bonderized and coated with a baked enamel finish for corrosion protection.
3. Fan:
 - a. The fan shall be direct drive, propeller type fan with fan guard.
 - b. Fan blades shall be statically and dynamically balanced.
 - c. The fan shall have permanently lubricated type bearings.
 - d. Motor shall be protected by internal thermal overload protection.
 - e. Airflow shall be horizontal discharge.
4. Coil:
 - a. The outdoor coil shall be nonferrous construction with corrugated fin tube.
 - b. The coil shall be protected with an internal guard.
 - c. Refrigerant flow from the condenser shall be controlled via a metering device.
5. Compressor:
 - a. Hermetic or scroll refrigerant compressors with resilient suspension system, oil strainer, sight glass/moisture indicator, internal motor protection, high pressure switch, and crankcase heater.
 - b. The outdoor unit shall have an accumulator and four-way reversing valve.
6. Refrigerant:
 - a. Unit shall use R-410a.
 - b. The use of chlorofluorocarbon (CFC)-based refrigerants is prohibited.
- I. Condensate Pump: Provide condensate pump.
- J. Refrigerant Piping:
 1. Design Pressure: 450 psig.
 2. Maximum Design Temperature: 250 F.
 3. Piping - 4" and under.
 - a. Tubing: Type ACR seamless copper tube linesets, ASTM B1003. Sizes indicated are nominal designation.
 - b. Joints: Brazed with silver solder.
 - c. Fittings: Wrought copper solder joint, ANSI B16.22.
 - d. Special Requirements: All tubing shall be cleaned, dehydrated, pressurized with dry nitrogen, plugged, and tagged by manufacturer "for refrigeration service". During brazing operations, continuously purge the interior of the pipe with nitrogen to prevent oxide formation.
 4. Insulation:
 - a. EPDM (NBR/PVC Blend is not permitted) elastomeric cellular foam; ANSI/ASTM C534; flexible plastic; 0.25 maximum 'K' value at 75°F, 25/50 flame spread/smoke developed rating when tested in accordance with ASTM E84 (UL 723). Minimum 1/2" thick for pipe sizes < 1-1/4" and 3/4" thick for pipe sizes 1-1/4" and above.

K. COATINGS:

- a. Apply marine coating by certified licensed applicator.
- b. The coating product manufacturer shall be able to document a class 5B result on a cross hatch adhesion test (ASTM D5339) and the testing for a minimum 4000 hours in both salt spray (ASTM B117) and acid salt spray (ASTM G85) test.
- c. The coating service provider shall also be able to offer a 3-year conditioned warranty for coating applied on finned-tube coils.
- d. The coating shall be applied insuring total penetration and coverage without bridging or significantly affecting the heat transfer ability of the coil.
- e. The total dry film thickness of the coating shall be 1mil.
- f. The coating shall provide inherent protection against ultra-violet radiation and have a dry temperature resistance from -4°F to 302°F.
- g. The following components shall be coated:
 1. Condenser coils
 2. Cabinet

3. PART EXECUTION

3.1 EXAMINATION

- A. Verify that proper power supply is available.

3.2 INSTALLATION

A. General Installation Requirements:

1. Install units in accordance with manufacturer's instructions. Install all units level and plumb. Indoor units shall be installed using manufacturer's standard mounting hardware securely fastened to building structure.
2. Refer to Section 23 05 29 for roof support rails for outdoor unit.
3. Coordinate the exact mounting location of all indoor and outdoor units with architectural and electrical work. Coordinate installation of ceiling-mounted units with ceiling grid layout. Provide additional ceiling grid reinforcement or modification as required and coordinate the work with the GC. Locate the indoor unit where it is readily accessible for maintenance and filter changes. Where outdoor units are located on the roof, locate at least 10' from the roof edge.
4. Verify locations of wall-mounted remote controllers with drawings and room details before installation. Coordinate mounting heights to be consistent with other wall-mounted devices. Height above finished floor shall not exceed 48".

B. Refrigerant Piping:

1. Install refrigerant piping from the indoor unit(s) to the condensing unit. Refrigerant pipe sizes, lengths, specialties and configurations shall be as recommended by the manufacturer. Evacuate refrigerant piping and fully charge system with refrigerant per manufacturer's requirements.

2. Provide weather-tight insulated roof curb to accommodate refrigerant piping and conduit roof penetrations.
 3. Insulate all refrigerant piping. Both liquid and suction lines shall be insulated between the indoor and outdoor units.
- C. Condensate Removal:
1. Install condensate piping with trap and route from drain pan to nearest drain. Discharge to nearest code-approved receptor or to a properly vented indirect waste fitting. Flush all piping before making final connections to units.
- D. Comb all coils to repair bent fins.
- E. Install new filters in the unit at Substantial Completion.
- F. A factory-authorized service agent shall assist in commissioning the unit and inspecting the installation prior to startup. Submit startup report with O&M manuals.

END OF SECTION

SECTION 26 05 00

BASIC ELECTRICAL REQUIREMENTS

1. PART GENERAL

1.1 SECTION INCLUDES

- A. Requirements applicable to all Division 26 Sections. Also refer to Division 1 - General Requirements. This section is also applicable to Interior Communications Pathways Section 27 05 28. This section is also applicable to Fire Alarm and Detection Systems Section 28 31 00.
- B. All materials and installation methods shall conform to the applicable standards, guidelines and codes referenced herein and within each specification section.

1.2 REFERENCES

- A. OSHPD - Office of State Wide Health Planning and Development (California)
- B. CCR California Code of Regulation
- C. CBC California Building Code
- D. CFC California Fire Code
- E. CEC California Electric Code
- F. CMC California Mechanical Code
- G. CPC California Plumbing Code
- H. California Title 24 - Building Energy Efficiency Standards
- I. SCAQMD Southern California Air Quality Management Division

1.3 OWNER FURNISHED PRODUCTS

- A. The Owner will supply manufacturer's installation data for new equipment purchased by him for this project.
- B. This Contractor shall make all electrical system connections shown on the drawings **or** required for fully functional units.
- C. This Contractor is responsible for all damage to Owner furnished equipment caused during installation.

1.4 WORK SEQUENCE

- A. All work that will produce excessive noise or interference with normal building operations, as determined by the Owner, shall be scheduled with the Owner. It may be necessary to schedule such work during unoccupied hours. The Owner reserves the right to determine when restricted construction hours are required.
- B. Itemize all work and list associated hours and pay scale for each item.

1.5 UNIT PRICES

1.6 DIVISION OF WORK BETWEEN MECHANICAL, ELECTRICAL, AND CONTROL CONTRACTORS

- A. Division of work is the responsibility of the Prime Contractor. Any scope of work described at any location on the contract document shall be sufficient for including said requirement in the project. The Prime Contractor shall be solely responsible for determining the appropriate subcontractor for the described scope. In no case shall the project be assessed an additional cost for scope that is described on the contract documents on bid day. The following division of responsibility is a guideline based on typical industry practice.
- B. Definitions:
1. "Mechanical Contractors" refers to the Contractors listed in Division 21/22/23 of this Specification.
 2. "Technology Contractors" refers to the Contractors furnishing and installing systems listed in Division 27/28 of this Specification.
 3. Motor Power Wiring: The single phase or 3 phase wiring extending from the power source (transformer, panelboard, feeder circuits, etc.) through disconnect switches and motor controllers to, and including the connections to the terminals of the motor.
 4. Motor Control Wiring: The wiring associated with the remote operation of the magnetic coils of magnetic motor starters or relays, or the wiring that permits direct cycling of motors by means of devices in series with the motor power wiring. In the latter case, the devices are usually single phase, have "Manual-Off-Auto" provisions, and are usually connected into the motor power wiring through a manual motor starter.
 5. Control devices such as start-stop push buttons, thermostats, pressure switches, flow switches, relays, etc., generally represent the types of equipment associated with motor control wiring.
 6. Motor control wiring is single phase and usually 120 volts. In some instances, the voltage will be the same as the motor power wiring. When the motor power wiring exceeds 120 volts, a control transformer is usually used to give a control voltage of 120 volts.
 7. Temperature Control Wiring: The wiring associated with the operation of a motorized damper, solenoid valve or motorized valve, etc., either modulating or two-position, as opposed to wiring that directly powers or controls a motor used to drive equipment such as fans, pumps, etc. This wiring will be from a 120-volt source and may continue as 120 volt, or be reduced in voltage (24 volt), in which case a control transformer shall be furnished as part of the temperature control wiring.
 8. Control Motor: An electric device used to operate dampers, valves, etc. It may be two-position or modulating. Conventional characteristics of such a motor are 24 volts, 60 cycles, 1 phase, although other voltages may be encountered.
 9. Low Voltage Technology Wiring: The wiring associated with the technology systems, used for analog or digital signals between equipment.
 10. Telecommunications/Technology Rough-in: Relates specifically to the backboxes, necessary plaster rings and other miscellaneous hardware required for the installation or mounting of telecommunications/technology information outlets.

C. General:

1. The purpose of these Specifications is to outline the Electrical and Mechanical Contractors' responsibilities related to electrical work required for items such as temperature controls, mechanical equipment, fans, chillers, compressors, etc. The exact wiring requirements for much of the equipment cannot be determined until the systems have been selected and submittals approved. Therefore, the electrical drawings show only known wiring related to such items. All wiring not shown on the electrical drawings, but required for mechanical systems, is the responsibility of the Mechanical Contractor.
2. Where the drawings require the Electrical Contractor to wire between equipment furnished by the Mechanical Contractor, such wiring shall terminate at terminals provided in the equipment. The Mechanical Contractor shall furnish complete wiring diagrams and supervision to the Electrical Contractor and designate the terminal numbers for correct wiring.
3. Control low (24V) and control line (120V) voltage wiring, conduit, and related switches and relays required for the automatic control and/or interlock of motors and equipment, including final connection, are to be furnished and installed under Divisions 21, 22 and 23. Materials and installation to conform to Class 1 or 2 requirements, California Code of Regulation Title 24, Article E725.
4. The Electrical Contractor shall establish electrical utility elevations prior to fabrication and installation. The Electrical Contractor shall coordinate utility elevations with other trades. When a conflict arises, priority shall be as follows:
 - a. Luminaires.
 - b. Gravity flow piping, including steam and condensate.
 - c. Sheet metal.
 - d. Other piping.
 - e. Conduits and wireway.

D. Mechanical Contractor's Responsibility:

1. Assumes responsibility for internal wiring of all equipment furnished by the Mechanical Contractor.
2. Assumes all responsibility for miscellaneous items furnished by the Mechanical Contractor that require wiring but are not shown on the electrical drawings or specified in the Electrical Specification. If items such as relays, flow switches, or interlocks are required to make the mechanical system function correctly or are required by the manufacturer, they are the responsibility of the Mechanical Contractor.
3. Assumes all responsibility for Temperature Control wiring, if the Temperature Control Contractor is a Subcontractor to the Mechanical Contractor.
4. This Contractor is responsible for coordination of utilities with all other Contractors. If any field coordination conflicts are found, the Contractor shall coordinate with other Contractors to determine a viable layout.

E. Temperature Control Contractor's or Subcontractor's Responsibility:

1. Wiring of all devices needed to make the Temperature Control System functional.
2. Verifying any control wiring on the electrical drawings as being by the Electrical Contractor. All wiring required for the Control System, but not shown on the electrical drawings, is the responsibility of the Temperature Control Contractor or Subcontractor.
3. Coordinating equipment locations (such as PE's, EP's, relays, transformers, etc.) with the Electrical Contractor, where wiring of the equipment is by the Electrical Contractor.

F. Electrical Contractor's Responsibility:

1. Furnishes and installs all combination starters, manual starters and disconnect devices shown on the Electrical Drawings or indicated to be by the Electrical Contractor in the Mechanical Drawings or Specifications.
2. Installs and wires all remote-control devices furnished by the Mechanical Contractor or Temperature Control Contractor when so noted on the Electrical Drawings.
3. Furnishes and installs motor control and temperature control wiring, when noted on the drawings.
4. Furnishes, installs, and connects all relays, etc., for automatic shutdown of certain mechanical equipment (supply fans, exhaust fans, etc.) upon actuation of the Fire Alarm System.
5. This Contractor is responsible for coordination of utilities with all other Contractors. If any field coordination conflicts are found, the Contractor shall coordinate with other Contractors to determine a viable layout.

G. General (Electrical/Technology):

1. "Electrical Contractor" as referred to herein shall be responsible for scope listed in Division 27/28 of this specification when the "Suggested Matrix of Scope Responsibility" indicated work shall be furnished and installed by the EC. Refer to the Contract Documents for this "Suggested Matrix of Scope Responsibility".
2. The purpose of these Specifications is to outline the Electrical and Technology Contractor's work responsibilities as related to Telecommunications Rough-in, conduit, cable tray, power wiring and Low Voltage Technology Wiring.
3. The exact wiring requirements for much of the equipment cannot be determined until the systems have been purchased and submittals approved. Therefore, only known wiring, conduits, raceways and electrical power related to such items is shown on the Technology drawings. Other wiring, conduits, raceways, junction boxes and electrical power not shown on the Technology Drawings but required for operation of the systems is the responsibility of the Technology Contractor and included in said Contractor's bid.
4. Where the Electrical Contractor is required to install conduit, conduit sleeves and/or power connections in support of Technology systems, the final installation shall not be until a coordination meeting between the Electrical Contractor and the Technology Contractor has convened to determine the exact location and requirements of the installation.
5. Where the Electrical Contractor is required to install cable tray that will contain Low Voltage Technology Wiring, installation shall not begin prior to a coordination review of the cable tray shop drawings by the Technology Contractor.

H. Technology Contractor's Responsibility:

1. Assumes all responsibility for the low voltage technology wiring of all systems, including cable support where open cable is specified.
2. Assumes all responsibility for all required backboxes, conduit and power connections not specifically shown as being furnished and installed by the Electrical Contractor on the "Suggested Matrix of Scope Responsibility".
3. Assumes all responsibility for providing and installing all ladder rack and other cable management hardware (as defined herein).

4. Responsible for providing the Electrical Contractor with the required grounding lugs or other hardware for each piece of technology equipment which is required to be bonded to the telecommunications ground bar.
5. This Contractor is responsible for coordination of utilities with all other Contractors. If any field coordination conflicts are found, the Contractor shall coordinate with other Contractors to determine a viable layout.

1.7 COORDINATION DRAWINGS

A. Definitions:

1. Coordination Drawings: A compilation of the pertinent layout and system drawings that show the sizes and locations, including elevations, of system components and required access areas to ensure that no two objects will occupy the same space.
 - a. Mechanical trades shall include, but are not limited to, mechanical equipment, ductwork, fire protection systems, plumbing piping, medical gas systems, hydronic piping, steam and steam condensate piping, and any item that may impact coordination with other disciplines.
 - b. Electrical trades shall include, but are not limited to, electrical equipment, conduit 1.5" and larger, conduit racks, cable trays, pull boxes, transformers, raceway, busway, lighting, ceiling-mounted devices, and any item that may impact coordination with other disciplines.
 - c. Technology trades shall include, but are not limited to, technology equipment, racks, conduit 1.5" and larger, conduit racks, cable trays, ladder rack, pull boxes, raceway, ceiling-mounted devices, and any item that may impact coordination with other disciplines.
 - d. Maintenance clearances and code-required dedicated space shall be included.
 - e. The coordination drawings shall include all underground, underfloor, in-floor, in chase, and vertical trade items.
2. The contractors shall use the coordination process to identify the proper sequence of installation of all utilities above ceilings and in other congested areas, to ensure an orderly and coordinated end result, and to provide adequate access for service and maintenance.

B. Participation:

1. The contractors and subcontractors responsible for work defined above shall participate in the coordination drawing process.
2. One contractor shall be designated as the Coordinating Contractor for purposes of preparing a complete set of composite electronic CAD coordination drawings that include all applicable trades, and for coordinating the activities related to this process. The Coordinating Contractor for this project shall be the Mechanical Contractor.
 - a. The Coordinating Contractor shall utilize personnel familiar with requirements of this project and skilled as draftspersons/CAD operators, competent to prepare the required coordination drawings.
3. Electronic CAD drawings shall be submitted to the Coordinating Contractor for addition of work by other trades. IMEG will provide electronic file copies of ventilation drawings for contractor's use if the contractor signs and returns an "Electronic File Transfer" waiver provided by IMEG. IMEG will not consider blatant reproductions of original file copies an acceptable alternative for coordination drawings.

C. Drawing Requirements:

1. The file format and file naming convention shall be coordinated with and agreed to by all contractors participating in the coordination process and the Owner.
 - a. Scale of drawings:
 - 1) General plans: 1/4 Inch = 1'-0" (minimum).
 - 2) Mechanical, electrical, communication rooms, and including the surrounding areas within 10 feet: 1/2 Inch = 1'-0" (minimum).
 - 3) Shafts and risers: 1/2 Inch = 1'-0" (minimum).
 - 4) Sections of shafts and mechanical and electrical equipment rooms: 1/4 Inch = 1'-0" (minimum).
 - 5) Sections of congested areas: 1/2 Inch = 1'-0" (minimum).
2. Ductwork layout drawings shall be the baseline system for other components. Ductwork layout drawings shall be modified to accommodate other components as the coordination process progresses.
3. There may be more drawings required for risers, top and bottom levels of mechanical rooms, and shafts.
4. The minimum quantity of drawings will be established at the first coordination meeting and sent to the A/E for review. Additional drawings may be required if other areas of congestion are discovered during the coordination process.

D. General:

1. Coordination drawing files shall be made available to the A/E and Owner's Representative. The A/E will only review identified conflicts and give an opinion, but will not perform as a coordinator.
2. A plotted set of coordination drawings shall be available at the project site.
3. Coordination drawings are not shop drawings and shall not be submitted as such.
4. The contract drawings are schematic in nature and do not show every fitting and appurtenance for each utility. Each contractor is expected to have included in his/her bid sufficient fittings, material, and labor to allow for adjustments in routing of utilities made necessary by the coordination process and to provide a complete and functional system.
5. The contractors will not be allowed additional costs or time extensions due to participation in the coordination process.
6. The contractors will not be allowed additional costs or time extensions for additional fittings, reroutings or changes of duct size, that are essentially equivalent sizes to those shown on the drawings and determined necessary through the coordination process.
7. The A/E reserves the right to determine space priority of equipment in the event of spatial conflicts or interference between equipment, piping, conduit, ducts, and equipment provided by the trades.
8. Changes to the contract documents that are necessary for systems installation and coordination shall be brought to the attention of the A/E.

9. Access panels shall preferably occur only in gypsum board walls or plaster ceilings where indicated on the drawings.
 - a. Access to mechanical, electrical, technology, and other items located above the ceiling shall be through accessible lay-in ceiling tile areas.
 - b. Potential layout changes shall be made to avoid additional access panels.
 - c. Additional access panels shall not be allowed without written approval from the A/E at the coordination drawing stage.
 - d. Providing additional access panels shall be considered after other alternatives are reviewed and discarded by the A/E and the Owner's Representative.
 - e. When additional access panels are required, they shall be provided without additional cost to the Owner.
10. Complete the coordination drawing process and obtain sign-off of the drawings by all contractors prior to installing any of the components.
11. Conflicts that result after the coordination drawings are signed off shall be the responsibility of the contractor or subcontractor who did not properly identify their work requirements, or installed their work without proper coordination.
12. Updated coordination drawings that reflect as-built conditions may be used as record documents.

1.8 QUALITY ASSURANCE

A. Contractor's Responsibility Prior to Submitting Pricing/Bid Data:

1. The Contractor is responsible for constructing complete and operating systems. The Contractor acknowledges and understands that the Contract Documents are a two-dimensional representation of a three-dimensional object, subject to human interpretation. This representation may include imperfect data, interpreted codes, utility guides, three-dimensional conflicts, and required field coordination items. Such deficiencies can be corrected when identified prior to ordering material and starting installation. The Contractor agrees to carefully study and compare the individual Contract Documents and report at once in writing to the Architect/Engineer any deficiencies the Contractor may discover. The Contractor further agrees to require each subcontractor to likewise study the documents and report at once any deficiencies discovered.
2. The Contractor shall resolve all reported deficiencies with the Architect/Engineer prior to awarding any subcontracts, ordering material, or starting any work with the Contractor's own employees. Any work performed prior to receipt of instructions from the Architect/Engineer will be done at the Contractor's risk.

B. Qualifications:

1. Only products of reputable manufacturers as determined by the Architect/Engineer are acceptable.
2. All Contractors and subcontractors shall employ only workmen who are skilled in their trades. At all times, the number of apprentices at the job site shall be less than or equal to the number of journeymen at the job site.

C. Compliance with Codes, Laws, Ordinances:

1. Conform to all requirements of the State of California Codes, Laws, Ordinances and other regulations having jurisdiction.

2. If there is a discrepancy between the codes and regulations and these specifications, the Architect/Engineer shall determine the method or equipment used.
 3. If the Contractor notes, at the time of bidding, any parts of the drawings or specifications that do not comply with the codes or regulations, he shall inform the Architect/Engineer in writing, requesting a clarification. If there is insufficient time for this procedure, he shall submit with his proposal a separate price to make the system comply with the codes and regulations.
 4. All changes to the system made after the letting of the contract to comply with codes or the requirements of the Inspector, shall be made by the Contractor without cost to the Owner.
 5. If there is a discrepancy between manufacturer's recommendations and these specifications, the manufacturer's recommendations shall govern.
 6. If there are no local codes having jurisdiction, the current issue of the NEC shall be followed.
- D. Permits, Fees, Taxes, Inspections:
1. Procure all applicable permits and licenses.
 2. Abide by all laws, regulations, ordinances, and other rules of the State or Political Subdivision where the work is done, or as required by any duly constituted public authority.
 3. Pay all charges for permits or licenses.
 4. Pay all fees and taxes imposed by State, Municipal, and other regulatory bodies.
 5. Pay all charges arising out of required inspections by an authorized body.
 6. Pay all charges arising out of required contract document reviews associated with the project and as initiated by the Owner or authorized agency/consultant.
 7. Where applicable, all fixtures, equipment and materials shall be listed by Underwriter's Laboratories, Inc. or a nationally recognized testing organization.
 8. Pay all telephone company charges related to the service or change in service.
- E. Utility Company Requirements:
1. Secure from the private or public utility company all applicable requirements.
 2. Comply with all utility company requirements.
 3. The Owner shall make application for and pay for new electrical service equipment and installation. The Contractor shall coordinate schedule and requirements with the Owner and Utility Company.
 4. Furnish the meter socket metering compartment with CT space within the main switchboard. Verify approved manufacturers and equipment with the Utility Company.
 5. The Owner shall apply and pay for any changes for removal of existing electrical service by the utility company. The Contractor shall verify approved manufacturers and equipment with the Utility Company.
 6. Electrical contractor cannot start work on the power service without the approved power service design drawings from Utility Company. Electrical contractor shall obtain a copy of the approved power service design plan from Utility Company.

F. Examination of Drawings:

1. The drawings for the electrical work are completely diagrammatic, intended to convey the scope of the work and to indicate the general arrangements and locations of equipment, outlets, etc., and the approximate sizes of equipment.
2. Contractor shall determine the exact locations of equipment and rough-ins, and the exact routing of raceways to best fit the layout of the job. Conduit entry points for electrical equipment including, but not limited to, panelboards, switchboards, switchgear and unit substations, shall be determined by the Contractor unless noted in the contract documents.
3. Scaling of the drawings will not be sufficient or accurate for determining these locations.
4. Where job conditions require reasonable changes in arrangements and locations, such changes shall be made by the Contractor at no additional cost to the Owner.
5. Because of the scale of the drawings, certain basic items, such as junction boxes, pull boxes, conduit fittings, etc., may not be shown, but where required by other sections of the specifications or required for proper installation of the work, such items shall be furnished and installed.
6. If an item is either shown on the drawings or called for in the specifications, it shall be included in this contract.
7. The Contractor shall determine quantities and quality of material and equipment required from the documents. Where discrepancies arise between drawings, schedules and/or specifications, the greater and better-quality number shall govern.
8. Where used in electrical documents the word "furnish" shall mean supply for use, the word "install" shall mean connect up complete and ready for operation, and the word "provide" shall mean to supply for use and connect up complete and ready for operation.
9. Any item listed as furnished shall also be installed unless otherwise noted.
10. Any item listed as installed shall also be furnished unless otherwise noted.

G. Electronic Media/Files:

1. Construction drawings for this project have been prepared utilizing AutoCAD MEP Revit.
2. Contractors and Subcontractors may request electronic media files of the contract drawings and/or copies of the specifications. Specifications will be provided in PDF format.
3. Upon request for electronic media, the Contractor shall complete and return a signed "Electronic File Transmittal" form provided by IMEG.
4. If the information requested includes floor plans prepared by others, the Contractor will be responsible for obtaining approval from the appropriate Design Professional for use of that part of the document.
5. The electronic contract documents can be used for preparation of shop drawings and as-built drawings only. The information may not be used in whole or in part for any other project.
6. The drawings prepared by IMEG for bidding purposes may not be used directly for ductwork layout drawings or coordination drawings.
7. The use of these CAD documents by the Contractor does not relieve them from their responsibility for coordination of work with other trades and verification of space available for the installation.

8. The information is provided to expedite the project and assist the Contractor with no guarantee by IMEG as to the accuracy or correctness of the information provided. IMEG accepts no responsibility or liability for the Contractor's use of these documents.

H. Field Measurements:

1. Verify all pertinent dimensions at the job site before ordering any conduit, conductors, wireways, bus duct, fittings, etc.

1.9 SUBMITTALS

- A. Submittals shall be required for the following items, and for additional items where required elsewhere in the specifications or on the drawings.

1. Submittals list:

**Referenced
Specification**

Section

Submittal Item

26 05 03	Through Penetration Firestopping
26 05 13	Wire and Cable
26 05 23	Manufactured Wiring Assemblies
26 05 26	Grounding and Bonding
26 05 33	Conduit and Boxes
26 05 35	Surface Raceways
26 05 37	Manholes
26 05 48	Seismic Requirements for Equipment and Supports
26 05 53	Electrical Identification
26 05 73	Power System Study
26 09 13	Power Monitoring and Control System
26 09 33	Lighting Control System
26 20 00	Service Entrance
26 22 00	Dry Type Transformers
26 24 13	Switchboards
26 24 16	Panelboards
26 24 19	Motor Control
26 26 00	Power Distribution Unit
26 27 16	Cabinets and Enclosures
26 27 26	Wiring Devices
26 27 29	Electric Vehicle Charging Station
26 28 13	Fuses
26 28 16	Disconnect Switches
26 28 21	Contactors
26 29 23	Variable Frequency Drives
26 31 00	Solar Photovoltaic Systems
26 32 13	Packaged Engine Generator Systems
26 33 53	Static Uninterruptible Power Supply (UPS)
26 36 00	Transfer Switch
26 43 00	Surge Protection Devices
26 51 00	Lighting
26 56 68	Sports Lighting
28 31 00	Fire Alarm and Detection Systems
Drawings	Photocells, Timeclocks, Relays

B. General Submittal Procedures: In addition to the provisions of Division 1, the following are required:

1. Transmittal: Each transmittal shall include the following:
 - a. Date
 - b. Project title and number
 - c. Contractor's name and address
 - d. Division of work (e.g., electrical, plumbing, heating, ventilating, etc.)
 - e. Description of items submitted and relevant specification number
 - f. Notations of deviations from the contract documents
 - g. Other pertinent data
2. Submittal Cover Sheet: Each submittal shall include a cover sheet containing:
 - a. Date
 - b. Project title and number
 - c. Architect/Engineer
 - d. Contractor and subcontractors' names and addresses
 - e. Supplier and manufacturer's names and addresses
 - f. Division of work (e.g., electrical, plumbing, heating, ventilating, etc.)
 - g. Description of item submitted (using project nomenclature) and relevant specification number
 - h. Notations of deviations from the contract documents
 - i. Other pertinent data
 - j. Provide space for Contractor's review stamps
3. Composition:
 - a. Submittals shall be submitted using specification sections and the project nomenclature for each item.
 - b. Individual submittal packages shall be prepared for items in each specification section. All items within a single specification section shall be packaged together where possible. An individual submittal may contain items from multiple specifications sections if the items are intimately linked (e.g., pumps and motors).
 - c. All sets shall contain an index of the items enclosed with a general topic description on the cover.
4. Content: Submittals shall include all fabrication, erection, layout, and setting drawings; manufacturers' standard drawings; schedules; descriptive literature, catalogs and brochures; performance and test data; wiring and control diagrams; dimensions; shipping and operating weights; shipping splits; service clearances; and all other drawings and descriptive data of materials of construction as may be required to show that the materials, equipment or systems and the location thereof conform to the requirements of the contract documents.
5. Contractor's Approval Stamp:
 - a. The Contractor shall thoroughly review and approve all shop drawings before submitting them to the Architect/Engineer. The Contractor shall stamp, date and sign each submittal certifying it has been reviewed.
 - b. Unstamped submittals will be rejected.
 - c. The Contractor's review shall include, but not be limited to, verification of the following:
 - 1) Only approved manufacturers are used.
 - 2) Addenda items have been incorporated.
 - 3) Catalog numbers and options match those specified.

- 4) Performance data matches that specified.
 - 5) Electrical characteristics and loads match those specified.
 - 6) Equipment connection locations, sizes, capacities, etc. have been coordinated with other affected trades.
 - 7) Dimensions and service clearances are suitable for the intended location.
 - 8) Equipment dimensions are coordinated with support steel, housekeeping pads, openings, etc.
 - 9) Constructability issues are resolved (e.g., weights and dimensions are suitable for getting the item into the building and into place, sinks fit into countertops, etc.).
- d. The Contractor shall review, stamp and approve all subcontractors' submittals as described above.
 - e. **The Contractor's approval stamp is required on all submittals. Approval will indicate the Contractor's review of all material and a complete understanding of exactly what is to be furnished. Contractor shall clearly mark all deviations from the contract documents on all submittals. If deviations are not marked by the Contractor, then the item shall be required to meet all drawing and specification requirements.**
6. Submittal Identification and Markings:
 - a. The Contractor shall clearly mark each item with the same nomenclature applied on the drawings or in the specifications.
 - b. The Contractor shall clearly indicate the size, finish, material, etc.
 - c. Where more than one model is shown on a manufacturer's sheet, the Contractor shall clearly indicate exactly which item and which data is intended.
 - d. All marks and identifications on the submittals shall be unambiguous.
 7. Schedule submittals to expedite the project. Coordinate submission of related items.
 8. Identify variations from the contract documents and product or system limitations that may be detrimental to the successful performance of the completed work.
 9. Reproduction of contract documents alone is not acceptable for submittals.
 10. Incomplete submittals will be rejected without review. Partial submittals will only be reviewed with prior approval from the Architect/Engineer.
 11. Submittals not required by the contract documents may be returned without review.
 12. The Architect/Engineer's responsibility shall be to review one set of shop drawing submittals for each product. If the first submittal is incomplete or does not comply with the drawings and/or specifications, the Contractor shall be responsible to bear the cost for the Architect/Engineer to recheck and handle the additional shop drawing submittals.
 13. Submittals shall be reviewed and approved by the Architect/Engineer **before** releasing any equipment for manufacture or shipment.
 14. Contractor's responsibility for errors, omissions or deviation from the contract documents in submittals is not relieved by the Architect/Engineer's approval.
- C. Electronic Submittal Procedures:
 1. Distribution: Email submittals as attachments to all parties designated by the Architect/Engineer, unless a web-based submittal program is used.

2. Transmittals: Each submittal shall include an individual electronic letter of transmittal.
 3. Format: Electronic submittals shall be in PDF format only. Scanned copies, in PDF format, of paper originals are acceptable. Submittals that are not legible will be rejected. Do not set any permission restrictions on files; protected, locked, or secured documents will be rejected.
 4. File Names: Electronic submittal file names shall include the relevant specification section number followed by a description of the item submitted, as follows. Where possible, include the transmittal as the first page of the PDF instead of using multiple electronic files.
 - a. Submittal file name: 26 XX XX.description.YYYYMMDD
 - b. Transmittal file name: 26 XX XX.description.YYYYMMDD
 5. File Size: Electronic file size shall be limited to a maximum of 4MB. Larger files shall be transmitted via a pre-approved method.
- D. Paper Copy Submittal Procedures:
1. Paper copies are acceptable where electronic copies are not provided.
 2. The Contractor shall submit ten (10) paper copies of each shop drawing.
 3. Each set shall be bound in a three-ring binder or presentation binder. Copies that are loose or in pocket folders are not acceptable.

1.10 SCHEDULE OF VALUES

- A. The requirements herein are in addition to the provisions of Division 1.
- B. Format:
1. Use AIA Document Continuation Sheets G703 or another similar form approved by the Owner and Architect/Engineer.
 2. Submit in Excel format.
 3. Support values given with substantiating data.
- C. Preparation:
1. Itemize work required by each specification section and list all providers. All work provided by subcontractors and major suppliers shall be listed on the Schedule of Values. List each subcontractor and supplier by company name.
 2. Break down all costs into:
 - a. Material: Delivered cost of product with taxes paid.
 - b. Labor: Labor cost, excluding overhead and profit.
 3. Itemize the cost for each of the following:
 - a. Overhead and profit.
 - b. Bonds.
 - c. Insurance.
 - d. General Requirements: Itemize all requirements.
 4. For each line item having an installed cost of more than \$5,000, break down costs to list major products or operations under each item. At a minimum, provide material and labor cost line items for the following:
 - a. Each piece of equipment requiring shop drawings. Use the equipment nomenclature (SB-1, PANEL P-1, etc.) on the Schedule of Values.

- b. Each type of small unitary equipment (e.g., FDS, FCS, CS, etc.). Multiple units of the same type can be listed together provided quantities are also listed so unit costs can be determined.
- c. Each conduit system (medium voltage, normal, emergency, low voltage systems, etc.). In addition, for larger projects breakdown the material and labor for each conduit system based on geography (building, floor, and/or wing).
- d. Fire alarm broken down into material and labor for the following:
 - 1) Engineering
 - 2) Controllers, devices, sensors, etc.
 - 3) Conduit
 - 4) Wiring
 - 5) Programming
 - 6) Commissioning
- e. Site utilities (5' beyond building)
- f. Seismic design
- g. Testing
- h. Commissioning
- i. Record drawings
- j. Punchlist and closeout

D. Update Schedule of Values when:

- 1. Indicated by Architect/Engineer.
- 2. Change of subcontractor or supplier occurs.
- 3. Change of product or equipment occurs.

1.11 CHANGE ORDERS

- A. A detailed material and labor takeoff shall be prepared for each change order, along with labor rates and markup percentages. Change orders with inadequate breakdown will be rejected.
- B. Change order work shall not proceed until authorized.

1.12 PRODUCT DELIVERY, STORAGE, HANDLING AND MAINTENANCE

- A. Exercise care in transporting and handling to avoid damage to materials. Store materials on the site to prevent damage.
- B. Keep all materials clean, dry and free from damaging environments.
- C. Coordinate the installation of heavy and large equipment with the General Contractor and/or Owner. If the Electrical Contractor does not have prior documented experience in rigging and lifting similar equipment, he/she shall contract with a qualified lifting and rigging service that has similar documented experience. Follow all equipment lifting and support guidelines for handling and moving.
- D. Contractor is responsible for moving equipment into the building and/or site. Contractor shall review site prior to bid for path locations and any required building modifications to allow movement of equipment. Contractor shall coordinate his/her work with other trades.

1.13 NETWORK / INTERNET CONNECTED EQUIPMENT

- A. These specifications may require certain equipment or systems to have network, Internet and/or remote access capability ("Network Capability"). Any requirement for Network Capability shall be interpreted only as a functional capability and is not to be construed as authority to connect or enable any Network Capability. Network Capability may only be connected or enabled with the express written consent of the Owner.

1.14 WARRANTY

- A. Provide one-year warranty for all fixtures, equipment, materials, and workmanship.

- B. The warranty period for all work in this specification Division shall commence on the date of Substantial Completion or successful system performance whichever occurs later. The warranty may also commence if a whole or partial system or any separate piece of equipment or component is put into use for the benefit of any party other than the installing contractor with prior written authorization of the Owner. In this instance, the warranty period shall commence on the date when such whole system, partial system or separate piece of equipment or component is placed in operation and accepted in writing by the Owner.
- C. Warranty requirements extend to correction, without cost to the Owner, of all work found to be defective or nonconforming to the contract documents. The Contractor shall bear the cost of correcting all damage due to defects or nonconformance with contract documents excluding repairs required as a result of improper maintenance or operation, or of normal wear as determined by the Architect/Engineer.

1.15 INSURANCE

- A. This Contractor shall maintain insurance coverage as set forth in Division 1 of these specifications.

1.16 CONTINGENCY

- A. Include in the Base Bid a contingency of one percent (1%) to be used only by change orders issued by the Architect/Engineer. The unused portion of the contingency shall be deducted from the Contract price before final payment is made.

1.17 MATERIAL SUBSTITUTION

- A. Where several manufacturers' names are given, the manufacturer for which a catalog number is given is the basis of design and establishes the quality required.
- B. Equivalent equipment manufactured by the other named manufacturers may be used. Contractor shall ensure that all items submitted by these other manufacturers meet all requirements of the drawings and specifications, and fit in the allocated space. The Architect/Engineer shall make the final determination of whether a product is equivalent.
- C. Any material, article or equipment of other unnamed manufacturers which will adequately perform the services and duties imposed by the design and is of a quality equal to or better than the material, article or equipment identified by the drawings and specifications may be used if approval is secured in writing from the Architect/Engineer via addendum. The Contractor assumes all costs incurred as a result of using the offered material, article or equipment, on his part or on the part of other Contractors whose work is affected.
- D. Voluntary add or deduct prices for alternate materials may be listed on the bid form. These items will not be used in determining the low bidder. This Contractor assumes all costs incurred as a result of using the offered material or equipment on his part or on the part of other Contractors whose work is affected.
- E. All material substitutions requested after the final addendum must be listed as voluntary changes on the bid form.

1.18 PROJECT COMMISSIONING

- A. The Contractor shall work with the Commissioning Agent (CxA) as described in Section 01 91 00 and 26 08 00, and provide all services as described in the Commissioning Plan.

2. PART PRODUCTS

2.1 GENERAL

- A. All items of material having a similar function (e.g., safety switches, panelboards, switchboards, contactors, motor starters, dry type transformers) shall be of the same manufacturer unless specifically stated otherwise on drawings or elsewhere in specifications.

3. PART EXECUTION

3.1 JOBSITE SAFETY

- A. Neither the professional activities of the Architect/Engineer, nor the presence of the Architect/Engineer or his or her employees and subconsultants at a construction site, shall relieve the Contractor and any other entity of their obligations, duties and responsibilities including, but not limited to, construction means, methods, sequence, techniques or procedures necessary for performing, superintending or coordinating all portions of the work of construction in accordance with the contract documents and any health or safety precautions required by any regulatory agencies. The Architect/Engineer and his or her personnel have no authority to exercise any control over any construction contractor or other entity or their employees in connection with their work or any health or safety precautions. The Contractor is solely responsible for jobsite safety. The Architect/Engineer and the Architect/Engineer's consultants shall be indemnified and shall be made additional insureds under the Contractor's general liability insurance policy.

3.2 EXCAVATION, FILL, BACKFILL, COMPACTION

- A. General:

- 1. Prior to the commencement of any excavation or digging, the Contractor shall verify all underground utilities with the regional utility locator. Provide prior notice to the locator before excavations. Contact information for most regional utility locaters can be found by calling 811.
 - 2. The Contractor shall do all excavating, filling, backfilling, compacting, and restoration in connection with his work.

- B. Excavation:

- 1. Make all excavations to accurate, solid, undisturbed earth, and to proper dimensions.
 - 2. If excavations are carried in error below indicated levels, concrete of same strength as specified for the foundations or thoroughly compacted sand-gravel fill, as determined by the Architect/Engineer shall be placed in such excess excavations under the foundation. Place thoroughly compacted, clean, stable fill in excess excavations under slabs on grade, at the Contractor's expense.
 - 3. Trim bottom and sides of excavations to grades required for foundations.
 - 4. Protect excavations against frost and freezing.
 - 5. Take care in excavating not to damage surrounding structures, equipment or buried pipe. Do not undermine footing or foundation.
 - 6. Perform all trenching in a manner to prevent cave-ins and risk to workmen.
 - 7. Where original surface is pavement or concrete, the surface shall be saw cut to provide clean edges and assist in the surface restoration.

8. If satisfactory bearing soil is not found at the indicated levels, immediately notify the Architect/Engineer or their representative, and do no further work until the Architect/Engineer or their representative gives further instructions.
 9. Excavation shall be performed in all ground conditions, including rock, if encountered. Bidders shall visit the premises and determine the soil conditions by actual observations, borings, or other means. The cost of all such inspections, borings, etc., shall be borne by the bidder.
 10. If a trench is excavated in rock, a compacted bed with a depth of 3" (minimum) of sand and gravel shall be used to support the conduit unless masonry cradles or encasements are used.
 11. Mechanical excavation of the trench to line and grade of the conduit or to the bottom level of masonry cradles or encasements is permitted, unless otherwise indicated on the electrical drawings.
 12. Mechanical excavation of the trench to line and grade where direct burial cables are to be installed is permitted provided the excavation is made to a depth to permit installation of the cable on a fine sand bed at least 3 inches deep.
- C. Dewatering:
1. Furnish, install, operate and remove all dewatering pumps and pipes needed to keep trenches and pits free of water.
- D. Underground Obstructions:
1. Known underground piping, conduit, feeders, foundations, and other obstructions in the vicinity of construction are shown on the drawings. Review all Bid Documents for all trades on the project to determine obstructions indicated. Take great care in making installations near underground obstructions.
 2. If objects not shown on the drawings are encountered, remove, relocate, or perform extra work as directed by the Architect/Engineer.
- E. Fill and Backfilling:
1. No rubbish or waste material is permitted for fill or backfill.
 2. Furnish all necessary sand for backfilling.
 3. Dispose of the excess excavated earth as directed.
 4. Backfill materials shall be suitable for required compaction, clean and free of perishable materials, frozen earth, debris, earth with a high void content, and stones greater than 4 inches in diameter. Water is not permitted to rise in unbackfilled trenches.
 5. Backfill all trenches and excavations immediately after installing of conduit, or removing forms, unless other protection is directed.
 6. Around piers and isolated foundations and structures, backfill and fill shall be placed and consolidated simultaneously on all sides to prevent wedge action and displacement. Spread fill and backfill materials in 6" uniform horizontal layers with each layer compacted separately to required density.
 7. For conduits that are not concrete encased, lay all conduits on a compacted bed of sand at least 3" deep. Backfill around conduits with sand, in 6" layers and compact each layer.

8. Conduits that are concrete encased or in a ductbank, conduit spacers, and cradles shall be installed on a bed of compacted CA-6 gravel. Refer to conduit section for backfilling and ductbank requirements.
9. Backfill with sand up to grade for all conduits under slabs or paved areas. All other conduits shall have sand backfill to 6" above the top of the conduit.
10. Place all backfill above the sand in uniform layers not exceeding 6" deep. Place then carefully and uniformly tamp each layer to eliminate lateral or vertical displacement.
11. Where the fill and backfill will ultimately be under a building, floor or paving, each layer of fill shall be compacted to 95% of the maximum density as determined by AASHTO Designation T-99 or ASTM Designation D-698. Moisture content of soil at time of compaction shall not exceed plus or minus 2% of optimum moisture content as determined by AASHTO T-99 or ASTM D-698 test.
12. After backfilling of trenches, no superficial loads shall be placed on the exposed surface of the backfill until a period of 48 hours has elapsed.

F. Surface Restoration:

1. Where trenches are cut through graded, planted or landscaped areas, the areas shall be restored to the original condition. Replace all planting and landscaping features removed or damaged to its original condition. At least 6" of topsoil shall be applied where disturbed areas are to be seeded or sodded. All lawn areas shall be sodded unless seeding is called out in the drawings or specifications.
2. Concrete or asphalt type pavement, seal coat, rock, gravel or earth surfaces removed or damaged shall be replaced with comparable materials and restored to original condition. Broken edges shall be saw cut and repaired as directed by Architect/Engineer.

3.3 ARCHITECT/ENGINEER OBSERVATION OF WORK

- A. The contractor shall provide seven (7) calendar days' notice to the Architect/Engineer prior to:
 1. Placing fill over underground and underslab utilities.
 2. Covering exterior walls, interior partitions and chases.
 3. Installing hard or suspended ceilings and soffits.
- B. The Architect/Engineer will review the installation and provide a written report noting deficiencies requiring correction. The contractor's schedule shall account for these reviews and show them as line items in the approved schedule.
- C. Above-Ceiling Final Observation:
 1. All work above the ceilings must be complete prior to the Architect/Engineer's review. This includes, but is not limited to:
 - a. All junction boxes are closed and identified in accordance with Section 26 05 53 Electrical Identification.
 - b. Luminaires, including ceiling-mounted exit and emergency lights, are installed and operational.
 - c. Luminaire whips are supported above the ceiling.
 - d. Conduit identification is installed in accordance with Section 26 05 53 Electrical Identification.

- e. Luminaires are suspended independently of the ceiling system when required by these contract documents.
 - f. All wall penetrations have been sealed.
2. To prevent the Above-Ceiling Final Observation from occurring too early, the Contractor shall review the status of the work and certify, in writing, that the work is ready for the Above-Ceiling Final Observation.
 3. It is understood that if the Architect/Engineer finds the ceilings have been installed prior to this review and prior to seven days elapsing, the Architect/Engineer may not recommend further payments to the contractor until full access has been provided.

3.4 PROJECT CLOSEOUT

- A. The following paragraphs supplement the requirements of Division 1.
- B. IDPH Pre-Occupancy Requirements:
 1. Each Contractor must submit all forms and certifications required by IDPH relating to their work at 85% completion of the project or when directed by the Owner/Architect/Engineer.
- C. Final Jobsite Observation:
 1. To prevent the Final Jobsite Observation from occurring too early, the Contractor shall review the completion status of the project and certify that the job is ready for the final jobsite observation.
 2. Attached to the end of this section is a typical list of items that represent the degree of job completeness expected prior to requesting a review. The Contractor shall sign the attached certification and return it to the Architect/Engineer so that the final observation can be scheduled.
 3. It is understood that if the Architect/Engineer finds the job not ready for the final observation and additional trips and observations are required to bring the project to completion, the cost of the additional time and expenses incurred by the Architect/Engineer will be deducted from the Contractor's final payment.
 4. Contractor shall notify Architect/Engineer 48 hours prior to installation of ceilings or lay-in ceiling tiles.
- D. The following must be submitted before Architect/Engineer recommends final payment:
 1. Operation and maintenance manuals with copies of approved shop drawings.
 2. Record documents including marked-up or reproducible drawings and specifications.
 3. A report documenting the instructions given to the Owner's representatives complete with the number of hours spent in the instruction. The report shall bear the signature of an authorized agent of this Contractor and shall be signed by the Owner's representatives.
 4. Provide spare parts, maintenance, and extra materials in quantities specified in individual specification sections. Deliver to project site and place in location as directed and submit receipt to Architect/Engineer.
 5. Inspection and testing report by the fire alarm system manufacturer.
 6. Start-up reports on all equipment requiring a factory installation or start-up.

E. Circuit Directories:

1. Provide custom typed circuit directory for each branch circuit panelboard. Provide updated custom typed circuit directory for each existing branch circuit panelboard with new or revised circuits per the scope of work. Label shall include equipment name or final approved room name, room number, and load type for each circuit (examples: SUMP SP-1 or ROOM 101 RECEPT). Revise directory to reflect circuit changes required to balance phase loads. Printed copies of the bid document panel schedules are not acceptable as circuit directories.

3.5 OPERATION AND MAINTENANCE MANUALS

A. General:

1. Provide an electronic copy of the O&M manuals as described below for Architect/Engineer's review and approval. The electronic copy shall be corrected as required to address the Architect/Engineer's comments. Once corrected, electronic copies and paper copies shall be distributed as directed by the Architect/Engineer.
2. Approved O&M manuals shall be completed and in the Owner's possession prior to Owner's acceptance and at least 10 days prior to instruction of operating personnel.

B. Electronic Submittal Procedures:

1. Distribution: Email the O&M manual as attachments to all parties designated by the Architect/Engineer.
2. Transmittals: Each submittal shall include an individual electronic letter of transmittal.
3. Format: Electronic submittals shall be in PDF format only. Scanned copies, in PDF format, of paper originals are acceptable. Submittals that are not legible will be rejected. Do not set any permission restrictions on files; protected, locked, or secured documents will be rejected.
4. File Names: Electronic submittal file names shall include the relevant specification section number followed by a description of the item submitted, as follows. Where possible, include the transmittal as the first page of the PDF instead of using multiple electronic files.
 - a. O&M file name: O&M.div26.contractor.YYYYMMDD
 - b. Transmittal file name: O&Mtransmittal.div26.contractor.YYYYMMDD
5. File Size: Electronic file size shall be limited to a maximum of 4MB. Larger files shall be divided into files that are clearly labeled as "1 of 2", "2 of 2", etc.
6. Provide the Owner with an approved copy of the O&M manual on compact discs (CD), digital video discs (DVD), or flash drives with a permanently affixed label, printed with the title "Operation and Maintenance Instructions", title of the project and subject matter of disc/flash drive when multiple disc/flash drives are required.
7. All text shall be searchable.
8. Bookmarks shall be used, dividing information first by specification section, then systems, major equipment and finally individual items. All bookmark titles shall include the nomenclature used in the construction documents and shall be an active link to the first page of the section being referenced.

C. Operation and Maintenance Instructions shall include:

1. Title Page: Include title page with project title, Architect, Engineer, Contractor, all subcontractors, and major equipment suppliers, with addresses, telephone numbers, website addresses, email addresses and point of contacts. Website URLs and email addresses shall be active links in the electronic submittal.

2. Table of Contents: Include a table of contents describing specification section, systems, major equipment, and individual items.
3. Copies of all final approved shop drawings and submittals. Include Architect's/Engineer's shop drawing review comments. Insert the individual shop drawing directly after the Operation and Maintenance information for the item(s) in the review form.
4. Copies of all factory inspections and/or equipment startup reports.
5. Copies of warranties.
6. Schematic wiring diagrams of the equipment that have been updated for field conditions. Field wiring shall have label numbers to match drawings.
7. Dimensional drawings of equipment.
8. Detailed parts lists with lists of suppliers.
9. Operating procedures for each system.
10. Maintenance schedule and procedures. Include a chart listing maintenance requirements and frequency.
11. Repair procedures for major components.
12. Replacement parts and service material requirements for each system and the frequency of service required.
13. Instruction books, cards, and manuals furnished with the equipment.
14. Include record drawings of the one-line diagrams for each major system. The graphic for each piece of equipment shown on the one-line diagram shall be an active link to its associated Operation & Maintenance data.
15. Copies of all panel schedules in electronic Microsoft Excel spreadsheet (.xlsx) file. Each panelboard shall be a separate tab in the workbook.

3.6 INSTRUCTING THE OWNER'S REPRESENTATIVE

- A. Adequately instruct the Owner's designated representatives in the maintenance, care, and operation of the complete systems installed under this contract.
- B. Provide verbal and written instructions to the Owner's representatives by FACTORY PERSONNEL in the care, maintenance, and operation of the equipment and systems.
- C. Contractor shall make a DVD video recording of instructions to the Owner while explaining the system so additional personnel may view the instructions at a later date. The video recording shall be the property of the Owner.
- D. The instructions shall include:
 1. Maintenance of equipment.
 2. Start-up procedures for all major equipment.
 3. Description of emergency system operation.
- E. Notify the Architect/Engineer of the time and place for the verbal instructions to the Owner's representative so his representative can be present if desired.
- F. Minimum hours of instruction time for each item and/or system shall be as indicated in each individual specification section.

G. Operating Instructions:

1. Contractor is responsible for all instructions to the Owner's representatives for the electrical and specialized systems.
2. If the Contractor does not have staff that can adequately provide the required instructions, he shall include in his bid an adequate amount to reimburse the Owner for the Architect/Engineer to perform these services.

3.7 RECORD DOCUMENTS

- A. The following paragraphs supplement the requirements of Division 1.
- B. Maintain at the job site a separate and complete set of electrical drawings and specifications with all changes made to the systems clearly and permanently marked in complete detail.
- C. Mark drawings and specifications to indicate approved substitutions; Change Orders, and actual equipment and materials used. All Change Orders, RFI responses, Clarifications and other supplemental instructions shall be marked on the documents. Record documents that merely reference the existence of the above items are not acceptable. Should this Contractor fail to complete Record Documents as required by this contract, this Contractor shall reimburse Architect/Engineer for all costs to develop record documents that comply with this requirement. Reimbursement shall be made at the Architect/Engineer's hourly rates in effect at the time of work.
- D. Record changes daily and keep the marked drawings available for the Architect/Engineer's examination at any normal work time.
- E. Upon completing the job, and before final payment is made, give the marked-up drawings to the Architect/Engineer.
- F. Record actual routing of conduits exceeding 2 inches.

3.8 PAINTING

- A. This Contractor shall paint the following items:
- B. Paint all equipment that is marred or damaged prior to the Owner's acceptance. Paint and color shall match original equipment paint and shall be obtained from the equipment supplier if available. All equipment shall have a finished coat of paint applied unless specifically allowed to be provided with a prime coat only.
- C. Equipment in finished areas that will be painted to match the room decor will be painted by others. Should this Contractor install equipment in a finished area after the area has been painted, he shall have the equipment and all its supports, hangers, etc., painted to match the room decor. Painting shall be performed as described in project specifications.
- D. Equipment cabinets, casings, covers, metal jackets, etc., located in equipment rooms or concealed spaces, shall be furnished in standard finish, free from scratches, abrasions, chippings, etc.
- E. Equipment in occupied spaces, or if standard to the unit, shall have a baked primer with baked enamel finish coat free from scratches, abrasions, chipping, etc. If color option is specified or is standard to the unit, verify with the Architect his color preference before ordering.
- F. Paint all equipment in unfinished areas such as boiler room, mechanical spaces, and storage rooms. Equipment furnished with a suitable factory finish need not be painted; provided the factory applied finish is not marred or spattered. If so, equipment shall be refinished with the same paint as was factory applied.
- G. All electrical conduit and equipment, fittings, hangers, structural supports, etc., in unfinished areas, such as equipment and storage room area, shall be painted two (2) coats of oil paint of colors selected by the Architect.

- H. Do NOT paint electric conduits in crawl spaces, tunnels, or spaces above suspended ceilings except that where conduit is in a damp location give exposed threads at joints two coats of sealer after joint is made up.
- I. After surfaces have been thoroughly cleaned and are free of oil, dirt or other foreign matter, paint all raceway and equipment with the following:
 - 1. Bare Metal Surfaces - Apply one coat of metal primer suitable for the metal being painted. Finish with two coats of Alkyd base enamel paint.
 - 2. Plastic Surfaces - Paint plastic surfaces with two coats of semi-gloss acrylic latex paint.
- J. In accordance with LEED EQc4.2: Low-Emitting Materials - Paints and Coatings, all paints and coatings used on the interior of the building must comply with the following criteria:
 - 1. Architectural paints and coatings applied to interior walls and ceilings must not exceed the volatile organic compound (VOC) content limits established in Green Seal Standard GS-11, Paints, 1st Edition, May 20, 1993.
 - 2. Anti-corrosive and anti-rust paints applied to interior ferrous metal substrates must not exceed the VOC content limit of 250 g/L (2 lb./gal) established in Green Seal Standard GC-03, Anti-Corrosive Paints, 2nd Edition, January 7, 1997.

3.9 ADJUST AND CLEAN

- A. Thoroughly clean all equipment and systems prior to the Owner's final acceptance of the project.
- B. Clean all foreign paint, grease, oil, dirt, labels, stickers, etc. from all equipment.
- C. Remove all rubbish, debris, etc., accumulated during construction from the premises.

3.10 SPECIAL REQUIREMENTS

- A. Coordinate the installation of all equipment, controls, devices, etc., with other trades to maintain clear access area for servicing.
- B. Install all equipment to maximize access to parts needing service or maintenance. Review the final location, placement, and orientation of equipment with the Owner's representative prior to setting equipment.
- C. Installation of equipment or devices without regard to coordination of access requirements and confirmation with the Owner's representative will result in removal and reinstallation of the equipment at the Contractor's expense.
 - 1. Adhesives and Sealants: All sealers, adhesives, and sealants shall comply with the low emitting material limits of the following standards: LEED v4- Low Emitting Materials – Adhesives and Sealants.
 - 2. CDPH Standard Method V1.1-2010 - Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions VOC from Indoor Sources Using Environmental Chambers Version 1.1.
 - 3. South Coast Air Quality Management District Rule 1168 – Adhesive and Sealant Applications. All adhesives and sealants wet-applied on site shall comply with the applicable chemical content requirements of SCAQMD Rule 1168.
 - 4. South Coast Air Quality Management District Rule SCAQMD 1113 – Wet Applied Paints and Coatings. All paints and coatings wet-applied on site must meet the applicable VOC limits of SCAQMD Rule 1113.

3.11 INDOOR AIR QUALITY (IAQ) MAINTENANCE FOR OCCUPIED FACILITIES UNDER CONSTRUCTION

A. Within the limits of Construction:

1. The Electrical Contractor shall coordinate all work with the contractor responsible for IAQ.
2. The means, methods and materials used by the Electrical Contractor shall be coordinated with the contractor responsible for IAQ and shall comply with the IAQ requirements set forth in Division 1 and Division 21/22/23 of these specifications.

B. Outside the limits of Construction:

1. IAQ shall be the responsibility of the electrical contractor for work that is required outside the limits of construction.
2. The Electrical Contractor is responsible for the IAQ set forth in Division 1 and Division 21/22/23 of these specifications.
3. The Electrical Contractor shall review and coordinate all IAQ plans and procedures with the owner's IAQ representative.

C. Contractors shall make all reasonable efforts to prevent construction activities from affecting the air quality of the occupied areas of the building or outdoor areas near the building. These measures shall include, but not be limited to:

1. General Contractor shall erect and maintain dust barriers throughout the construction work. These barriers shall be reasonably airtight and shall prevent entry into the construction zone by unauthorized persons. Reasonably airtight means construction equivalent to full-height temporary or permanent walls with joints taped or sealed, and shafts and other penetrations sealed as well as possible. Fire resistant polyethylene is acceptable; if flame spread/smoke developed ratings are demonstrated to conform to the applicable building codes and licensing acts.
2. The Contractor shall continuously maintain the construction zone under a negative pressure of at least 0.01" w.g. minimum relative to all adjacent areas of the building.
 - a. Exhaust fans used for this purpose shall filter air and discharge it outdoors or to the least populated area adjacent to the construction work using negative air machines designed specifically for this purpose. All filtration for air recirculated back into the building shall be HEPA (99.97% DOP efficiency) for work adjacent to healthcare or elderly facilities. If no work is adjacent to these areas, 95% filtration is acceptable. Filtering air discharged to outdoors shall be accomplished with 30% filters.
 - b. If air is discharged outdoors, maintain all required distances to doors, windows, air intakes, etc.
 - c. If high levels of Volatile Organic Compounds (VOC's) or odors are released, activated carbon or equivalent filtration shall also be employed. Exhaust shall not discharge near doors, air intakes, pedestrians, gathering areas, or operable windows.
 - d. Adjusting existing air handling equipment to assist in pressure control is acceptable, if approved by the Owner and the authority having jurisdiction.
 - e. Seal return, exhaust, and supply air openings in or near the construction zone that serve existing air handling systems, and rebalance the systems for proper operation. If this is impractical, add filters at the intakes of sufficient cross sectional area to minimize the pressure drop and avoid the need for rebalancing.

- f. Maintain pressure control one hour before and after all construction periods, and 24 hours per day in healthcare or elderly facilities.
- 3. All contractors shall endeavor to minimize the amount of contaminants generated during construction. Methods to be employed shall include, but not be limited to:
 - a. Minimizing the amount of dust generated.
 - b. Reducing solvent fumes and VOC emissions.
 - c. Maintain good housekeeping practices, including sweeping and periodic dust and debris removal. There should be no visible haze in the air.
- 4. Request that the Owner designate an IAQ representative.
- 5. Review and receive approval from the Owner's IAQ representative for all IAQ-related construction activities and negative pressure containment plans.
- 6. Inform the IAQ representative of all conditions that could adversely impact IAQ, including operations that will produce higher than normal dust production or odors.
- 7. Schedule activities that may cause IAQ conditions that are not acceptable to the Owner's IAQ representative during unoccupied periods.
- 8. Request copies of and follow all Owner's IAQ and infection control policies.
- 9. Unless no other access is possible, the entrance to construction site shall not be through the existing facility.
- 10. To minimize growth of infectious organisms, do not permit damp areas in or near the construction area to remain for over 24 hours.
- 11. In addition to the criteria above, provide measures as recommended in the SMACNA "IAQ Guidelines for Occupied Buildings under Construction".

3.12 SYSTEM STARTING AND ADJUSTING

- A. The electrical systems shall be complete and operating. System startup, testing, adjusting, and balancing to obtain satisfactory system performance is the responsibility of the Contractor. This includes all calibration and adjustment of electrical controls, balancing of loads, troubleshooting and verification of software, and final adjustments that may be needed.
- B. Complete all manufacturer-recommended startup procedures and checklists to verify proper equipment operation and does not pose a danger to personnel or property.
- C. All operating conditions and control sequences shall be tested during the start-up period. Testing all interlocks, safety shut-downs, controls, and alarms.
- D. The Contractor, subcontractors, and equipment suppliers shall have skilled technicians to ensure that all systems perform properly. If the Architect/Engineer is requested to visit the job site for trouble shooting, assisting in start-up, obtaining satisfactory equipment operation, resolving installation and/or workmanship problems, equipment substitution issues or unsatisfactory system performance, including call backs during the warranty period, through no fault of the design; the Contractor shall reimburse the Owner on a time and materials basis for services rendered at the Architect/Engineer's standard hourly rates in effect when the services are requested. The Contractor shall pay the Owner for services required that are product, installation or workmanship related. Payment is due within 30 days after services are rendered.

3.13 FIELD QUALITY CONTROL

A. General:

1. Conduct all tests required during and after construction. Submit test results in NETA format, or equivalent form, that shows the test equipment used, calibration date, tester's name, ambient test conditions, humidity, conductor length, and results corrected to 40°C.
2. Supply necessary instruments, meters, etc., for the tests. Supply competent technicians with training in the proper testing techniques.
3. All cables and wires shall be tested for shorts and grounds following installation and connection to devices. Replace shorted or grounded wires and cables.
4. Any wiring device, electrical apparatus or luminaire, if grounded or shorted on any integral "live" part, shall have all defective parts or materials replaced.
5. Test cable insulation of service and panel feeder conductors for proper insulation values. Tests shall include the cable, all splices, and all terminations. Each conductor shall be tested and shall test free of short circuits and grounds and have an insulation value not less than CEC Standards. Take readings between conductors, and between conductors and ground.
6. If the results obtained in the tests are not satisfactory, make adjustments, replacements, and changes as needed. Then repeat the tests, and make additional tests, as the Architect/Engineer or authority having jurisdiction deems necessary.

B. Ground Resistance:

1. Conduct service ground resistance tests using an approved manufactured ground resistance meter. Submit to the Architect/Engineer a proposed test procedure including type of equipment to be used. (The conventional ohmmeter is not an acceptable device.)
2. Make ground resistance measurements during normal dry weather and not less than 48 hours after a rain. Ground resistance values shall be verified by the Architect/Engineer at the time the readings are taken.
3. If the ground resistance value obtained is more than the value set forth in Section 26 05 26, the following shall be done to obtain the value given:
 - a. Verify that all connections in the service ground system are secure.
 - b. Increase the depth to which ground rods are driven by adding section lengths to the rods and retest. If the resistance is still excessive increase the depth by adding an additional rod section and retest.
 - c. If the resistance is still excessive, furnish and install additional ground rods, spaced not less than 20 feet from other ground rods unless otherwise noted on plans, and connect into the ground electrode system. Retest.
 - d. Review results with the Architect/Engineer.
4. Before final payment is made to the Contractor submit a written report to the Architect/Engineer including the following:
 - a. Date of test.
 - b. Number of hours since the last rain.
 - c. Soil condition at the time of the test in the ground electrode location. That is: dry, wet, moist, sand, clay, etc.

- d. Diagram of the test set-up showing distances between test equipment, ground electrode, auxiliary electrodes, etc.
 - e. Make, model, and calibration date of test equipment.
 - f. Tabulation of measurements taken and calculations made.
- C. Other Equipment:
 - 1. Give other equipment furnished and installed by the Contractor all standard tests normally made to assure that the equipment is electrically sound, all connections properly made, phase rotation correct, fuses and thermal elements suitable for protection against overloads, voltage complies with equipment nameplate rating, and full load amperes are within equipment rating.
- D. If any test results are not satisfactory, make adjustments, replacements and changes as needed and repeat the tests and make additional tests as the Architect/Engineer or authority having jurisdiction deem necessary.
- E. Contractor shall thermographic study all electrical gear, switchboard, panelboards, etc. at the end of construction to identify any unusual conditions/heating within the equipment. Coordinate with Owner/Architect/Engineer to have an Owner/Architect/Engineer representative present during testing.
- F. Report shall include color printouts, in binder, of pictures taken to use as a baseline reading after building is occupied.
- G. Upon completion of the project, the Contractor shall provide amperage readings for all panelboards and switchboards and turn the results over to the Owner for "benchmark" amperages.

3.14 CONSTRUCTION WASTE MANAGEMENT

- A. This Contractor shall comply with all construction and demolition waste disposal and recycling requirements outlined in LEED MRc2: Construction Waste Management (follow latest edition at the time of bidding or as referenced in these specifications).
 - 1. This Contractor shall coordinate with the General Contractor or Construction Manager to develop and implement a construction waste management plan that, at a minimum, identifies the materials to be diverted from disposal and whether the materials will be sorted on-site or co-mingled.
 - 2. The Contractor shall track waste disposal and recycling efforts throughout the construction process for all materials associated with this Contractor's scope of work. The Contractor shall provide this information to the General Contractor or Construction Manager so that it can be incorporated with similar information from all other contractors for the project.
 - a. Calculations for waste and recycled material can be done by weight or volume, but they must be consistent throughout the project. The Contractor shall coordinate with the General Contractor or Construction Manager to establish the preferred calculation method and report the results accordingly.
 - b. Excavated soil and land-clearing debris do not count towards the waste disposal or recycled material.
 - 3. At a minimum, 75% of the construction and demolition debris for this project must be recycled or salvaged.

3.15 UTILITY REBATE

- A. Submit utility rebate forms, where offered at project location, with rebate items completed. Rebate may include lighting, lighting controls, variable speed drives, heat pumps, package terminal A/C, air conditioners, chillers, water heaters, programmable thermostats, and motors.
- B. Contractor must submit notification of any value engineering or product substitution that will affect the utility rebate amount prior to approval.

END OF SECTION

READINESS CERTIFICATION PRIOR TO FINAL JOBSITE OBSERVATION

To prevent the final job observation from occurring too early, we require that the Contractor review the completion status of the project and, by copy of this document, certify that the job is indeed ready for the final job observation. The following is a typical list of items that represent the degree of job completeness expected prior to your requesting a final job observation.

1. Penetrations of fire-rated construction fire sealed in accordance with specifications.
2. Electrical panels have typed circuit identification.
3. Smoke and fire/smoke dampers are wired and have been tested.
4. Per Section 26 05 00, cable insulation test results have been submitted.
5. Per Section 26 05 00, ground resistance test results have been submitted.
6. Operation and Maintenance manuals have been submitted as per Section 26 05 00.
7. Bound copies of approved shop drawings have been submitted as per Section 26 05 00.
8. Report of instruction of Owner's representative has been submitted as per Section 26 05 00.
9. Fire alarm inspection and testing report has been submitted as per Sections 26 05 00 and 28 31 00.
10. Start-up reports from factory representative have been submitted as per Section 26 05 00.

Accepted by:

Prime Contractor _____

By _____ Date _____

Upon Contractor certification that the project is complete and ready for a final job observation, we require the Contractor to sign this agreement and return it to the Architect/Engineer so that the final observation can be scheduled.

It is understood that if the Architect/Engineer finds the job not ready for the final observation and that additional trips and observations are required to bring the project to completion, the costs incurred by the Architect/Engineers for additional time and expenses will be deducted from the Contractor's contract retainage prior to final payment at the completion of the job.

* * * * *

SECTION 26 05 03

THROUGH PENETRATION FIRESTOPPING

1. PART GENERAL

1.1 SECTION INCLUDES

- A. Through-Penetration Firestopping.

1.2 QUALITY ASSURANCE

- A. Manufacturer: Company specializing in manufacturing products specified in this Section.
- B. Installer: Individuals performing work shall be certified by the manufacturer of the system selected for installation.

1.3 REFERENCES

- A. UL 263 - Fire Tests of Building Construction and Materials.
- B. UL 723 - Surface Burning Characteristics of Building Materials
- C. ANSI/UL 1479 - Fire Tests of Through Penetration Firestops
- D. UL 2079 - Tests for Fire Resistance of Building Joint Systems
- E. UL Fire Resistance Directory Through Penetration Firestop Systems (XHEZ)
- F. Intertek / Warnock Hersey - Directory of Listed Products
- G. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials
- H. ASTM E814 - Standard Test Method for Fire Tests of Through-Penetration Firestops
- I. The Building Officials and Code Administrators National Building Code
- J. NFPA 5000 – Building Construction Safety Code
- K. OSHPD - Office of State Wide Health Planning and Development (California)
- L. CBC California Building Code

1.4 SUBMITTALS

- A. Submit under provisions of Division 1.
- B. Submit Firestopping Installers Certification for all installers on the project.
- C. Shop Drawings: Submit for each condition requiring firestopping. Include descriptions of the specific penetrating item, actual wall/floor construction, manufacturer's installation instructions, and UL or Interek / Warnock Hersey Assembly number.
- D. Through-Penetration Firestop System Schedule: Indicate locations of each through-penetration firestop system, along with the following information:
 - 1. Types of penetrating items.
 - 2. Types of constructions penetrated, including fire-resistance ratings and, where applicable, thicknesses of construction penetrated.
 - 3. Through-penetration firestop systems for each location identified by firestop design designation of qualified testing and inspecting agency.
 - 4. F and T ratings for each firestop system.
- E. Maintain a notebook on the job site at all times that contains copies of approved submittals for all through penetration firestopping to be installed. Notebook shall be made available to the Authority Having Jurisdiction at their request and turned over to the Owner at the end of construction as part of the O&M Manuals.

- F. Submit VOC rating of firestopping material in g/L (less water) with documentation that it meets the limits set forth in SCAQMD Rule 1168.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Store, protect and handle products on site. Accept material on site in factory containers and packing. Inspect for damage. Protect from deterioration or damage due to moisture, temperature changes, contaminants, or other causes. Follow manufacturer's instructions for storage.
- B. Install material prior to expiration of product shelf life.

1.6 PERFORMANCE REQUIREMENTS

- A. General: For penetrations through the following fire-resistance-rated constructions, including both empty openings and openings containing penetrating items, provide through-penetration firestop systems that are produced and installed to resist spread of fire according to requirements indicated, resist passage of smoke and other gases, and maintain original fire-resistance rating of construction penetrated.
 - 1. Fire-resistance-rated walls including fire partitions, fire barriers, and smoke barriers.
 - 2. Fire-resistance-rated horizontal assemblies including floors, floor/ceiling assemblies, and ceiling membranes of roof/ceiling assemblies.
- B. Rated Systems: Provide through-penetration firestop systems with the following ratings determined per UL 1479:
 - 1. F-Rated Systems: Provide through-penetration firestop systems with F-ratings indicated, but not less than that equaling or exceeding fire-resistance rating of constructions penetrated.
 - 2. T-Rated Systems: For the following conditions, provide through-penetration firestop systems with T-ratings indicated, as well as F-ratings:
 - a. Floor penetrations located outside wall cavities.
 - b. Floor penetrations located outside fire-resistance-rated shaft enclosures.
 - c. Wall penetrations above corridor ceilings which are not part of a fire-resistive assembly.
 - d. Wall penetrations below any ceiling that are larger than 4" diameter or 16 square inches.
 - 3. L-Rated Systems: Provide through-penetration firestop systems with L-ratings of not more than 5.0 cfm/sq.ft. at both ambient temperature and 400°F.
- C. For through-penetration firestop systems exposed to light, traffic, moisture, or physical damage, provide products that, after curing, do not deteriorate when exposed to these conditions both during and after construction.
- D. For through-penetration firestop systems exposed to view, provide products with flame-spread and smoke-developed indexes of less than 25 and 450, respectively, as determined per ASTM E 84.
- E. For through-penetration firestop systems in air plenums, provide products with flame-spread and smoke-developed indexes of less than 25 and 50, respectively, as determined per ASTM E 84.
 - 1. Adhesives and Sealants: All sealers, adhesives, and sealants shall comply with the low emitting material limits of the following standards:
 - 2. LEED v4– Low Emitting Materials – Adhesives and Sealants.

3. CDPH Standard Method V1.1-2010 - Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions VOC from Indoor Sources Using Environmental Chambers Version 1.1.
4. South Coast Air Quality Management District Rule 1168 – Adhesive and Sealant Applications. All adhesives and sealants wet-applied on site shall comply with the applicable chemical content requirements of SCAQMD Rule 1168.
5. South Coast Air Quality Management District Rule SCAQMD 1113 – Wet Applied Paints and Coatings. All paints and coatings wet-applied on site must meet the applicable VOC limits of SCAQMD Rule 1113.

1.7 MEETINGS

- A. Pre-installation meeting: A pre-installation meeting shall be scheduled and shall include the Construction Manager, General Contractor, all Subcontractors associated with the installation of systems penetrating fire barriers, Firestopping Manufacturer's Representative, and the Owner.
 1. Review foreseeable methods related to firestopping work.
 2. Tour representative areas where firestopping is to be installed; inspect and discuss each type of condition and each type of substrate that will be encountered, and preparation to be performed by other trades.

1.8 WARRANTY

- A. Provide one year warranty on parts and labor.
- B. Warranty shall cover repair or replacement of firestop systems which fail in joint adhesion, cohesion, abrasion resistance, weather resistance, extrusion resistance, migration resistance, stain resistance, general durability, or appear to deteriorate in any manner not clearly specified by the manufacturer as an inherent quality of the material.

2. PART PRODUCTS

2.1 MANUFACTURERS

- A. Products: Subject to compliance with requirements, provide one of the through-penetration firestop systems indicated for each application that are produced by one of the following manufacturers. All firestopping systems installed shall be provided by a single manufacturer.
 1. 3M; Fire Protection Products Division
 2. Hilti, Inc.
 3. RectorSeal Corporation, Metacaulk
 4. Tremco; Sealant/Weatherproofing Division
 5. Johns-Manville
 6. Specified Technologies Inc. (S.T.I.)
 7. Spec Seal Firestop Products
 8. AD Firebarrier Protection Systems
 9. Wiremold/Legrand: FlameStopper
 10. Dow Corning Corp
 11. Fire Trak Corp
 12. International Protective Coating Corp

2.2 THROUGH PENETRATION FIRESTOP SYSTEMS

- A. Provide materials and systems classified by or listed by Intertek / Warnock Hersey to provide firestopping equal to time rating of construction being penetrated.
- B. All firestopping materials shall be free of asbestos, lead, PCB's, and other materials that would require hazardous waste removal.
- C. Firestopping shall be flexible to allow for normal penetrating item movement due to expansion and contraction.
- D. Provide firestopping systems capable of supporting floor loads where systems are exposed to possible floor loading or traffic.
- E. Provide firestopping systems allowing continuous insulation for all insulated pipes.
- F. Provide firestopping systems classified by UL or listed by Intertek / Warnock Hersey for penetrations through all fire rated construction. Firestopping systems shall be selected from the UL or listed by Intertek / Warnock Hersey Fire Resistance Directory Category XHEZ based on substrate construction and penetrating item size and material and shall fall within the range of numbers listed:

- 1. Combustible Framed Floors and Chase Walls - 1 or 2 Hour Rated
 - F Rating = Floor/Wall Rating
 - T Rating = Floor/Wall Rating
 - L Rating = Penetrations in Smoke Barriers

<u>Penetrating Item</u>	<u>UL System No.</u>
No Penetrating Item	FC 0000-0999*
Metallic Pipe or Conduit	FC 1000-1999
Non-Metallic Pipe or Conduit	FC 2000-2999
Electrical Cables	FC 3000-3999
Cable Trays	FC 4000-4999
Insulated Pipes	FC 5000-5999
Duct without Damper and Misc. Mechanical	FC 7000-7999
Multiple Penetrations	FC 8000-8999

- 2. Non-Combustible Framed Walls - 1 or 2 Hour Rated
 - F Rating = Wall Rating
 - T Rating = 0
 - L Rating = Penetrations in Smoke Barriers

<u>Penetrating Item</u>	<u>UL System No.</u>
No Penetrating Item	WL 0000-0999*
Metallic Pipe or Conduit	WL 1000-1999
Non-Metallic Pipe or Conduit	WL 2000-2999
Electrical Cables	WL 3000-3999
Cable Trays	WL 4000-4999
Insulated Pipes	WL 5000-5999
Duct without Damper and Misc. Mechanical	WL 7000-7999
Multiple Penetrations	WL 8000-8999

3. Concrete or Masonry Floors and Walls - 1 or 2 Hour Rated
 F Rating = Wall/Floor Rating
 T Rating (Walls) = 0 or Wall Rating
 T Rating (Floors) = Floor Rating
 L Rating = Penetrations in Smoke Barriers

<u>Penetrating Item</u>	<u>UL System No.</u>
No Penetrating Item	CAJ 0000-0999*
Metallic Pipe or Conduit	CAJ 1000-1999
Non-Metallic Pipe or Conduit	CAJ 2000-2999
Electrical Cables	CAJ 3000-3999
Cable Trays	CAJ 4000-4999
Insulated Pipes	CAJ 5000-5999
Duct without Damper and Misc. Mechanical	CAJ 7000-7999
Multiple Penetrations	CAJ 8000-8999

*Alternate method of firestopping is patching opening to match original rated construction.

- G. Any opening in walls or floors not covered by the listed series of numbers shall be coordinated with the firestopping manufacturer.
- H. Any openings in floors or walls not described in the UL or listed by Intertek / Warnock Hersey Fire Resistance Directory, or outlined in manufacturer's information shall be sealed in a manner agreed upon by the Firestopping Manufacturer, Owner, and the Authority Having Jurisdiction.

3. PART EXECUTION

3.1 EXAMINATION

- A. Ensure all surfaces that contact seal materials are free of dirt, dust, grease, oil, rust, or loose materials. Clean and repair surfaces as required. Remove laitance and form-release agents from concrete.
- B. Ensure substrate and penetrating items have been permanently installed prior to installing firestopping systems. Ensure penetrating items have been properly spaced and have proper clearance prior to installing firestopping systems.
- C. Surfaces to which sealing materials are to be installed must meet the selected UL or Intertek / Warnock Hersey system substrate criteria.
- D. Prime substrates where recommended in writing by through-penetration firestop system manufacturer. Confine primer to area of bond.

3.2 INSTALLATION

- A. In existing construction, provide firestopping of openings prior to and after installation of penetrating items. Remove any existing coatings on surfaces prior to firestopping installation. Temporary firestopping shall consist of packing openings with fire resistant mineral wool for the full thickness of substrate, or an alternate method approved by the Authority Having Jurisdiction. All openings shall be temporarily firestopped immediately upon their installation and shall remain so until the permanent UL or listed by Intertek / Warnock Hersey listed firestopping system is installed.
- B. Install penetration seal materials in accordance with printed instructions of the UL or Intertek / Warnock Hersey Fire Resistance Directory and with the manufacturer's printed application instructions.

- C. Install dams as required to properly contain firestopping materials within openings and as required to achieve required fire resistance rating. Remove combustible damming after appropriate curing.

3.3 CLEANING AND PROTECTING

- A. Clean excess fill materials adjacent to openings as Work progresses by methods and with cleaning materials that are approved in writing by through-penetration firestop system manufacturers and that do not cause damage.
- B. Provide final protection and maintain conditions during and after installation that ensure that through-penetration firestop systems are without damage or deterioration at time of Substantial Completion. If, despite such protection, damage or deterioration occurs, remove damaged or deteriorated through-penetration firestop systems immediately and install new materials to produce systems complying with specified requirements.

3.4 IDENTIFICATION

- A. Provide and install labels adjacent to each firestopping location. Label shall be provided by the firestop system supplier and contain the following information in a contrasting color:
 - 1. The words "Warning - Through Penetration Firestop System - Do Not Disturb. Notify Building Management of Any Damage."
 - 2. Firestop System Supplier; UL or listed by Intertek / Warnock Hersey system number; date installed; contractor name and phone number; manufacturer's representative name, address, and phone number.

3.5 INSPECTION

- A. All penetrations shall be inspected by the manufacturer's representative to ensure proper installation.
- B. Access to firestop systems shall be maintained for examination by the Authority Having Jurisdiction at their request.
- C. Proceed with enclosing through-penetration firestop system with other construction only after inspection reports are issued and firestop installations comply with requirements.
- D. The contractor shall allow for visual destructive review of 5% of installed firestop systems (minimum of one) to prove compliance with specifications and manufacturer's instructions and details. Destructive system removal shall be performed by the contractor and witnessed by the Architect/Engineer and manufacturer's factory representative. The Architect/Engineer shall have sole discretion of which firestop system installations will be reviewed. The contractor is responsible for all costs associated with this requirement including labor and material for removing and replacing the installed firestop system. If any firestop system is found to not be installed per manufacturer's specific instructions and details, all firestop systems are subject to destructive review and replacement at the Architect/Engineer's discretion and the contractor's expense.

END OF SECTION

SECTION 26 05 13

WIRE AND CABLE

1. PART GENERAL

1.1 SECTION INCLUDES

- A. Building wire
- B. Cabling for remote control, signal, and power limited circuits
- C. Fire rated and circuit integrity (CI) cable and assemblies

1.2 RELATED WORK

- A. Section 26 05 53 – Electrical Identification: Refer to electrical identification for color and identification labeling requirements.

1.3 REFERENCES

- A. ASTM B800-05 – Standard Specification for 8000 Series Aluminum Alloy Wire Electrical Purposes- Annealed and Intermediate Tempered.
- B. ASTM B801-07 – Standard Specification for Concentric-Lay-Stranded Conductors of 8000 Series Aluminum Alloy for Subsequent Covering or Insulation
- C. NEMA WC 70 - Power Cables Rated 2,000V or Less for the Distribution of Electrical Energy
- D. NFPA 70 - National Electrical Code (NEC)
- E. UL 44 – Thermoset-Insulated Wires and Cables
- F. UL 83 – Thermoplastic-Insulated Wires and Cables
- G. UL 854 – Service-Entrance Cables
- H. UL 1581 – Standard for Electrical Wires, Cables, and Flexible Cords
- I. UL 2196 – Fire Resistive, Fire Resistant and Circuit Integrity Cables
- J. California Division of State Architect (DSA) Interpretation of Regulations

1.4 SUBMITTALS

- A. Submit shop drawings and product data under the provisions of Section 26 05 00.
- B. Submit manufacturer's installation instructions.

2. PART PRODUCTS

2.1 BUILDING WIRE

- A. Feeders and Branch Circuits Larger Than 6 AWG: Copper, stranded conductor, 600-volt insulation, THHN/THWN or XHHW-2.
- B. Feeders and Branch Circuits Larger Than 6 AWG in Underground Conduit: Copper, stranded conductor, 600-volt insulation, THWN or XHHW-2.
- C. Feeders and Branch Circuits 6 AWG and Smaller: Copper conductor, 600-volt insulation, THHN/THWN. 6 and 8 AWG, stranded conductor; smaller than 8 AWG, solid or stranded conductor, unless otherwise noted on the drawings. Aluminum, compact stranded conductor is not acceptable.
- D. Motor Feeder from Variable Frequency Drives: Copper conductor, 600-volt XHHW-2 insulation, stranded conductor, unless otherwise noted on the drawings. Three conductor stranded overall helical copper tape shield. Shield shall be terminated at both ends of cable with an approved termination.
- E. Control Circuits: Copper, stranded conductor 600-volt insulation, THHN/THWN.

- F. Aluminum conductors are not to be used for feeds to motor loads.
- G. Each 120 and 277-volt branch circuit shall have a dedicated neutral conductor. Neutral conductors shall be considered current-carrying conductors for wire derating.

2.2 CABLING FOR REMOTE CONTROL, SIGNAL, AND POWER LIMITED CIRCUITS:

- A. Wire for the following specialized systems shall be as designated on the drawings, or elsewhere in these specifications. If not designated on the drawings or specifications, the system manufacturer's recommendations shall be followed.
 - 1. Fire alarm
 - 2. Low voltage switching
 - 3. Building automation systems and control
 - 4. Sound
 - 5. Electronic control
 - 6. Security
 - 7. TV
 - 8. Telephone
 - 9. Data
 - 10. Clock
- B. Control Cable for Class 1 Remote Control and Signal Circuits: Copper conductor, 600-volt insulation, rated 60°C, individual conductors twisted together, shielded, and covered with a PVC jacket.
- C. Control Cable for Class 2 or Class 3 Remote Control and Signal Circuits: Copper conductor, 300-volt insulation, rated 60°C, individual conductors twisted together, shielded, and covered with a PVC jacket; UL listed.
- D. Plenum Cable for Class 2 or Class 3 Remote Control and Signal Circuits: Copper conductor, 300-volt insulation, rated 60°C, individual conductors twisted together, shielded, and covered with a nonmetallic jacket; UL listed for use in air handling ducts, hollow spaces used as ducts, and plenums.

2.3 FIRE-RATED AND CIRCUIT INTEGRITY (CI) CABLE AND ASSEMBLIES

- A. Properties and requirements of fire rated cables and assemblies:
 - 1. 2HR fire rated for horizontal and vertical installations.
- B. Acceptable fire-rated cables and listed assemblies:
 - 1. Feeder assembly located outside the structure (example: below finished grade) or encased in concrete; minimum 2 inches of concrete).
 - 2. Mineral Insulated Cables: Copper conductor, 600-volt insulation, rated 90°C, Type MI.
 - 3. MC Cable: Copper conductor, 600V thermoset, low smoke zero halogen silicone rubber insulation, continuously welded corrugated copper armor for equipment grounding conductor, rated 90°C, UL listed 2196. MC fire rated cable shall not be used for branch circuits that required redundant equipment ground paths per code.
 - a. Approved Manufacturer:
 - 1) VITALink MC
 - 2) Raychem Tycothermal MC

4. Fire rated cable in phenolic RTRC conduit: Copper conductor, 600-volt RHW-2 or RW90 low smoke zero halogen (LSZH) insulation, rated 90°C. Assembly shall be UL listed 2196 and UL circuit integrity (FHIT).

- a. Approved Manufacturers:

- 1) Draka Lifeline
- 2) VITALink 300

3. PART EXECUTION

3.1 WIRE AND CABLE INSTALLATION SCHEDULE

A. Above Accessible Ceilings:

1. Building wire shall be installed in raceway.

B. All Other Locations: Building wire in raceway.

C. Above Grade: All conductors installed above grade shall be type "THHN".

D. Underground or In Slab: All conductors shall be type "THWN".

E. Low Voltage Cable (less than 100 volts): Low voltage cable shall be installed in raceway.

F. Fire-Rated 2-Hour Feeders and Circuit Requiring Continuous Operation (CI): Refer to Part 2 of this section for acceptable products and assemblies. Installation shall meet UL 2196.

3.2 CONTRACTOR CHANGES

A. The basis of design is copper conductors installed in raceway based on ambient temperature of 30°C, NEC Table 310.16. Service entrance feeder conductors are based on copper conductor installed in underground electrical ducts, NEC Table B.310.15(B)(2)(7).

B. The Contractor shall be responsible for derating and sizing conductors and conduits to equal or exceed the ampacity of the basis of design circuits, if he/she chooses to use methods or materials other than the basis of design.

C. Underground electrical duct ampacity rating shall be in accordance with NEC Table B.310.15(B)(2)(7) or calculated in accordance with Annex B Application Information for Ampacity Calculation. The calculations and a sketch of the proposed installation shall be submitted prior to any conduit being installed.

D. Record drawing shall include the calculations and sketches.

3.3 GENERAL WIRING METHODS

A. Use no wire smaller than 12 AWG for power and lighting circuits, and no smaller than 14 AWG for control wiring.

B. Use no wire smaller than 18 AWG for low voltage control wiring (<100 volts).

C. Use 10 AWG conductor for 20 ampere, 120-volt branch circuit home runs longer than 75 feet, and for 20 ampere, 277-volt branch circuit home runs longer than 200 feet.

D. Use no wire smaller than 8 AWG for outdoor lighting circuits.

E. The ampacity of multiple conductors in one conduit shall be derated per NEC 310. In no case shall more than 4 conductors be installed in one conduit to such loads as motors larger than 1/4 HP, panelboards, motor control centers, etc.

- F. Where installing parallel feeders, place an equal number of conductors for each phase of a circuit in same raceway or cable.
- G. Splice only in junction or outlet boxes.
- H. Neatly train and lace wiring inside boxes, equipment, and panelboards.
- I. Make conductor lengths for parallel circuits equal.
- J. All conductors shall be continuous in conduit from last outlet to their termination.
- K. Terminate all spare conductors on terminal blocks, and label the spare conductors.
- L. Cables or wires shall not be laid out on the ground before pulling.
- M. Cables or wires shall not be dragged over earth or paving.
- N. Care shall be taken so as not to subject the cable or wire to high mechanical stresses that would cause damage to the wire and cable.
- O. At least six (6)-inch loops or ends shall be left at each outlet for installation connection of luminaires or other devices.
- P. All wires in outlet boxes not connected to fixtures or other devices shall be rolled up, spliced if continuity of circuit is required, and insulated.

3.4 WIRING INSTALLATION IN RACEWAYS

- A. Pull all conductors into a raceway at the same time. Use UL listed wire pulling lubricant for pulling 4 AWG and larger wires. Do not use wire pulling lubricant for isolated (ungrounded) power system wiring.
- B. Install wire in raceway after interior of building has been physically protected from the weather and all mechanical work likely to injure conductors has been completed.
- C. Pulling shall be continuous without unnecessary stops and starts with wire or cable only partially through raceway.
- D. Where reels of cable or wire are used, they shall be set up on jacks close to the point where the wire or cable enters the conduit or duct so that the cable or wire may be unreeled and run into the conduit or duct with a minimum of change in the direction of the bend.
- E. Conductors shall not be pulled through conduits until plastering or masonry work is completed and conduits are free from moisture. Care shall be taken so that long pulls of wire or pulls around several bends are not made where the wire may be permanently stretched and the insulation damaged.
- F. Only nylon rope shall be permitted to pull cables into conduit and ducts.
- G. Completely and thoroughly swab raceway system before installing conductors.
- H. Conductor Supports in Vertical Raceways:
 - 1. Support conductors in vertical raceways in accordance with NEC 300.19 and Table 300.19(A) Spacing of Conductors Supports.
 - 2. Supports shall be of insulated wedge type (OZ Gedney Type S, or equal) and installed in a tapered insulated bushing fitting or a metal woven mesh with a support ring that fits inside conduit fitting installed in an accessible junction box (Hubbell Kellems support grip or equal).

3.5 CABLE INSTALLATION

- A. Provide protection for exposed cables where subject to damage.
- B. Use suitable cable fittings and connectors.
- C. Run all open cable parallel or perpendicular to walls, ceilings, and exposed structural members. Follow the routing as illustrated on the drawings as closely as possible. Cable routing on drawings scaled 1/4"=1'-0" or less shall be considered diagrammatical, unless noted otherwise. The correct routing, when shown diagrammatically, shall be chosen by the Contractor based on information in the contract documents; in accordance with the manufacturer's written instructions, applicable codes, the NECA's "Standard of Installation", recognized industry standards; and coordinated with other contractors.
- D. Open cable shall be supported by the appropriate size J-hooks or other means if called for on the drawings. Wire and cable from different systems shall not be installed in the same J-hook. J-hooks shall be sized with 20% spare capacity. J-hooks shall provide proper bend radius support for data cable and fiber cables.
- E. Open cable installed above suspended ceilings shall not rest on the suspended ceiling construction, nor utilize the ceiling support system for wire and cable support.
- F. J-hook supports shall be installed at a maximum of five-foot (5') intervals. All J-hooks shall be installed where completely accessible and not blocked by piping, ductwork, inaccessible ceilings, etc. J-hooks shall be independently rigidly attached to a structural element. J-hooks shall be installed to provide 2" horizontal separation and 6" vertical separation between systems.
- G. Open cable shall only be installed where specifically shown on the drawings, or permitted in these specifications.

3.6 FIRE-RATED CABLE AND ASSEMBLY INSTRUCTIONS

- A. Terminations of the fire-rated cable must be outside of the fire zone.
- B. Fire-rated cable shall be installed according to the manufacturer's instructions, recommendations, and UL listing.
- C. Route fire-rated cable and assemblies separate from other feeders and distribution. Install cable and assemblies in locations protected from physical damage.
- D. Refer to Electrical Identification Section 26 05 53 for specific identification requirements.

3.7 WIRING CONNECTIONS AND TERMINATIONS

- A. Splice and tap only in accessible junction boxes.
- B. Use solderless, tin-plated copper, compression terminals (lugs) applied with circumferential crimp for conductor terminations, 8 AWG and larger.
- C. Use solderless, tin-plated, compression terminals (lugs) applied with indenter crimp for copper conductor terminations, 10 AWG and smaller.
- D. Use solderless pressure connectors with insulating covers for copper wire splices and taps, 8 AWG and smaller. For 10 AWG and smaller, use insulated spring wire connectors with plastic caps.
- E. Use compression connectors applied with circumferential crimp for conductor splices and taps, 6 AWG and larger. Tape uninsulated conductors and connectors with electrical tape to 150 percent of the insulation value of conductor. Cold shrink connector insulator with 1kV rating shall be used in damp and wet locations.
- F. Thoroughly clean wires before installing lugs and connectors.

- G. Make splices, taps and terminations to carry full ampacity of conductors without perceptible temperature rise.
- H. Phase Sequence: All apparatus shall be connected to operate in the phase sequence A-B-C representing the time sequence in which the phase conductors so identified reach positive maximum voltage.
- I. As a general rule, applicable to switches, circuit breakers, starters, panelboards, switchgear and the like, the connections to phase conductors are intended thus:
 - 1. Facing the front and operating side of the equipment, the phase identification shall be:
 - a. Left to Right - A-B-C
 - b. Top to Bottom - A-B-C
- J. Connection revisions as required to achieve correct rotation of motors shall be made at the load terminals of the starters or disconnect switches.
- K. Use antioxidant joint compound on all aluminum conductor terminations. Apply antioxidant joint compound per manufacturer's recommendations.

3.8 FIELD QUALITY CONTROL

- A. Field inspection and testing will be performed under provisions of Division 1.
- B. Building Wire and Power Cable Testing: Perform an insulation-resistance test on each conductor with respect to ground and adjacent conductors. Test shall be made by means of a low-resistance ohmmeter, such as a "Megger". The applied potential shall be 500 volts dc for 300 volt rated cable and 1000 volts dc for 600 volt rated cable. The test duration shall be one minute. Insulation resistance must be greater than 100 mega-ohm for 600 volt and 25 mega-ohm for 300 volt rated cables per NETA Acceptance Testing Standard. Verify uniform resistance of parallel conductors.
- C. MI cable shall have the insulation resistance of each cable tested with a 500-volt dc megohmmeter prior to energizing the cables. Tabulate resistance values and submit to Architect/Engineer for acceptance.
- D. Inspect wire and cable for physical damage and proper connection.
- E. Torque test conductor connections and terminations to manufacturer's recommended values.
- F. Perform continuity test on all power and equipment branch circuit conductors. Verify proper phasing connections.
- G. Provide documentation of the manufacturer's recommended lug torque value for copper conductors, the date the lugs were torqued, and installed torque readings. Documentation indicating that the torque wrench has been calibrated not more than 30 days prior to tightening of lugs shall be provided.
- H. Protection of wire and cable from foreign materials:
 - 1. It is the Contractor's responsibility to provide adequate physical protection to prevent foreign material application or contact with any wire or cable type. Foreign material is defined as any material that would negatively impact the validity of the manufacturer's performance warranty. This includes, but is not limited to, overspray of paint (accidental or otherwise), drywall compound, or any other surface chemical, liquid, or compound that could come in contact with the cable, cable jacket, or cable termination components.

- I. Overspray of paint on any wire or cable will not be accepted. It shall be the Contractor's responsibility to replace any component containing overspray, in its entirety, at no additional cost to the project. Cleaning of the cables with harsh chemicals is not allowed.

END OF SECTION

SECTION 26 05 26

GROUNDING AND BONDING

1. PART GENERAL

1.1 SECTION INCLUDES

- A. Equipment grounding system
- B. Bonding system
- C. Grounding electrode system

1.2 QUALITY ASSURANCE

- A. Testing Agency Qualifications: Testing agency as defined by OSHA in 29 CFR 1910.7 or a member company of the International Electrical Testing Association and that is acceptable to authorities having jurisdiction.
- B. Testing Agency's Field Supervisor: Person currently certified by the International Electrical Testing Association to supervise on-site testing specified in Part 3.
- C. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
- D. Comply with UL 467 Grounding and Bonding Equipment.
- E. Comply with NFPA 780 and UL 96 when interconnecting with lightning protection system.
- F. Comply with NFPA 70; for overhead-line construction and medium-voltage underground construction, comply with IEEE/ANSI C2 National Electrical Safety Code (NESC).

1.3 REFERENCES

- A. California Electrical Code (CEC)

1.4 SUBMITTALS

- A. Submit shop drawings under provisions of Section 26 05 00.
- B. Product Data: For the following:
 - 1. Ground rods.
 - 2. Chemical electrodes.
- C. Field Test Reports: Submit written test reports to include the following:
 - 1. Test procedures used.
 - 2. Test results that comply with requirements.
 - 3. Results of failed tests and corrective action taken to achieve test results that comply with requirements.
- D. Indicate layout of ground field, location of system grounding electrode connections, and routing of grounding electrode conductor and ground ring.

1.5 SUMMARY

- A. This section includes grounding of electrical systems and equipment. Grounding requirements specified in this Section may be supplemented by special requirements of systems described in other Sections.

2. PART PRODUCTS

2.1 GROUNDING CONDUCTORS

- A. For insulated conductors, comply with Division 26 Section 26 05 13 "Wire and Cable".
- B. Material: Copper.
- C. Equipment Grounding Conductors: Insulated. Refer to Section 26 05 53 for insulation color.
- D. Isolated Ground Conductors: Insulated. Refer to Section 26 05 53 for insulation color.
- E. Grounding Electrode Conductors: Stranded cable.
- F. Underground Conductors: Bare, tinned, stranded, unless otherwise indicated.
- G. Copper Bonding Conductors: As follows:
 - 1. Bonding Cable: 28 kcmil, 14 strands of No. 17 AWG copper conductor, 1/4 inch in diameter.
 - 2. Bonding Conductor: No. 4 or No. 6 AWG, stranded copper conductor.
 - 3. Bonding Jumper: Bare copper tape, braided bare copper conductors, terminated with copper ferrules; 1-5/8 inches wide and 1/16 inch thick.
 - 4. Tinned Bonding Jumper: Tinned-copper tape, braided copper conductors, terminated with copper ferrules; 1-5/8 inches wide and 1/16 inch thick.
- H. Grounding Bus:
 - 1. Bare, annealed copper bars of rectangular cross section, with insulators. 1/4" x 4" x 36", length minimum.

2.2 CONNECTOR PRODUCTS

- A. Comply with UL 467; listed for use for specific types, sizes, and combinations of conductors and connected items.
- B. Connectors: Hydraulic compression type Exothermic-welded type, in kit form, and selected per manufacturer's written instructions.
- C. Bolted Connectors: Bolted-pressure-type connectors.
- D. Substation connectors shall comply with IEEE 837 listed for use for specific types, sizes, and combinations of conductors and connected items.

2.3 GROUNDING ELECTRODES

- A. Ground Rods: Sectional type; copper-clad steel stainless steel.
 - 1. Size: 3/4" n diameter by 120 inches
- B. Chemical Electrodes: Copper tube, straight or L-shaped, filled with nonhazardous chemical salts, terminated with a 4/0 bare conductor. Provide backfill material recommended by manufacturer.
- C. Test Wells: Provide handholes as shown on drawings or as specified in Division 2 Section "Underground Ducts and Utility Structures."

- D. Concrete-Encased Grounding Electrode (Ufer): Fabricate according to NFPA 70, Paragraph 52-(3), using a minimum of 20 feet of bare copper conductor not smaller than No. 4 AWG or 20 feet (6.0 m) of 1/2" (13mm) steel reinforcing bar.

3. PART EXECUTION

3.1 CONNECTIONS

- A. General: Make connections so galvanic action or electrolysis possibility is minimized. Select connectors, connection hardware, conductors, and connection methods so metals in direct contact will be galvanically compatible.
1. Use electroplated or hot-tin-coated materials to ensure high conductivity and to make contact points closer to order of galvanic series.
 2. Make connections with clean, bare metal at points of contact.
 3. Make aluminum-to-steel connections with stainless-steel separators and mechanical clamps.
 4. Make aluminum-to-galvanized steel connections with tin-plated copper jumpers and mechanical clamps.
 5. Coat and seal connections having dissimilar metals with inert material to prevent future penetration of moisture to contact surfaces.
- B. Exothermic-Welded Connections: Comply with manufacturer's written instructions. Welds that are puffed up or that show convex surfaces indicating improper cleaning are not acceptable.
- C. Compression-Type Connections: Use hydraulic compression tools to provide correct circumferential pressure for compression connectors. Use tools and dies recommended by connector manufacturer. Provide embossing die code or other standard method to make a visible indication that a connector has been adequately compressed on grounding conductor.
- D. Equipment Grounding Conductor Terminations: For No. 8 AWG and larger, use pressure-type grounding lugs. No. 10 AWG and smaller grounding conductors may be terminated with winged pressure-type connectors.
- E. Noncontact Metal Raceway Terminations: If metallic raceways terminate at metal housings without mechanical and electrical connection to housing, terminate each conduit with a grounding bushing. Connect grounding bushings with a bare grounding conductor to grounding bus or terminal in housing. Bond electrically non-continuous conduits at entrances and exits with grounding bushings and bare grounding conductors, unless otherwise indicated.
- F. Structural Steel Connection: Exothermic-welded connections to structural steel. Coordinate with structure to provide physical protection.
- G. Underground Connections: Exothermic-welded connections. Use for underground connections, except those at test wells.
- H. Connections at Test Wells: Use compression-type connectors on conductors and make two bolted-and clamped-type connections between conductors and ground rods.
- I. Connections at back boxes, junction boxes, pull boxes, and equipment terminations: The equipment grounding conductor(s) associated with all circuits in the box shall be connected together and to the box using a suitable grounding screw. The removal of the respective receptacle, luminaire, or other device served by the box shall not interrupt the grounding continuity. The connection to the non-metallic boxes shall be made to any metallic fitting or device requiring grounding.

- J. Tighten screws and bolts for grounding and bonding connectors and terminals according to manufacturer's published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A and UL 486B.
- K. Moisture Protection: If insulated grounding conductors are connected to ground rods or grounding buses, insulate entire area of connection and seal against moisture penetration of insulation and cable.

3.2 INSTALLATION

- A. Use only copper conductors for both insulated and bare grounding conductors in direct contact with earth, concrete, masonry, crushed stone, and similar materials.
- B. Grounding Conductors: Route along shortest and straightest paths possible, unless otherwise indicated. Avoid obstructing access or placing conductors where they may be subjected to strain, impact, or damage. Each grounding conductor that passes through a below grade wall must be provided with a waterstop.
- C. Grounding electrode conductor (GEC) shall be protected from physical damage by rigid polyvinyl chloride conduit (PVC) in exposed locations.
- D. Bonding Straps and Jumpers: Install so vibration by equipment mounted on vibration isolation hangers and supports is not transmitted to rigidly mounted equipment. Use exothermic-welded connectors for outdoor locations, unless a disconnect-type connection is required; then use a bolted clamp. Bond straps directly to the basic structure, taking care not to penetrate any adjacent parts. Install straps only in locations accessible for maintenance.
- E. In raceways, use insulated equipment grounding conductors.
- F. Underground Grounding Conductors: Use tinned copper conductor, No. 2/0 AWG minimum. Bury at least 24 inches below grade or bury 12 inches above duct bank when installed as part of the duct bank.
- G. Grounding Bus: Install in electrical and telephone equipment rooms, in rooms housing service equipment, below access floors, and elsewhere as indicated, with bolted connections to form a continuous ground path.

3.3 EQUIPMENT GROUNDING SYSTEM

- A. Comply with NFPA 70, Article 250, for types, sizes, and quantities of equipment grounding conductors, unless specific types, larger sizes, or more conductors than required by NFPA 70 are indicated.
- B. Install equipment grounding conductors in all feeders and circuits. Terminate each end on a grounding lug or bus.
- C. Install insulated equipment grounding conductor with circuit conductors for the following items, in addition to those required by NEC:
 - 1. Lighting and receptacle circuits. Terminate each end on a grounding lug or bus.
 - 2. Single-phase and three-phase motor and appliance branch circuits.
 - 3. Flexible raceway runs, including FMC and LFMC.
 - 4. Armored and metal-clad cable runs.
- D. Busway Supply Circuits: Install insulated equipment grounding conductor from the grounding bus in the switchgear, switchboard, or distribution panel to equipment grounding bar terminal on busway.
- E. Computer Outlet Circuits: Install insulated equipment grounding conductor in branch-circuit runs from computer-area power panels or power-distribution units.

- F. X-Ray Equipment Circuits: Install insulated equipment grounding conductor in circuits supplying x-ray equipment.
- G. Isolated Grounding Circuits: Install an insulated equipment grounding conductor connected to the receptacle or equipment grounding terminal. Isolate grounding conductor from raceway and from panelboard grounding terminals. Terminate at isolated equipment grounding conductor terminal of the applicable derived system or service, unless otherwise indicated.
- H. Nonmetallic Raceways: Install an equipment grounding conductor in nonmetallic raceways unless they are designated for telephone or data cables.

3.4 BONDING SYSTEM

- A. At building expansion joints, provide flexible bonding jumpers to connect to columns or beams on each side of the expansion joint.
- B. Isolated Equipment Enclosure: For designated equipment supplied by a branch circuit or feeder, isolate equipment enclosure from supply raceway with a nonmetallic raceway fitting listed for the purpose. Install fitting where raceway enters enclosure, and install a separate equipment bonding conductor.
- C. Exterior Metallic Pull and Junction Box Covers, Metallic Hand Rails: Bond to grounding system using flexible grounding conductors.
- D. Equipment Circuits: Install a bonding conductor to duct-mounted electrical devices operating at 120 V and more, including air cleaners, dampers, and heaters. Bond conductor to each unit and to air duct. Bond interior metal piping systems and metal air ducts to equipment grounding conductors of associated pumps, fans, blowers, electric heaters, and air cleaners. Use braided-type bonding straps or copper conductor sized equal to the equipment grounding conductor.
- E. Bond metal ducts of dust collectors, particulate conveying, fume hoods, and other hazardous materials to the equipment grounding conductors of associated pumps, fans, or blowers. Use braided-type bonding straps. Provide braided bare copper bonding conductor in nonmetallic dust collector ductwork to each equipment inlet location, and bond to equipment.
- F. Water Heater, Heat-Tracing, Metal Well Casing, and Heating Cables: Install a separate equipment grounding conductor to each electric water heater, heat-tracing, and anti-frost heating cable. Bond conductor to heater units, piping, well casing, connected equipment, and components.
- G. Connect bonding conductors to metal water pipe using a suitable ground clamp. Make connections to flanged piping at street side of flange. Provide bonding jumper around water meter.
- H. Remote control, signaling, and fire alarm circuits shall be bonded in accordance with the most recent version of the National Electric Code.
- I. Metal Poles Supporting Outdoor Lighting Fixtures > 15 feet: Provide a grounding electrode in addition to installing a separate equipment grounding conductor with supply branch-circuit conductors.

3.5 GROUNDING ELECTRODE SYSTEM

- A. Ground Ring (Counterpoise):
 - 1. Ground the steel framework of the building with a driven ground rod at the base of every corner column and at intermediate exterior columns at average distances not more than 60 feet apart. Provide a grounding conductor, electrically connected to each ground rod and to each steel column, extending around the perimeter of the building. Use tinned-copper conductor not less than No. 2 AWG for ground ring and for tap to building steel. Bury conductor not less than 30 inches below grade, 24 inches from building foundation, and 18 inches (459 mm) outside of roof drip line.

- B. Supplementary Grounding Electrode: Use driven ground rod on exterior of building.
- C. Provide bonding at Utility Company's metering equipment and pad mounted transformer.
- D. Ground Rods: Install at least two rods spaced at least 20 feet from each other and located at least the same distance from other grounding electrodes.
 - 1. Drive ground rods until tops are 12 inches below finished floor or final grade, unless otherwise indicated.
 - 2. Interconnect ground rods with grounding electrode conductors. Use exothermic welds, except at test wells and as otherwise indicated. Make connections without exposing steel or damaging copper coating.
- E. Metal Water Service Pipe: Provide insulated copper grounding conductors, in conduit, from building's main service equipment, or grounding bus, to main metal water service entrances to building. Connect grounding conductors to main metal water service pipes by grounding clamp connectors. Where a dielectric main water fitting is installed, connect grounding conductor to street side of fitting. Bond metal grounding conductor conduit or sleeve to conductor at each end.
- F. Water Meter Piping: Use braided-type bonding jumpers to electrically bypass water meters. Connect to pipe with grounding clamp connectors.
- G. Bond each aboveground portion of natural gas metallic piping system at equipment locations. The equipment grounding conductor may serve as the bonding means.
- H. Install one test well for each service at the ground rod electrically closest to the service entrance. Set top of well flush with finished grade or floor.
- I. Concrete-Encased Grounding Electrode (Ufer): Install concrete-encased grounding electrode encased in at least 2 inches (50mm) of concrete horizontally within the foundation that is in contact with the earth. If concrete foundation is less than 20 feet long, coil excess conductor within the base of the foundation. Bond grounding conductor to reinforcing steel in at least four locations and to anchor bolts. Extend grounding conductor below grade and connect to building grounding grid or to a grounding electrode external to concrete.

3.6 CONCRETE OR WOOD BUILDING GROUNDING SYSTEM

- A. Provide a copper common grounding electrode conductor for the attachment of multiple separately derived systems in accordance with NEC 250.30(A)(4)(a) through 250.30(A)(4)(c). Individual grounding conductor taps from the separately derived systems to the common grounding electrode shall be sized in accordance with NEC 250.66. All tap connections shall be made in an accessible location in such a manner that common grounding electrode conductor remains without a splice or joint.

3.7 EQUIPOTENTIAL (MULTI-POINT) GROUNDING SYSTEM

- A. Provide an equipotential grounding system in the following locations:
 - 1. Class I Div 1 and Div 2 locations as required in NEC 501.30.
 - 2. Swimming pool, fountains, and similar locations as required in NEC 680
 - 3. Critical patient care and special care areas as indicated on drawings.
- B. The non-current-carrying metal parts of equipment, raceways and other enclosures shall be bonded to the grounding system.

3.8 UNDERGROUND DISTRIBUTION SYSTEM GROUNDING

- A. Manholes and Handholes: Install a driven ground rod close to wall and set rod depth so 4 inches will extend above finished floor. If necessary, install ground rod before manhole is placed and provide a No. 1/0 AWG bare, tinned-copper conductor from ground rod into manhole through a waterproof sleeve in manhole wall. Protect ground rods passing through concrete floor with a double wrapping of pressure-sensitive tape or heat-shrunk insulating sleeve from 2 inches above to 6 inches below concrete. Seal floor opening with waterproof, non-shrink grout.
- B. Connections to Manhole Components: Connect exposed-metal parts, such as inserts, cable racks, pulling irons, ladders, and cable shields within each manhole or handhole, to ground rod or grounding conductor. Make connections with No. 4 AWG minimum, stranded, hard-drawn copper conductor. Train conductors level or plumb around corners and fasten to manhole walls. Connect to cable armor and cable shields as recommended by manufacturer of splicing and termination kits.
- C. Pad-Mounted Transformers and Switches: Install two ground rods and counterpoise circling pad. Ground pad-mounted equipment and noncurrent-carrying metal items associated with substations by connecting them to underground cable and grounding electrodes. Use tinned-copper conductor not less than No. 2 AWG for counterpoise and for taps to equipment ground pad. Bury counterpoise not less than 18 inches below grade and 6 inches from the foundation. The pad rebar shall be attached to the counterpoise conductor at the four corners.

3.9 FIELD QUALITY CONTROL

- A. Inspect grounding and bonding system conductors and connections for tightness and proper installation.
 - 1. Measure ground resistance from system neutral connection at service entrance to convenient ground reference points using suitable ground testing equipment. Resistance shall not exceed 5 ohms.
 - 2. Testing: Owner will engage a qualified testing agency to perform the following field quality-control testing:
 - 3. Testing: Engage a qualified testing agency to perform the following field quality-control testing:
 - 4. Testing: Perform the following field quality-control testing:
 - a. After installing grounding system but before permanent electrical circuitry has been energized, test for compliance with requirements.
 - b. Test completed grounding system at each location where a maximum ground-resistance level is specified, at service disconnect enclosure grounding terminal, and at ground test wells. Measure ground resistance not less than two full days after the last trace of precipitation, and without the soil being moistened by any means other than natural drainage or seepage and without chemical treatment or other artificial means of reducing natural ground resistance. Perform tests, by the fall-of-potential method according to IEEE 81.
 - c. Provide drawings locating each ground rod and ground rod assembly and other grounding electrodes, identify each by letter in alphabetical order, and key to the record of tests and observations. Include the number of rods driven and their depth at each location and include observations of weather and other phenomena that may affect test results. Describe measures taken to improve test results.
 - 1) Equipment Rated 500 kVA and Less: 10 ohms.
 - 2) Equipment Rated 500 to 1000 kVA: 5 ohms.
 - 3) Equipment Rated More Than 1000 kVA: 3 ohms.
 - 4) Substations and Pad-Mounted Switching Equipment: 5 ohms.
 - 5) Manhole Grounds: 10 ohms.

- d. Excessive Ground Resistance: If resistance to ground exceeds specified values, notify Architect/Engineer promptly and include recommendations to reduce ground resistance.

3.10 GRADING AND PLANTING

- A. Restore surface features, including vegetation, at areas disturbed by Work of this Section. Reestablish original grades, unless otherwise indicated. If sod has been removed, replace it as soon as possible after backfilling is completed. Restore areas disturbed by trenching, storing of dirt, cable laying, and other activities to their original condition. Include application of topsoil, fertilizer, lime, seed, sod, sprig, and mulch. Comply with Division 2. Maintain restored surfaces. Restore disturbed paving.

END OF SECTION

SECTION 26 05 27

SUPPORTING DEVICES

1. PART GENERAL

1.1 SECTION INCLUDES

- A. Conduit and equipment supports
- B. Fastening hardware
- C. Concrete housekeeping pads

1.2 QUALITY ASSURANCE

- A. Support systems shall be adequate for weight of equipment and conduit, including wiring, which they carry.

1.3 COORDINATION

- A. Coordinate size, shape and location of concrete pads with Section on Cast-in-Place Concrete or Concrete Topping.

2. PART PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

- A. Allied Support Systems
- B. Cooper B-Line
- C. Erico, Inc.
- D. Hilti
- E. Power Fasteners

2.2 MATERIAL

- A. Support Channel: Hot-dip galvanized; stainless steel for wet/damp locations; painted steel for interior/dry locations. All field cut ends shall be touched up with matching finish to inhibit rusting.
- B. Hardware: Corrosion resistant.
- C. Anchorage and Structural Attachment Components:
 - 1. Strength: Defined in reports by ICBO Evaluation Service or another agency acceptable to Authorities Having Jurisdiction.
 - a. Structural Safety Factor: Strength in tension and shear of components used shall be at least two times the maximum seismic forces to which they will be subjected.
 - 2. Through Bolts: Structural type, hex head, high strength. Comply with ASTM A 325.
 - 3. Welding Lugs: Comply with MSS-SP-69, Type 57.
 - 4. Beam clamps for Steel Beams and Joists: Double sided. Single-sided type is not acceptable.
 - 5. Bushings for Floor-Mounted Equipment Anchors: Neoprene units designed for seismically rated rigid equipment mountings, and matched to the type and size of anchor bolts and studs used.

6. Bushing Assemblies for Wall-Mounted Equipment Anchorage: Assemblies of neoprene elements and steel sleeves designed for seismically rated rigid equipment mountings, and matched to the type and size of attachment devices used.
7. Concrete Anchors: Fasten to concrete using cast-in or post-installed anchors designed per the requirements of Appendix D of ACI 318-05. Post-installed anchors shall be qualified for use in cracked concrete by ACI-355.2.
8. Masonry Anchors: Fasten to concrete masonry units with expansion anchors or self-tapping masonry screws. For expansion anchors into hollow concrete block, use sleeve-type anchors designed for the specific application. Do not fasten in masonry joints. Do not use powder actuated fasteners, wooden plugs, or plastic inserts.

D. Conduit Sleeves and Lintels:

1. Each Contractor shall provide, to the General Contractor for installation, lintels for all openings required for the Contractor's work in masonry walls and conduit sleeves for floors, unless specifically shown as being by others.
2. Refer to Structural General Notes for lintel requirements in masonry construction.
3. Refer to Structural plans and specifications for lintel requirements and sizes.
4. Lintels:
 - a. Lintels in non-bearing masonry wall openings can be sized in accordance with the note below. Lintels that occur in existing bearing walls are to be sized according to similar conditions and spans in the new construction and lintel schedule. Bottom plate size shall be a minimum of 3/8" thick. The width of the plate shall be 3/4" less than the field verified wall thickness. The plate shall be the full length of the lintel member. Lintels are not required over openings that are 12" wide or less and at least 1 course below the top of the wall.
 - b. All lintels shall have a minimum of 8" end bearing.
 - c. All lintels in exterior wall construction shall be hot-dip galvanized.
 - d. For all openings not otherwise detailed or scheduled, minimum lintels shall be for each 4 inch of masonry width:

1)	0 to 2'-0" span	5/16" plate (3/4" less than wall width)
2)	2'-0" to 4'-0" span	L 3 1/2 x 3 1/2 x 1/4
3)	4'-0" to 6'-0" span	L 4 x 3 1/2 x 5/16 (llv)
4)	6'-0" to 8'-0" span	L 5 x 3 1/2 x 5/16 (llv)
 - e. All angles that are back to back shall be welded top and bottom 3" at 12" minimum.
5. Fabricate all lintels from structural steel shapes or as indicated on the drawings. All lintels and grouped wall openings shall be approved by the Architect or Structural Engineer.
6. Fabricate all sleeves from standard weight black steel pipe. Provide continuous sleeve. Cut or split sleeves are not acceptable. Sleeves through concrete walls may be high density polyethylene pipe penetration sleeve with a water stop collar, suitable for use with Link-Seal mechanical seals. Century-Line Model CS.
7. Sleeves through the floors on exposed risers shall be flush with the ceiling, with planed squared ends extending 1" above the floor in unfinished areas, and flush with the floor in finished areas, to accept spring closing floor plates.
8. Sleeves shall not penetrate structural members without approval from the Structural Engineer.

9. Openings through unexcavated floors and/or foundation walls below the floor shall have a smooth finish with sufficient annular space around material passing through opening so slight settling will not place stress on the material or building structure.
 10. Install all sleeves concentric with conduits. Secure sleeves in concrete to wood forms. This Contractor is responsible for sleeves dislodged or moved when pouring concrete.
 11. Where conduits rise through concrete floors that are on earthen grade, provide 3/4" resilient expansion joint material (asphalt and cork) wrapped around the pipe, the full depth of concrete, at the point of penetration. Secure to prevent shifting during concrete placement and finishing.
 12. Size sleeves large enough to allow expansion and contraction movement.
- E. Concrete Housekeeping Pads:
1. Concrete bases for all floor mounted equipment and wall mounted equipment which is surface mounted and extends to within 6" of the finished floor, unless shown otherwise on the drawings, shall be 4" thick concrete.
 2. Bases shall extend 3" on all sides of the equipment (6" larger than factory base).
 3. Where the base is less than 12" from a wall, the base shall be carried to the wall to prevent a "dirt-trap".
 4. Concrete materials and workmanship required for the Contractor's work shall be provided by him. Materials and workmanship shall conform to the applicable standards of the Portland Cement Association. Reinforce with 6" x 6", W1.4-W1.4 welded wire fabric. Concrete shall withstand 3,000 pounds compression per square inch at twenty-eight days.
- F. Rooftop Support System:
1. Provide pre-fabricated roof supports for all conduit and equipment installed above the roof. Support all conduit and equipment a minimum of 4" above roof.
 2. Support system shall be compatible with single ply, bituminous, metal, and spray foam roof systems. The base shall be rounded to prevent damage to the roof, and drainage holes shall prevent ponding of water in the support.
 3. All metal components shall be hot dipped galvanized. Mounting hardware shall be stainless steel or hot dipped galvanized. Support shall be UV, corrosion, and freeze/thaw resistant. Support shall include orange paint, reflective safety orange accents, or similar markings for increased visibility.
 4. Acceptable Products: Anvil International HBS-Base Series, Cooper B-Line Dura-Blok, Erico Caddy Pyramid 50, 150, 300, or 600 (to match load).

3. PART EXECUTION

3.1 INSTALLATION

- A. Fasten hanger rods, conduit clamps, and outlet and junction boxes to building structure using expansion anchors in concrete and beam clamps on structural steel.
- B. Use toggle bolts or hollow wall fasteners in hollow masonry, plaster, or gypsum board partitions and walls; expansion anchors or preset inserts in solid masonry walls; self-drilling anchors or expansion anchor on concrete surfaces; sheet metal screws in sheet metal studs; and wood screws in wood construction.

- C. Do not fasten supports to ceiling systems, piping, ductwork, mechanical equipment, or conduit, unless otherwise noted.
- D. Do not use powder-actuated anchors without specific permission.
- E. Do not drill structural steel members.
- F. Fabricate supports from structural steel or steel channel, rigidly welded or bolted to present a neat appearance. Use hexagon head bolts with spring lock washers under all nuts.
- G. In wet locations and on all building floors below exterior earth grade install free-standing electrical equipment on concrete pads.
- H. Install cabinets and panelboards with minimum of four anchors. Provide horizontal backing/support framing in stud walls for rigid mounting. Provide steel channel supports to stand surface-mounted panelboard or cabinet one inch off wall.
- I. Bridge studs top and bottom with channels to support flush-mounted cabinets and panelboards in stud walls.
- J. Do not exceed 25 lbs. per hanger and a minimum spacing of 2'-0" on center when attaching to metal roof decking (excludes concrete on metal deck). This 25 lbs. load and 2'-0" spacing include adjacent electrical and mechanical items hanging from deck. If the hanger restrictions cannot be achieved, supplemental framing off steel framing will need to be added.
- K. Refer to Section 26 05 33 for special conduit supporting requirements.

3.2 FINISH

- A. Prime coat exposed steel hangers and supports. Hangers and supports in crawl spaces, pipe shafts, and above suspended ceiling spaces are not considered exposed.
- B. Trim all ends of exposed field fabricated steel hangers, slotted channel and threaded rod to within 1" of support or fastener to eliminate potential injury to personnel unless shown otherwise on the drawings. Smooth ends and install elastomeric insulation with two coats of latex paint if exposed steel is within 6'-6" of finish floor and presents potential injury to personnel.

END OF SECTION

SECTION 26 05 33

CONDUIT AND BOXES

1. PART GENERAL

1.1 SECTION INCLUDES

- A. Rigid metallic conduit and fittings (RMC)
- B. Stainless steel conduit (316SS) and fittings
- C. Intermediate metallic conduit and fittings (IMC)
- D. Electrical metallic tubing and fittings (EMT)
- E. Flexible metallic conduit and fittings (FMC)
- F. Liquidtight flexible metallic conduit and fittings (LFMC)
- G. Rigid polyvinyl chloride conduit and fittings (PVC)
- H. Wall and ceiling outlet boxes
- I. Electrical connection
- J. Pull and junction boxes
- K. Rough-ins
- L. Handholes
- M. Accessories

1.2 RELATED WORK

- A. Section 26 05 53 – Electrical Identification: Refer to electrical identification for color and identification labeling requirements.

1.3 REFERENCES

- A. American National Standards Institute (ANSI):
 - 1. ANSI C80.1 - Rigid Steel Conduit, Zinc-Coated
 - 2. ANSI C80.3 - Electrical Metallic Tubing, Zinc-Coated and Fittings
 - 3. ANSI C80.4 - Fittings for Rigid Metal Conduit and Electrical Metallic Tubing
 - 4. ANSI C80.6 – Intermediate Metal Conduit, Zinc Coated
 - 5. ANSI/NEMA OS 1 - Sheet-Steel Outlet Boxes, Device Boxes, Covers and Box Supports
 - 6. ANSI/NEMA OS 2 - Nonmetallic Outlet Boxes, Device Boxes, Covers and Box Supports
- B. Federal Specifications (FS):
 - 1. A-A-50553A – Fittings for Conduit, Metal, Rigid, (Thick-Wall and Thin-Wall (EMT) Type
 - 2. A-A-55810 – Specification for Flexible Metal Conduit
- C. NECA “Standards of Installation”
- D. National Electrical Manufacturers Association (NEMA):
 - 1. ANSI/NEMA FB 1 – Fittings, Cast Metal Boxes, and Conduit Bodies for Conduit, Electrical Metallic Tubing and Cable
 - 2. RN 1 – Polyvinyl chloride (PVC) Externally Coated Galvanized Rigid Steel Conduit, Rigid Aluminum Conduit, and Intermediate Metal Conduit
 - 3. TC 2 – Electrical Polyvinyl Chloride (PVC) Conduit
 - 4. TC 9 – Fittings for PVC Plastic Utilities Duct for Underground Installation
- E. NFPA 70 – National Electrical Code (NEC)
- F. Underwriters Laboratories (UL): Applicable Listings
 - 1. UL 1 – Flexible Metal Conduit
 - 2. UL 6 – Rigid Metal Conduit

3. UL 360 – Liquid Tight Flexible Steel Conduit
4. UL514-B – Conduit Tubing and Cable Fittings
5. UL651-A – Type EB and a PVC Conduit and HDPE Conduit
6. UL651-B – Continuous Length HDPE Conduit
7. UL746A – Standard for Polymeric Materials – Short Term Property Evaluations
8. UL797 – Electrical Metal Tubing
9. UL1242 – Intermediate Metal Conduit

G. Definitions:

1. Fittings: Conduit connection or coupling.
2. Body: Enlarged fittings with opening allowing access to the conductors for pulling purposes only.
3. Mechanical Spaces: Enclosed areas, usually kept separated from the general public, where the primary use is to house service equipment and to route services. These spaces generally have exposed structures, bare concrete and non-architecturally emphasized finishes.
4. Finished Spaces: Enclosed areas where the primary use is to house personnel and the general public. These spaces generally have architecturally emphasized finishes, ceilings and/or floors.
5. Concealed: Not visible by the general public. Often indicates a location either above the ceiling, in the walls, in or beneath the floor slab, in column coverings, or in the ceiling construction.
6. Above Grade: Not directly in contact with the earth. For example, an interior wall located at an elevation below the finished grade shall be considered above grade but a wall retaining earth shall be considered below grade.
7. Slab: Horizontal pour of concrete used for a floor or sub-floor.

1.4 SUBMITTALS

- A. Include fittings and conduits 1.5" and larger in coordination files. Include all in--floor and underfloor conduit in coordination files. Refer to Section 26 05 00 for coordination drawing requirements.

2. PART PRODUCTS

2.1 RIGID METALLIC CONDUIT (RMC) AND FITTINGS

A. Acceptable Manufacturers:

1. Acceptable Manufacturers: Allied, LTV, Steelduct, Calbond Calpipe, Wheatland Tube Co, O-Z Gedney, or approved equal.
2. Acceptable Manufacturers of RMC Conduit Fittings: Appleton Electric, O-Z/Gedney Co., Electroline, Raco, Bridgeport, Midwest, Regal, Thomas & Betts, Crouse-Hinds, Killark, or approved equal.

B. Minimum Size Galvanized Steel: 3/4 inch (19mm), unless otherwise noted.

C. Fittings and Conduit Bodies:

1. End Bell Fittings: Malleable iron, hot dip galvanized, threaded flare type with provisions for mounting to form.

2. Expansion Joints: Malleable iron and hot dip galvanized providing a minimum of 4 inches of movement. Fitting shall be watertight with an insulating bushing and a bonding jumper.
 3. Expansion Joint for Concrete Encased Conduit: Neoprene sleeve with bronze end coupling, stainless steel bands and tinned copper braid bonding jumper. Fittings shall be watertight and concrete-tight.
 4. Conduit End Bushings: Malleable iron type with molded-on high impact phenolic thermosetting insulation. Where required elsewhere in the contract documents, bushing shall be complete with ground conductor saddle and clamp. **High impact phenolic threaded type bushings are not acceptable.**
 5. All other fittings and conduit bodies shall be of malleable iron construction and hot dip galvanized.
- D. PVC Externally Coated Conduit: Compliant with UL 6, ANSI C80.1 and NEMA RN 1; rigid galvanized steel conduit with external 40 mil PVC coating and internal 2 mil urethane coating surface. All fittings and conduit bodies shall be complete with coating. Threads shall be hot galvanized and coated with a clear coat of urethane. The PVC coated system shall include necessary PVC coated fittings, boxes and covers to form a complete encapsulated system. Acceptable Manufacturers: Calbond Calpipe, Robroy, T&B Ocal or approved equal.

2.2 INTERMEDIATE METALLIC CONDUIT (IMC) AND FITTINGS

- A. Minimum Size Galvanized Steel: 3/4 inch, unless otherwise noted.
- B. Acceptable Manufacturers: Allied, LTV, Steelduct, Wheatland Tube Co, O-Z Gedney, or approved equal.
- C. Fittings and Conduit Bodies:
 1. End Bell Fittings: Malleable iron, hot dip galvanized, threaded flare type with provisions for mounting to form.
 2. Expansion Joints: Malleable iron and hot dip galvanized providing a minimum of 4 inches of movement. Fitting shall be watertight with an insulating bushing and a bonding jumper.
 3. Expansion Joint for Concrete Encased Conduit: Neoprene sleeve with bronze end coupling, stainless steel bands and tinned copper braid bonding jumper. Fittings shall be watertight and concrete-tight.
 4. Conduit End Bushings: Malleable iron type with molded-on high impact phenolic thermosetting insulation. Where required elsewhere in the contract documents, bushing shall be complete with ground conductor saddle and clamp. **High impact phenolic threaded type bushings are not acceptable.**
 5. All other fittings and conduit bodies shall be of malleable iron construction and hot dip galvanized.

2.3 ELECTRICAL METALLIC TUBING (EMT) AND FITTINGS

- A. Minimum Size Electrical Metallic Tubing: 3/4 inch, unless otherwise noted.
- B. Acceptable Manufacturers of EMT Conduit: Allied, Calbond Calpipe, LTV, Steelduct, Wheatland Tube Co, or approved equal.
- C. Fittings and Conduit Bodies:
 1. 2" Diameter or Smaller: Compression type of steel designed for their specific application.

2. 1/2" and 3/4" Conduit: Push-on connectors and couplers with locking ring and washer of zinc plated steel, listed for use in dry locations.
3. Larger than 2": Compression type of steel designed for their specific application.
4. Acceptable Manufacturers of EMT Conduit Fittings: Appleton Electric, O-Z/Gedney Co., Electroline, Raco, Bridgeport, Midwest, Regal, Thomas & Betts, or approved equal.

2.4 LIQUIDTIGHT FLEXIBLE METALLIC CONDUIT (LFMC) AND FITTINGS

- A. Acceptable Manufacturers: Anaconda Type UA, Electri-Flex Type LA, Alfex, Carlon (Lamson & Sessions), or approved equal.
- B. Construction: Flexible steel, approved for conduit ground, zinc coated, threadless type formed from a continuous length of spirally wound, interlocked zinc coated strip steel and an extruded PVC cover.
- C. Fittings and Conduit Bodies:
 1. Watertight, compression type, galvanized zinc coated cadmium plated malleable cast iron, UL listed.
 2. Fittings and conduit bodies shall include plastic or cast metal inserts supplied by the manufacturer to protect conductors from sharp edges.
 3. Acceptable Manufacturers: Appleton Electric, O-Z/Gedney Co., Electroline, Bridgeport, Thomas & Betts, Midwest, Regal, Carlon (Lamson & Sessions), or approved equal.

2.5 RIGID NON-METALLIC CONDUIT (PVC) AND FITTINGS

- A. Minimum Size Rigid Smooth-Wall Nonmetallic Conduit: 3/4 inch, unless otherwise noted.
- B. Acceptable Manufacturers: Carlon (Lamson & Sessions) Type 40, Cantex, J.M. Mfg., or approved equal.
- C. Construction: Schedule 40 and Schedule 80 rigid polyvinyl chloride (PVC), UL labeled for 90°C.
- D. Fittings and Conduit Bodies: NEMA TC 3; sleeve type suitable for and manufactured especially for use with the conduit by the conduit manufacturer.
- E. Plastic cement for joining conduit and fittings shall be provided as recommended by the manufacturer.

2.6 OUTLET BOXES

- A. Sheet Metal Outlet Boxes: ANSI/NEMA OS 1; galvanized steel, minimum of 14 gauge, with 1/2-inch male fixture studs where required.
- B. Nonmetallic Outlet Boxes: ANSI/NEMA OS 2.
- C. Cast Boxes: NEMA FB1, Type FD, Aluminum, cast fer alloy, or stainless steel deep type, gasketed cover, threaded hubs.
- D. Outlet boxes for luminaires to be not less than 1-1/2" deep, deeper if required by the number of wires or construction. The box shall be coordinated with surface luminaires to conceal the box from view or provide a finished trim plate.

- E. Switch outlet boxes for local light control switches, dimmers and occupancy sensors shall be 4 inches square by 2-1/8 inches deep, with raised cover to fit flush with finish wall line. Multiple gang switch outlets shall consist of the required number of gang boxes appropriate to the quantity of switches comprising the gang. Where walls are plastered, provide a plaster raised cover. Where switch outlet boxes occur in exposed concrete block walls, boxes shall be installed in the block cavity with a raised square edge tile cover of sufficient depth to extend out to face of block or masonry boxes.
- F. Outlet boxes for telephone substations in walls and columns shall be 4 inches square and 2-1/8 inches deep with single gang raised cover to fit flush with finished wall line equipped with flush telephone plate.
- G. Wall or column receptacle outlet boxes shall be 4 inches square with raised cover to fit flush with finished wall line. Boxes in concrete block walls shall be installed the same as for switch boxes in block walls.

2.7 **[ECONN]: ELECTRICAL CONNECTION**

- A. Electrical connection to equipment and motors, sized per NEC. Coordinate requirements with contractor furnishing equipment or motor. Refer to specifications and general installation notes for terminations to motors.

2.8 **[JB]: PULL AND JUNCTION BOXES**

- A. Sheet Metal Boxes: ANSI/NEMA OS 1; galvanized steel.
- B. Sheet metal boxes larger than 12 inches in any dimension that contain terminations or components: Continuous hinged enclosure with 1/4 turn latch and white back panel for mounting terminal blocks and electrical components.
- C. Cast Metal Boxes for Outdoor and Wet Location Installations: NEMA 250; Type 4 and Type 6, flat-flanged, surface-mounted junction box, UL listed as raintight. Galvanized cast iron box and cover with ground flange, neoprene gasket, and stainless steel cover screws.
- D. Cast Metal Boxes for Underground Installations: NEMA 250; Type 4, inside flanged, recessed cover box for flush mounting, UL listed as raintight. Galvanized cast iron box and plain cover with neoprene gasket and stainless steel cover screws.
- E. Flanged type boxes shall be used where installed flush in wall.

2.9 **ROUGH-IN**

- A. Provide with one (1) flush mount double gang box with single gang plaster ring and appropriate cover plate,
- B. Conduit stubbed to above the lay-in ceiling.

2.10 **HANDHOLES**

- A. **[HH-#]:** Handhole, cast iron, hot dipped galvanized with checkered cover sidewalk weatherproof box, flat neoprene cover gasket. Stainless steel screw hardware. Mounted flush in concrete. 12"W, 18"L, 12"D or dimensions as shown on plans.
 - 1. Approved Manufacturers:
 - a. Appleton Electric WYT Series, WYT 181212
 - b. OZ Gedney YT Series
 - c. Crouse Hinds WJBF Series

- B. **[HH-#]**: Handhole, concrete traffic box and galvanized steel checkered cover. Stainless steel hardware. Bolted cover and box rated for H/20 vehicular traffic. Reinforced concrete slab for bottom. 11"W, 18"L, 24"D or dimensions as shown on plans.

1. Approved Manufacturer: Oldcastle Precast B1017 Box

2.11 ACCESSORIES

- A. Fire Rated Moldable Pads: UL #9700, moldable sheet putty at required thickness on all five sides of back boxes. Kinetics Noise Control – IsoBacker Pad, SpecSeal – SSP Putty and Pads, 3M #MPP-4S or equal.
- B. Sound Barrier Insulation Pads: Mastic, non-hardening, sheet material, minimum 1/8" thickness applied to all five sides of back boxes. Kinetics Noise Control – SealTight Backer Pad, L.H. DOTTIE Co., #68 or equal.

3. PART EXECUTION

3.1 INSTALLATION TRAINING

- A. PVC coated rigid metal conduit, phenolic reinforced thermosetting resin conduit (phenolic RTRC), and reinforced thermosetting resin conduit (RTRC) manufacturers shall provide Contractor installation training for field cutting, joint preparation, joint assembly, field bending, and field cut sealing.

3.2 CONDUIT INSTALLATION SCHEDULE AND SIZING

- A. In the event the location of conduit installation represents conflicting installation requirements as specified in the following schedule, a clarification shall be obtained from the Architect/Engineer. If this Contractor is unable to obtain a clarification as outlined above, concealed rigid galvanized steel conduit installed per these specifications and the NEC shall be required.
- B. The following schedule shall be adhered to unless they constitute a violation of applicable codes or are noted otherwise on the drawings. The installation of RMC conduit will be permitted in place of all conduit specified in this schedule.

Installation Type	RMC	IMC	EMT	PVC Coated RMC	PVC	ASR
Feeders: Switchboards, distribution panels, panelboards, motor control centers, etc.		X	X			
Branch Circuits: Lighting, receptacles, controls, etc.		X	X			
Mechanical Equipment Feeders: Pumps, chillers, air handling units, etc.		X	X			
Floor Mounted Equipment Feeders: Pumps, etc. (include no more than 6 feet of LFMC to pump)		X	X			
Controls (lighting, power, building automation, etc.)		X	X			
Finished Spaces / Concealed			X			
Wet and Damp Locations: (conduit, boxes, fittings, installed and equipped to prevent water entry)	X					
Corrosive Locations				X		
Elevated Concrete Slabs (above grade)	X				X	
Interior Locations: Concealed			X			
Interior Locations: Exposed		X	X			

1. Underground / Slabs on Grade:
 - a. In or Under Slabs on Grade:
 - 1) Within 5' from the perimeter of the building: PVC.

- 2) Within 5' from the perimeter of the building when passing through the perimeter of the building foundation: Concrete encased PVC conduit with a minimum of 3" thickness between the surface of the concrete and the nearest conduit. Concrete to be doweled into the foundation.

b. Site Conduits:

- 1) Within 5' from the Perimeter of a Building Foundation: Concrete encased PVC conduit with a minimum of 3" thickness between the surface of the concrete and the nearest conduit. Concrete to be doweled into the foundation.
- 2) 5' or Greater from the Perimeter of a Building Foundation: PVC.
- 3) Under Roads, Drives, and Vehicle Traveled Ways: Schedule 40 Concrete encased PVC with a minimum of 3" concrete cover on all sides of conduit.
- 4) Reinforcing shall consist of one-half inch deformed bars spaced 12 inches on center, paralleling the ducts on bottom, with one-half inch deformed tie bars spaced twelve inches on centers.
- 5) Bars shall overlap 40 diameters and shall extend 5' beyond roads, drives, traveled ways, etc.
- 6) Provide minimum 3" concrete cover on all sides of reinforcing.
- 7) Entire ductbank shall be installed on precast concrete pavers on 3' centers.

c. Fire Rated Assemblies:

- 1) Listed Fire Rated Assemblies: Phenolic RTRC

d. Hazardous Locations as Defined by the NEC: RMC conduit complete with screwed fittings and conduit seals.

C. Size conduit as shown on the drawings and specifications. Where not indicated in the contract documents, conduit size shall be according to NEC. Conduit and conductor sizing shall be coordinated to limit conductor fill to less than 40%, maintain conductor ampere capacity as required by the NEC (to include enlarged conductors due to temperature and quantity derating values) and to prevent excessive voltage drop and pulling tension due to long conduit/conductor lengths.

D. Minimum Conduit Size (Unless Noted Otherwise):

1. Above Grade: 3/4 inch. (The use of 1/2 inch would be allowed for installation conduit to individual light switches, individual receptacles and individual fixture whips from junction box.)
2. Below Grade 5' or less from Building Foundation: 1 inch.
3. Below Grade More than 5' from Building Foundation: 1 inch.
4. Telecommunication Conduit: 1 inch.
5. Controls Conduit: 3/4 inch.

E. Conduit Embedded in Slabs above Grade:

1. Embedded installation NOT allowed in elevated slabs with metal composite decks nor structural pour in place slabs less than 6 inches in depth unless specifically noted or shown on drawings otherwise.

2. Maximum size 1 inch for conduits crossing each other.
- F. Conduit sizes shall change only at the entrance or exit to a junction box, unless specifically noted on the drawings.

3.3 CONDUIT ARRANGEMENT

- A. In general, conduit shall be installed concealed in walls, in finished spaces and where possible or practical, or as noted otherwise. Conduit shall be installed parallel or perpendicular to walls, ceilings, and exposed structural members. In unfinished spaces, mechanical and utility areas, conduit may run either concealed or exposed as conditions dictate and as practical unless noted otherwise on drawings. Installation shall maintain headroom in exposed vicinities of pedestrian or vehicular traffic.
- B. Exposed conduit on exterior walls or above roof will not be allowed without prior written approval of Architect/Engineer. A drawing of the proposed routing and a photo of the location shall be submitted 14 days prior to start of conduit rough-in. Routing shall be shown on coordination drawings.
- C. Conduit arrangement in elevated slabs (restricted to applications specifically noted or shown on drawings):
1. Conduit size shall not exceed one-third of the structural slab thickness. Place conduit between the top and bottom reinforcing with a minimum of 3" concrete cover.
 2. Parallel conduits shall be spaced at least 8 inches apart. Exception: Within 18 inches of commonly served floor boxes, junction boxes, or similar floor devices. Arrange conduits parallel or perpendicular to building lines and walls.
- D. Conduit shall not share the same cell as structural reinforcement in masonry walls.
- E. Conduit runs shall be routed as shown on large scale drawings. Conduit routing on drawings scaled 1/4"=1'-0" or less shall be considered diagrammatic, unless noted otherwise. The correct routing, when shown diagrammatically shall be chosen by the Contractor based on information in the contract documents, in accordance with manufacturer's written instructions, applicable codes, the NECA's "Standard of Installation", in accordance with recognized industry standards, and coordinated with other contractors.
- F. Contractor shall adapt his work to the job conditions and make such changes as required and permitted by the Architect/Engineer, such as moving to clear beams and joists, adjusting at columns, avoiding interference with windows, etc., to permit the proper installation of other mechanical and/or electrical equipment.
- G. Contractor shall cooperate with all Contractors on the project. He shall obtain details of other Contractor's work to ensure fit and avoid conflict. Any expense due to the failure of This Contractor to do so shall be paid for in full by him. The other trades involved as directed by the Architect/Engineer shall perform the repair of work damaged as a result of neglect or error by This Contractor. The resultant costs shall be borne by This Contractor.

3.4 CONDUIT SUPPORT

- A. Conduit runs installed above a suspended ceiling shall be properly supported. In no case shall conduit rest on the suspended ceiling construction, nor utilize ceiling support system for conduit support.
- B. Conduit shall not be supported from ductwork, water, sprinkler piping, or other non-structural members, unless approved by the Architect/Engineer. All supports shall be from structural slabs, walls, structural members, and bar joists, and coordinated with all other applicable contractors, unless noted otherwise.
- C. Conduit shall be held in place by the correct size of galvanized one-hole conduit clamps, two-hole conduit straps, patented support devices, clamp back conduit hangers, or by other means if called for on the drawings.

- D. Support individual horizontal raceways with separate, malleable-iron pipe hangers or clamps.
- E. Spring-steel conduit clips specifically designed for supporting single conduits or tubing may be used in lieu of malleable-iron hangers for 1-1/2" 1" and smaller raceways serving lighting and receptacle branch circuits above accessible ceilings and for securing raceways to slotted channel and angle supports.
- F. Group conduits in parallel runs where practical and use conduit racks or trapeze hangers constructed of steel channel, suspended with threaded solid rods or wall mounted from metal channels with conduit straps or clamps. Provide space in each rack or trapeze for 25% additional conduits.
- G. Do not exceed 25 lbs. per hanger and a minimum spacing of 2'-0" on center when attaching to metal roof decking (excludes concrete on metal deck). This 25 lbs. load and 2'-0" spacing include adjacent electrical and mechanical items hanging from deck. If the hanger restrictions cannot be achieved, supplemental framing off steel framing will need to be added.
- H. Arrange supports in vertical runs so the weight of raceways and enclosed conductors is carried entirely by raceway supports, with no weight load on raceway terminals.
- I. Supports for metallic conduit shall be no greater than 10 feet. A smaller interval may be used if necessitated by building construction, but in no event shall support spans exceed the NEC requirements. Conduit shall be securely fastened within 3 feet of each outlet box, junction box, device box, cabinet, or fitting.
- J. Supports of flexible conduit shall be within 12 inches of each outlet box, junction box, device box, cabinet, or fitting and at intervals not to exceed 4.5 feet.
- K. Supports for non-metallic conduit shall be at sufficiently close intervals to eliminate any sag in the conduit. The manufacturer's recommendations shall be followed, but in no event shall support spans exceed the NEC requirements.
- L. Where conduit is to be installed in poured concrete floors or walls, provide concrete-tight conduit inserts securely fastened to forms to prevent conduit misplacement.
- M. Finish:
 - 1. Prime coat exposed steel hangers and supports. Hangers and supports in crawl spaces, pipe shafts, and above suspended ceiling spaces are not considered exposed.
 - 2. Trim all ends of exposed field fabricated steel hangers, slotted channel and threaded rod to within 1" of support or fastener to eliminate potential injury to personnel unless shown otherwise on the drawings. Smooth ends and install elastomeric insulation with two coats of latex paint if exposed steel is within 6'-6" of finish floor and presents potential injury to personnel.

3.5 CONDUIT INSTALLATION

- A. Conduit Connections:
 - 1. Shorter than standard conduit lengths shall be cut square using industry standards. The ends of all conduits cut shall be reamed or otherwise finished to remove all rough edges.
 - 2. Metallic conduit connections in slab on grade installation shall be sealed and one coat of rust inhibitor primer applied after the connection is made.
 - 3. Where conduits with tapered threads cannot be coupled with standard couplings, then approved split or Erickson couplings shall be used. Running threads will not be permitted.
 - 4. Install expansion/deflection joints where conduit crosses structure expansion/seismic joints.

- B. Conduit terminations for all low voltage wiring shall have nylon bushings installed on each end of every conduit run.
- C. Conduit Bends:
1. Use a hydraulic one-shot conduit bender or factory elbows for bends in conduit 2" in size or larger. All steel conduit bending shall be done cold; no heating of steel conduit shall be permitted.
 2. All bends of rigid polyvinyl chloride conduit (PVC) shall be made with the manufacturer's approved bending equipment. The use of spot heating devices will not be permitted (i.e. blow torches).
 3. A run of conduit shall not contain more than the equivalent of four (4) quarter bends (360°), including those bends located immediately at the outlet or body.
 4. Telecommunications conduits shall have no more than two (2) 90-degree bends between pull points and contain no continuous sections longer than 100 feet. Insert pull points or pull boxes for conduits exceeding 100 feet in length.
 - a. A third bend is acceptable if:
 - 1) The total run is not longer than (33) feet.
 - 2) The conduit size is increased to the next trade size.
 5. Telecommunications pull boxes shall not be used in lieu of a bend. Align conduits that enter the pull box from opposite ends with each other. Pull box size shall be twelve (12) times the diameter of the largest conduit. Slip sleeves or gutters can be used in place of a pull box.
 6. Telecommunications conduit bend radius shall be six (6) times the diameter for conduits under 2" and ten (10) times the diameter for conduits over 2".
 7. Rigid polyvinyl chloride conduit (PVC) runs longer than 100 feet or runs which have more than two 90° equivalent bends (regardless of length) shall use rigid metal or RTRC factory elbows for bends.
 8. Use conduit bodies to make sharp changes in direction (i.e. around beams).
- D. Conduit Placement:
1. Conduit shall be mechanically continuous from source of current to all outlets. Conduit shall be electrically continuous from source of current to all outlets, unless a properly sized grounding conductor is routed within the conduit. All metallic conduits shall be bonded per the NEC.
 2. Route exposed conduit and conduit above suspended ceilings (accessible or not) parallel/perpendicular to the building structural lines, and as close to building structure as possible. Wherever possible, route horizontal conduit runs above water and steam piping.
 3. Route conduit through roof openings provided for piping and ductwork where possible. If not provided or routing through provided openings is not possible, route through roof jack with pitch pocket. Coordinate roof penetrations with other trades.
 4. Conduits, raceway, and boxes shall not be installed in concealed locations in metal deck roofing or less than 1.5" below bottom of roof decking.
 5. Avoid moisture traps where possible. Where unavoidable, provide a junction box with drain fitting at conduit low point.

6. All conduits through walls shall be grouted or sealed into openings. Where conduit penetrates firewalls and floors, seal with a UL listed sealant. Seal penetrations with intumescent caulk, putty, or sheet installed per manufacturer's recommendations. All materials used to seal penetrations of firewalls and floors shall be tested and certified as a system per ASTM E814 Standard for fire tests or through-penetration fire stops as manufactured by 3M or approved equal; refer to Section 26 05 03 for through penetration firestopping requirements.
7. CONTRACTOR SHALL BE RESPONSIBLE FOR ALL OPENINGS REQUIRED IN MASONRY OR EXTERIOR WALLS UNDER THIS DIVISION. A QUALIFIED MASON AT THE EXPENSE OF THIS CONTRACTOR SHALL REPAIR ALL OPENINGS TO MATCH EXISTING CONDITIONS.
8. Seal interior of conduit at exterior entries, air handling units, coolers/freezers, etc., and where the temperature differential can potentially be greater than 20°F, to prevent moisture penetration. Seal shall be placed where conduit enters warm space. Conduit seal fitting shall be a drain/seal, with sealing compound, equal to O-Z/Gedney type EYD.
9. Horizontal conduit routing through slabs above grade
 - a. Conduits, if run in concrete structure, shall be in middle one-third of slab thickness, and leave at least 3" min. concrete cover. Conduits shall run parallel to each other and spaced at least 8" apart centerline to centerline. Secure raceways to reinforcing rods to prevent sagging or shifting during concrete placement. Maximum conduit outside diameter 1".
 - b. No conduits are allowed in concrete on metal deck unless expressly approved in writing by the Structural Engineer.
 - c. No conduits are allowed to be routed horizontally through slabs above grade.
10. Do not route conduits across each other in slabs on grade.
11. Rigid polyvinyl chloride conduit (PVC) shall be installed when material surface temperatures and ambient temperature are greater than 40°F.
12. Where rigid polyvinyl chloride conduit (PVC) is used below grade, in a slab, below a slab, etc., a transition to rigid galvanized steel or PVC-coated steel conduit shall be installed before conduit exits earth. The metallic conduit shall extend a minimum of 6" into the surface concealing the non-metallic conduit.
13. Contractor shall provide suitable mechanical protection around all conduits stubbed out from floors, walls or ceilings during construction to prevent bending or damaging of stubs due to carelessness with construction equipment.
14. Contractor shall provide a polypropylene pull cord with 2000 lbs. tensile strength in each empty conduit (indoor and outdoor), except in sleeves and nipples.
15. Telecommunications conduits that protrude through the structural floor shall be installed 1 to 3" above finished floor (AFF).
16. Telecommunications conduits that enter into Telecommunications rooms below the finished ceiling shall terminate a minimum of 4" below ceiling and as close to the wall as possible.
17. Telecommunications conduits that are below grade and enter into a building shall terminate a minimum of 4" above finished floor (AFF) and as close to the wall as possible.

3.6 CONDUIT TERMINATIONS

- A. Where conduit bonding is indicated or required in the contract documents, the bushings shall be a grounding type sized for the conduit and ground bonding conductor as manufactured by O-Z/Gedney, Appleton, Thomas & Betts, Burndy, Regal, or approved equal.
- B. Conduits with termination fittings shall be threaded for one (1) lock nut on the outside and one (1) lock nut and bushing on the inside of each box.
- C. Where conduits terminate in boxes with knockouts, they shall be secured to the boxes with lock nuts and provided with approved screw type tinned iron bushings or fittings with plastic inserts.
- D. Where conduits terminate in boxes, fittings, or bodies with threaded openings, they shall be tightly screwed against the shoulder portion of the threaded openings.
- E. Conduit terminations to all motors shall be made with flexible metallic conduit (FMC), unless noted otherwise. Final connections to roof exhaust fans, or other exterior motors and motors in damp or wet locations shall be made with liquidtight flexible metallic conduit (LFMC). Motors in hazardous areas, as defined in the NEC, shall be connected using flexible conduit rated for the environment. Flexible conduit shall not exceed 6' in length. Route equipment ground conductors from circuit ground to motor ground terminal through flexible conduit.
- F. Rigid polyvinyl chloride conduit (PVC) shall be terminated using fittings and bodies produced by the manufacturer of the conduit, unless noted otherwise. Prepare conduit as per manufacturer's recommendations before joining. All joints shall be solvent welded by applying full even coat of plastic cement to the entire areas that will be joined. Turn the conduit at least a quarter to one half turn in the fitting and let the joint cure for 1-hour minimum or as per the manufacturer's recommendations.
- G. All conduit ends shall be sealed with plastic immediately after installation to prevent the entrance of any foreign matter during construction. The seals shall be removed and the conduits blown clear of all foreign matter prior to any wires or pull cords being installed.

3.7 RIGID POLYVINYL CHLORIDE CONDUIT (PVC) OVERHEAD CONDUIT INSTALLATION

- A. Conduit shall be installed away from high temperature piping and equipment.
- B. Conduit shall be installed to prevent exposure to ultraviolet radiation.
- C. Proper allowances shall be made for expansion and/or contraction of the conduit during installation.
- D. Expansion fittings shall be installed in any 100' continuous run of conduit and at each 100' thereafter.
- E. Supports shall be made from non-corroding materials and spacing shall not be greater than the listing in the NEC, but also shall not exceed the manufacturer's recommendations depending on the expected surface temperature.

3.8 UNDERGROUND CONDUIT INSTALLATION

- A. Conduit Connections:
 - 1. Conduit joints in a multiple conduit run shall be staggered at least one foot apart.
- B. Conduit Bends (Lateral):
 - 1. Conduits shall have long sweep radius elbows instead of standard elbows wherever special bends are indicated and noted on the drawings, or as required by the manufacturer of the equipment or system being served.

2. Telecommunications conduit bend radius shall be six times the diameter for conduits under 2" and ten times the diameter for conduits over 2". Where long cable runs are involved, sidewall pressures may require larger radius bends. Coordinate with Architect/Engineer prior to conduit installation to determine bend radius.
- C. Conduit Elbows (vertical):
1. Minimum metal radiuses shall be 30 inches for primary conduits (>600V) and 18 inches for secondary conduits (<600V). Increase radius, as required, based on pulling tension calculation requirements.
- D. Conduit Placement:
1. Conduit runs shall be pitched a minimum of 4" per 100 feet to drain toward the terminations. Duct runs shall be installed deeper than the minimum wherever required to avoid any conflicts with existing or new piping, tunnels, etc.
 2. For parallel runs, use suitable separators and chairs installed not greater than 4' on centers. Band conduit together with suitable banding devices. Securely anchor conduit to prevent movement during concrete placement or backfilling.
 3. Where concrete is required, the materials for concreting shall be thoroughly mixed to a minimum $f_c = 2500$ and immediately placed in the trench around the conduits. No concrete that has been allowed to partially set shall be used.
 4. Before the Contractor pulls any cables into the conduit he shall have a mandrel 1/4" smaller than the conduit inside diameter pulled through each conduit and if any concrete or obstructions are found, the Contractor shall remove them and clear the conduit. Spare conduit shall also be cleared of all obstructions.
 5. Conduit terminations in manholes, masonry pull boxes, or masonry walls shall be with malleable iron end bell fittings.
 6. All spare conduits not terminated in a covered enclosure shall have its terminations plugged as described above.
 7. Ductbanks and conduit shall be installed a minimum of 24" below finished grade, unless otherwise noted on the drawings or elsewhere in these specifications.
 8. All non-metallic conduit installed underground outside of a slab shall be rigid.
- E. Horizontal Directional Drilling:
1. Entire drill path shall be accurately surveyed, with entry and exit stakes placed and coordinated with other contractors. If using a magnetic guidance system, entire drill path shall be surveyed for any surface geo-magnetic variations or anomalies.
 2. Any utility locates within 20 feet of the bore path shall have the exact location physically verified by hand digging or vacuum excavation. Restore inspection holes to original condition after verification.
- F. Raceway Seal:
1. Where a raceway enters a building or structure, it shall be sealed with a sealing bushing or duct seal to prevent the entry of liquids or gases. Seal must be compatible with conductors and raceway system. Spare or unused raceway shall also be sealed.
 2. All telecommunications conduits and innerducts, including those containing cables, shall be plugged at the building and vault with "JackMoon" or equivalent duct seal, capable of withstanding a 10-foot head of water (5 PSI).

3. Duct Seal Alternative Option: Inflatable duct seal system. Capable of withstanding a 10-foot head of water (5 PSEI).
 - a. Manufacturers: Raychem Rayflate Duct Sealing Systems RDSS

3.9 BOX INSTALLATION SCHEDULE

- A. Galvanized steel boxes may be used in:
 1. Concealed interior locations above ceilings and in hollow studded partitions.
 2. Exposed interior locations in mechanical rooms and in rooms without ceilings; higher than 8' above the highest platform level.
 3. Direct contact with concrete except slab on grade.
 4. Recessed in stud wall of kitchens and laundries.
- B. Cast boxes shall be used in:
 1. Exterior locations.
 2. Hazardous locations.
 3. Exposed interior locations within 8' of the highest platform level.
 4. Direct contact with earth.
 5. Direct contact with concrete in slab on grade.
 6. Wet locations.
 7. Kitchens and laundries when exposed on wall surface.

3.10 COORDINATION OF BOX LOCATIONS

- A. Provide electrical boxes as shown on the drawings, and as required for splices, taps, wire pulling, equipment connections, and code compliance.
- B. Electrical box locations shown on the Contract Drawings are approximate, unless dimensioned. Verify location of floor boxes and outlets in offices and work areas prior to rough-in.
- C. Locate and install boxes to allow access. Avoid interferences with ductwork, piping, structure, equipment, etc. Where installation is inaccessible, provide access doors. Coordinate locations and sizes of required access doors with the Architect/Engineer and General Contractor.
- D. Locate and install to maintain headroom and to present a neat appearance.
- E. Coordinate locations with Heating Contractor to avoid baseboard radiation cabinets.

3.11 OUTLET BOX INSTALLATION

- A. Do not install boxes back-to-back in walls.
 1. Provide a minimum horizontal separation of 6 inches between boxes installed on opposite sides of non-rated stud walls. When the minimum separation cannot be maintained, install sound insulation pads on all five sides of the back box in accordance with the manufacturer's instructions.
 2. Provide a minimum horizontal separation of 24 inches between boxes installed on opposite sides of fire-rated walls. When the minimum separation cannot be maintained, the box is greater than 16 square inches or the total box area (all trades) per 100 square feet is greater than or equal to 100 square inches, install fire-rated moldable pads to all five sides of the back box to maintain the fire rating of the wall. Install moldable pads in accordance with UL listing for the specific product. Sound insulation pads are not acceptable for use in fire-rated wall applications unless the product carries the necessary fire rating.
- B. Install sound insulation pads on all five sides of the back of all boxes in sound-rated wall assemblies. Sound-rated wall assemblies are defined as partition types carrying a Sound Transmission Class (STC) rating.

- C. The Contractor shall anchor switch and outlet box to wall construction so that it is flush with the finished masonry, paneling, drywall, plaster, etc. The Contractor shall check the boxes as the finish wall surface is being installed to assure that the box is flush. (Provide plaster rings as necessary.)
- D. Mount at heights shown or noted on the drawings or as generally accepted if not specifically noted.
- E. Locate boxes in masonry walls to require cutting of masonry unit corner only. Coordinate masonry cutting to achieve neat openings for boxes.
- F. Provide knockout closures for unused openings.
- G. Support boxes independently of conduit.
- H. Use multiple-gang boxes where more than one device is mounted together; do not use sectional boxes. Provide barriers to separate wiring of different voltage systems.
- I. Install boxes in walls without damaging wall insulation.
- J. Coordinate mounting heights and locations of outlets mounted above counters, benches, backsplashes, and below baseboard radiation.
- K. Position outlets to locate luminaires as shown on reflected ceiling drawings.
- L. In inaccessible ceiling areas, position outlets and junction boxes within 6 inches of recessed luminaire, to be accessible through luminaire ceiling opening.
- M. Provide recessed outlet boxes in finished areas; secure boxes to interior wall and partition studs, accurately positioned to allow for surface finish thickness. Use stamped steel stud bridges for flush outlets in hollow stud wall, and adjustable steel channel fasteners for flush ceiling outlet boxes.
- N. Align wall-mounted outlet boxes for switches, thermostats, and similar devices.
- O. Provide cast outlet boxes in exterior locations and wet locations, and where exposed rigid or intermediate conduit is used.

3.12 PULL AND JUNCTION BOX INSTALLATION

- A. Locate pull boxes and junction boxes above accessible ceilings or in unfinished areas.
- B. Support pull and junction boxes independent of conduit.
- C. Do not install boxes back-to-back in walls.
 - 1. Provide a minimum horizontal separation of 6 inches between boxes installed on opposite sides of non-rated stud walls. When the minimum separation cannot be maintained, install sound insulation pads on all five sides of the back box in accordance with the manufacturer's instructions.
 - 2. Provide a minimum horizontal separation of 24 inches between boxes installed on opposite sides of fire-rated walls. When the minimum separation cannot be maintained, the box is greater than 16 square inches or the total box area (all trades) per 100 square feet is greater than or equal to 100 square inches, install fire-rated moldable pads to all five sides of the back box to maintain the fire rating of the wall. Install moldable pads in accordance with UL listing for the specific product. Sound insulation pads are not acceptable for use in fire-rated wall applications unless the product carries the necessary fire rating.
- D. Install sound insulation pads on all five sides of the back of all boxes in sound-rated wall assemblies. Sound-rated wall assemblies are defined as partition types carrying a Sound Transmission Class (STC) rating.

3.13 EXPOSED BOX INSTALLATION

- A. Boxes shall be secured to the building structure with proper size screws, bolts, hanger rods, or structural steel elements.
- B. On brick, block and concrete walls or ceilings, exposed boxes shall be supported with no less than two (2) Ackerman-Johnson, Paine, Phillips, or approved equal screw anchors or expansion shields and round head machine screws. Cast boxes shall not be drilled.
- C. On steel structures, exposed boxes shall be supported to the steel member by drilling and tapping the member and fastening the boxes by means of round head machine screws.
- D. Boxes may be supported on steel members by APPROVED beam clamps if conduit is supported by beam clamps.
- E. Boxes shall be fastened to wood structures by means of a minimum of two (2) wood screws adequately large and long to properly support. (Quantity depends on size of box.)
- F. Wood, plastic, or fiber plugs shall not be used for fastenings.
- G. Explosive devices shall not be used unless specifically allowed.

END OF SECTION

SECTION 26 05 37

MANHOLES

1. PART GENERAL

1.1 SECTION INCLUDES

- A. Prefabricated Concrete Manholes
- B. Cast-In-Place Concrete Manholes
- C. Manhole Accessories

1.2 QUALITY ASSURANCE

- A. Manufacturer: Company specializing in precast concrete structures with three (3) years documented experience.

1.3 REFERENCES

- A. AASHTO HS-20 - Standard Specification for Highway Bridges
- B. ANSI/ASTM A153 - Zinc Coating (Hot-Dip) on Iron and Steel Hardware
- C. ANSI/ASTM A569 - Steel, Sheet and Strip, Carbon (0.15 Maximum Percent), Hot-Rolled, Commercial Quality
- D. ASTM A48 - Gray Iron Castings
- E. ASTM A123 - Zinc (Hot-Galvanized) Coatings on Products Fabricated from Rolled, Pressed, and Forged Steel Shapes, Plates, Bars, and Strips

1.4 SUBMITTALS

- A. Submit shop drawings and product data under provisions of Section 26 05 00.
- B. Indicate material specifications, dimensions, capacities, size and location of openings, reinforcing details, and accessory locations.
- C. Provide product data for manhole accessories.
- D. Submit manufacturer's installation instructions under provisions of Section 26 05 00.

2. PART PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS - PRECAST CONCRETE MANHOLES

- A. Utility Vault
- B. Grove Concrete
- C. Utility Concrete Products, LLC

2.2 **[MH-#]:** PRECAST CONCRETE MANHOLES

- A. Precast Concrete: Air-entrained, 2000 psi compressive strength at 28 days.
- B. Reinforcing: AASHTO HS-20; bridge loading.
- C. Construction: Monolithic.
- D. Manhole Shape: As indicated on the drawings.
- E. Inside Dimensions: As indicated on drawings.

- F. Wall Thickness: As indicated on drawings.
- G. Include 36 inch diameter grooved opening in top section.
- H. Necking and Shaft Sections: 30 inch diameter clear opening.
- I. Include 12 inch drain opening and 2 one inch ground rod openings in base section.
- J. Window for Duct Entry: 12X24 inches on each wall, with top of opening two feet below top of manhole.
- K. Include cable pulling irons opposite each duct entry window.
- L. Include inserts for cable racks at 12 feet on center.
- M. Include precast manhole steps at 16 inches on center.

2.3 [MH-#]: CAST-IN-PLACE MANHOLES

- A. Concrete: 3000 psi compressive strength at 28 days in conformance with requirements of Division 3.
- B. Provide reinforcing under the provisions of Division 3.

2.4 MANHOLE ACCESSORIES

- A. Manhole Frames and Covers: ASTM A48; Class 30B gray cast iron, machine finished with flat bearing surfaces.
- B. Sump Covers: ASTM A48; Class 30B gray cast iron.
- C. Pulling Irons: 7/8 inch diameter steel bar forming a triangle of 9 inches per side when set. Galvanize to ANSI/ASTM A153 for irregular shaped articles.
- D. Cable Rack Inserts: Anchor insert with 316 stainless steel hex head cap screw, minimum load capacity of 1250 pounds.
- E. Cable Rack Stanchion: Non-metallic 50% glass reinforced nylon stanchion with cable rack arm mounting slots on 4 inch centers. Hot dipped galvanized steel cable rack, with cable rack arm mounting slots on 8 inch centers. Install a minimum of two stanchions on each wall, with a maximum of 3' spacing.
- F. Cable Rack Arms: 14" arm shall have a minimum 200 lbs load rating. Non-metallic 50% glass reinforced nylon arm. Hot dipped galvanized steel T-section with high-glazed, wet-process porcelain insulators. Cable rack arm lengths shall be appropriate for the manhole size and amount of cable being installed. Provide two spare arms at each stanchion.
- G. Manhole Steps: Cast iron, suitable for manhole shape and construction and meeting OSHA requirements.

3. PART EXECUTION

3.1 PREPARATION

- A. Excavate, install base material, and compact base material in accordance with manufacturer's instructions.

3.2 INSTALLATION - PRECAST CONCRETE MANHOLES

- A. Install and seal precast sections in accordance with manufacturer's instructions.

- B. Use precast neck and shaft sections to bring manhole entrance to proper elevation.
- C. Install manholes plumb.
- D. Set the top of each manhole to finished elevation or as indicated on the drawings.

3.3 INSTALLATION - CAST-IN-PLACE CONCRETE MANHOLES

- A. Form cast-in-place manholes, inside and outside surfaces, in accordance with the provisions of Division 3.
- B. Manhole Shape: As indicated on the drawings.
- C. Inside Dimensions: As indicated on the drawings.
- D. Wall Thickness: As indicated on the drawings.
- E. Formed Window for Duct Entry: As indicated on the drawings.
- F. Include 12 inch drain opening and 2 one inch ground rod openings in base section.
- G. Cast Cable Pulling Irons in Place Opposite Each Duct Entry Window: As indicated on the drawings.
- H. Cast Inserts for Cable Racks in Place: As indicated on the drawings.

3.4 INSTALLATION - MANHOLE ACCESSORIES

- A. Install drains in manholes, and connect to 4 inch pipe terminating in 1/3 cu. yd. crushed gravel bed in accordance with provisions of Section 22 10 30.
- B. Install ground rod with top protruding 4 inches above manhole floor.
- C. Waterproof exterior surfaces, joints, and interruptions of manholes after concrete has cured 28 days minimum, in accordance with provisions of Division 7.
- D. Attach cable racks to inserts after manhole is complete.

END OF SECTION

SECTION 26 05 48

SEISMIC REQUIREMENTS FOR EQUIPMENT AND SUPPORTS

1. PART GENERAL

1.1 SECTION INCLUDES

- A. Seismic Requirements.

1.2 QUALITY ASSURANCE

A. General:

1. The contractor shall retain a specialty consultant or equipment manufacturer to develop a seismic restraint and support system and perform seismic calculations in accordance with these specifications, state, and local codes.
2. Items used for seismic restraint of equipment and systems shall be specifically manufactured for seismic restraint.
3. These requirements are beyond those listed in Section 26 05 27 of these specifications. Where a conflict arises between the seismic requirements of this section and any other section, the Architect/Engineer shall be immediately notified for direction to proceed.

B. Manufacturer:

1. System Supports/Restraints: Company specializing in the manufacture of products specified in this Section.
2. Equipment: Each company providing equipment that must meet seismic requirements shall provide certification included in project submittals the equipment supplied for the project meets or exceeds the seismic requirements of the project.

- C. Testing Agency: An independent testing agency, acceptable to Authorities Having Jurisdiction, with experience and capability to conduct the testing indicated.

- D. Installer: Company specializing in performing the work of this Section.

- E. Suppliers: Following is a partial list of manufacturer/supplier contact information for seismic restraints:

1. B-Line Systems, Inc. (800) 851-7415, www.b-line.com.
2. Unistrut Corporation <http://www.unistrut.us/>
3. Kinetics Noise Control (877) 457-2695, www.kineticsnoise.com.
4. Mason Industries, Inc. www.mason-ind.com.
5. Loos & Co., Inc. (800) 321-5667, www.loosnaples.com.
6. Tolco (909) 737-5599, www.tolco.com
7. ISAT 877.523.6060, www.isatsb.com
8. Vibro-Acoustics (416) 291-7371, <https://virs.vibro-acoustics.com/>

1.3 REFERENCES

- A. International Building Code 2015.
- B. California Building Code (CBC)
- C. California Division of State Architect (DSA) Interpretation of Regulations
- D. ASHRAE - A Practical Guide to Seismic Restraint.
- E. Technical Manual 5-809-10, NAVFAC P-355, Air Force Manual 88-3, Chapter 13.
- F. ASCE 7-02, Chapter 9.
- G. ASCE 7-05, Chapter 13.
- H. ASCE 7-10, Chapter 13.

1.4 SUBMITTALS

- A. Submit under provisions of Section 26 05 00.
 - 1. Submittal to Code Official Contractor shall submit copies of the seismic shop drawings to the governing code authority for approval.
- B. Shop Drawings:
 - 1. Calculations, restraint selections, and installation details shall be designed and sealed by a Professional Structural Engineer licensed in the state where the project is located experienced in seismic restraint design and installation.
 - 2. Coordination Drawings: Plans and sections drawn to scale, coordinating seismic bracing of electrical components with other systems and equipment in the vicinity, including other seismic restraints.
 - 3. Manufacturer's Certifications: Professional Structural Engineer licensed in the state where the project is located shall review and approve manufacturer's certifications of compliance.
 - 4. System Supports/Restraints - Submit for each condition requiring seismic bracing:
 - a. Calculations for each seismic brace and detail utilized on the project.
 - b. Plan drawings showing locations and types of seismic braces on contractor fabrication/installation drawings.
 - c. Cross-reference between details and plan drawings to indicate exactly which brace is being installed at each location. Details provided are to clearly indicate attachments to structure, correctly representing the fastening requirements of bracing.
 - d. Clear indication of brace design forces and maximum potential component forces at attachment points to building structure for confirmation of acceptability by the Structural Engineer of Record.
 - 5. Equipment - Submit for each piece of equipment supplied:
 - a. Certification that the equipment supplied for the project meets or exceeds the seismic requirements specified. Equipment certification is to be provided by the manufacturer
 - b. Specific details of seismic design features of equipment and maximum seismic loads imparted to the structural support.
 - c. Engineering calculations and details for equipment anchorage and support structure.
- C. A seismic restraint designer shall be provided whether or not exceptions listed in the applicable building code are met. If seismic restraints are not provided for a system that requires seismic bracing, the seismic designer shall submit a signed and sealed letter to the Architect/Engineer and Authorities Having Jurisdiction stating the exceptions, along with code reference, utilized for each item. Seismic designer shall review system installation for general conformance to the exception requirements stated in the code and document, in writing, the system has been installed in accordance to the exception.

1.5 TESTING AND INSPECTION

- A. Special Inspection and Testing shall be done in accordance with Chapter 17 of the California Building Code.

- B. The Owner Contractor shall employ a Special Inspection Agency to perform the duties and responsibilities specified in Section 1704 and 1705.
- C. Work performed on the premises of a fabricator approved by the building official need not be tested and inspected. The fabricator shall submit a certificate of compliance that the work has been performed in accordance with the approved plans and specifications to the building official and the Architect and Engineer of Record.
- D. The Special Inspection Agency shall furnish inspection reports to the building official, the Owner, the Architect, the Engineer of Record, and the General Contractor. The reports shall be completed and furnished within 48 hours of inspected work. A final signed report stating whether the work requiring special inspection was, to the best of the Special Inspection Agency's knowledge, in conformance with the approved plans and specifications shall be submitted.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Deliver, store, protect and handle products to site. Accept material on site in factory containers and packing. Inspect for damage. Protect from damage and contamination by maintaining factory packaging until installation. Follow manufacturer's instructions for storage.

1.7 DESIGN REQUIREMENTS

- A. Project is subject to the seismic bracing requirements of California Building Code, Division of State Architect (DSA) Interpretation of Regulations.
- B. The following criteria are applicable to this project:
 - 1. Risk Category II
 - 2. Seismic Factor: $I_E = 1.25$ Seismic Design Category: D0
 - 3. Component Amplification Factors (a_p) and Component Response Modification Factors (R_p) shall be taken from Table 1621.3 CBC 2016 13.5-1 in ASCE 7-10 for the individual equipment or system being restrained.
 - 4. Component Importance Factors (I_p) shall be taken from Section 1621.1.6 in CBC 2016 13.1.3 in ASCE 7-10 for the individual equipment or system being restrained.
 - 5. The total height of the structure and the height of the system to be restrained within the structure shall be determined in coordination with architectural plans and the General Contractor.
- C. Forces shall be calculated with the above requirements of CBC 2016 of ASCE 7-05, unless exempted by 13.1.4 of ASCE 7-10. Equipment shall meet California Building Code and ASCE 7 seismic qualification requirements in concurrence with ICC ES AC156 Acceptance Criteria for Seismic Qualification by Shake-Table Testing of Nonstructural Components and Systems.
- D. All seismic anchorage and bracing shall comply with the California Rules and Regulations on Anchorage & Sway Bracing - Mechanical, Electrical and Plumbing (MEP) Components.

1.8 COORDINATION

- A. Coordinate layout and installation of seismic bracing with building structural systems and architectural features, and with mechanical, fire-protection, electrical and other building features in the vicinity.
- B. Coordinate concrete bases with building structural system.

1.9 WARRANTY

- A. Provide one-year warranty on parts and labor for manufacturer defects and installation workmanship.

2. PART PRODUCTS

2.1 SEISMIC DESIGN CRITERIA

- A. This section describes the requirements for seismic restraint of systems and equipment related to continued operation of the facility after a design seismic event.
- B. Definitions
 - 1. Stay in Place:
 - a. All systems and equipment shall be anchored and restrained such that the anchoring system is intended not to fail and equipment and/or system components will not fall.
 - 2. Remain Operational:
 - a. Requirements for "Stay in Place" listed above shall be met.
 - b. The following systems and associated equipment are intended not to fail externally or internally and are intended to remain operational.
 - 1) Life Safety Power
 - 2) Emergency Power System
 - 3) Fire Alarm

2.2 SEISMIC BRACING AND SUPPORT OF SYSTEMS AND COMPONENTS

- A. General:
 - 1. Seismic restraint designer shall coordinate all attachments with the Structural Engineer of Record; refer to submittal requirements.
 - 2. The seismic restraint design shall be based on actual equipment data obtained from manufacturer's submittals or the manufacturer. The equipment manufacturer shall verify and provide written certification the attachment points on the equipment can accept the combination of seismic, weight, and other imposed loads.
 - 3. Design analysis shall include calculated dead loads, static seismic loads, and capacity of materials utilized for the connection of the equipment or system to the structure.
 - 4. Analysis shall detail anchoring methods, bolt diameter, embedment, and weld length.
 - 5. All seismic restraint devices shall be designed to accept without failure the forces calculated per the applicable building code.
 - 6. All seismic restraints and combination isolator/restraints shall have verification of their seismic capabilities witnessed by an independent testing agency.
- B. Friction from gravity loads shall not be considered resistance to seismic forces.
- C. Housekeeping Pads:
 - 1. Reinforced housekeeping pads shall be provided to handle shear, tension, and compression forces with proper reinforcement, doweling, and attachments connecting the pad to the structural slab.

2.3 SEISMIC RESTRAINT AND CONSTRUCTION OF EQUIPMENT

- A. Equipment supplied for the project shall be designed to meet the requirements of lateral forces calculated using the applicable code and method described above.

- B. The following is a partial list of equipment that shall be restrained and that shall be constructed to meet seismic forces described in this section:

1. Switchboards, Distribution Panelboards, Panelboards, Load Centers
2. Emergency Feeders
3. Transformers
4. Disconnect Switches
5. Magnetic, Manual, Combination Starters
6. Variable Frequency Drives
7. Automatic/Manual Transfer Switches
8. Interior Luminaires
9. Emergency Luminaires and Exit Signs
10. Emergency Power Supply
11. Engine Generator Systems
12. Uninterruptible Power Supplies
13. Fire Alarm Panel, Initiating and Notification Appliances

2.4 MATERIALS

- A. Use the following materials for restraints:

1. Indoor Dry Locations: Steel, zinc plated.
2. Outdoors and Damp Locations: Galvanized steel.
3. Corrosive Locations: Stainless steel.

2.5 ANCHORAGE AND STRUCTURAL ATTACHMENT COMPONENTS

- A. Strength: Defined in reports by ICC Evaluation Service or another agency acceptable to authorities having jurisdiction.
1. Structural Safety Factor: Strength in tension and shear of components used shall be at least two times the maximum seismic forces to which they will be subjected.
- B. Concrete and Masonry Anchor Bolts and Studs: Steel-expansion wedge type. Comply with IBC, ACI and ICC ES requirements for cracked concrete anchors.
- C. Concrete Inserts: Steel-channel type.
- D. Through Bolts: Structural type, hex head, high strength. Comply with ASTM F3125, Grade A 325.
- E. Welding Lugs: Comply with MSS SP-69, Type 57.
- F. Beam Clamps for Steel Beams and Joists: Double sided. Single-sided type is not acceptable.
- G. Bushings for Floor-Mounted Equipment Anchors: Neoprene units designed for seismically rated rigid equipment mountings, and matched to the type and size of anchor bolts and studs used.
- H. Bushing Assemblies for Wall-Mounted Equipment Anchorage: Assemblies of neoprene elements and steel sleeves designed for seismically rated rigid equipment mountings, and matched to the type and size of attachment devices used.

2.6 SEISMIC BRACING COMPONENTS

- A. Slotted Steel Channel: 1-5/8-by-1-5/8-inch cross section, formed from 0.1046-inch-thick steel, with 9/16-by-7/8-inch slots at a maximum of 2 inches o.c. in webs, and flange edges turned toward web.
1. Materials for Channel: ASTM A 1011, GR 33.
 2. Materials for Fittings and Accessories: ASTM A 635, ASTM A 576, or ASTM A 36.

3. Fittings and Accessories: Products of the same manufacturer as channels and designed for use with that product.
 4. Finish: Baked, rust-inhibiting, acrylic-enamel paint applied after cleaning and phosphate treatment, unless otherwise indicated.
- B. Cable-Type Bracing Assemblies: Zinc-coated, high-strength steel wire rope cable attached to steel thimbles, brackets, and bolts designed for cable service.
1. Arrange units for attachment to the braced component at one end and to the structure at the other end.
 2. Wire Rope Cable: Comply with ASTM A 603. Use 49- or 133-strand cable with a minimum strength of 2 times the calculated maximum seismic force to be resisted.
- C. Hanger Rod Stiffeners: Slotted steel channels with internally bolted connections to hanger rod.

3. PART EXECUTION

3.1 INSTALLATION

- A. Refer to the applicable code sections and Authority Having Jurisdiction for the exact seismic restraint requirements of conduit, equipment, etc.
- B. Layout of transverse and longitudinal bracing shall follow recommendations of approved design standards listed in Part 1 of this specification section.
- C. All rigid floor mounted equipment shall have a resilient media between the equipment mounting hole and the anchor bolt in concrete.
- D. All seismic restraint systems shall be installed in strict accordance with the manufacturer's written instructions and all certified submittal data.
- E. Installation of seismic restraints shall not cause any change in position of equipment lighting or conduits resulting in stresses or misalignment.
- F. No rigid connections between equipment and the building structure shall be made that degrade the noise and vibration-isolation system specified.
- G. Do not install any equipment or conduit that makes rigid connections with the building unless isolation is not specified.
- H. Coordinate work with all other trades to avoid rigid contact with the building. Any conflicts with other trades that will result in rigid contact with equipment or conduit due to inadequate space or other unforeseen conditions shall be brought to the Architect/Engineer's attention prior to specific equipment selection.
- I. Prior to installation, bring to the Architect/Engineer's attention any discrepancies between the specifications and the field conditions, or changes required due to specific equipment selection.
- J. Bracing may occur from flanges of structural beams, upper truss cords of bar joists, cast in place inserts, or International Code Council approved seismic anchors for installation in concrete.
- K. Cable restraints shall be installed slightly slack to avoid short-circuiting the isolated suspended equipment or conduit.
- L. Cable assemblies shall be installed taut on non-isolated systems. Solid braces may be used in place of cables on rigidly attached systems only.
- M. Do not install cables over sharp corners.

- N. Brace support rods when necessary to accept compressive loads. Welding of compression braces to the vertical support rods is not acceptable.
- O. Provide reinforced clevis bolts when required.
- P. The vibration isolation manufacturer shall furnish integral structural steel bases as required. Independent steel rails are not acceptable.
- Q. Post-Installed anchors shall be provided to meet seismic requirements.
- R. Vertical conduit risers flexibly supported to accommodate thermal motion and/or conduit vibration shall be guided to maintain conduit stability and provide horizontal seismic restraint.
- S. Seismic restraints shall be mechanically attached to the system. Looping restraints around the system is not acceptable.
- T. Conduit crossing building seismic or expansion joints, passing from building to building, or supported from different portions of the building shall be installed to allow differential support displacements without damaging the conduit, equipment connections, or support connections. Conduit offsets, loops, anchors, and guides shall be installed as required to provide required motion capability and limit motion of adjacent conduit.
- U. Do not brace a system to two different structures such as a wall and a ceiling.
- V. Provide appropriately sized openings in walls, floors, and ceilings for anticipated seismic movement. Provide fire seal systems in fire-rated walls.
- W. Positively attach all roof-mounted equipment to roof curbs. Positively attach all roof curbs to building structure.
- X. Exposed seismic supports in occupied areas shall be guarded or covered to protect occupants.

3.2 SEISMIC RESTRAINT EXCLUSIONS

- A. Refer to the applicable code sections and Authority Having Jurisdiction for allowable exclusions.

END OF SECTION

SECTION 26 05 53

ELECTRICAL IDENTIFICATION

1. PART GENERAL

1.1 SECTION INCLUDES

- A. Adhesive labels, markings, nameplates, and signs
- B. Wire and cable markers
- C. Raceway, box, and wire identification
- D. Equipment short circuit current rating (SCCR) labeling
- E. Electrical equipment labeling
- F. Electrical working clearance identification
- G. Series rating identification
- H. Pole identification

1.2 REFERENCES

- A. ANSI C2 – National Electrical Safety Code
- B. NFPA 70 – National Electrical Code (NEC)
- C. ANSI A13.1 – Standard for Pipe Identification
- D. ANSI Z535.4 – Standard for Product Safety Signs and Labels

1.3 SUBMITTALS

- A. General: Submit the following in accordance with Division 1 Specification Sections and under provisions of Section 26 05 00.
 - 1. Product Data for each type of product specified.
 - 2. Schedule of nomenclature to be used for identification signs and labels for each piece of equipment including, but not limited to, the following equipment types as specified in Division 26.
 - 3. Samples of each color, lettering style and other graphic representation required for identification materials including samples of labels and signs.
 - 4. Identification required in this section shall apply to equipment furnished in Division 26 and any other applicable Divisions including Division 21/22/23.

2. PART PRODUCTS

2.1 ADHESIVE MARKINGS AND FIELD LABELS

- A. Adhesive Marking Labels for Raceway: Pre-printed, flexible, self-adhesive vinyl labels with legend indicating voltage and service (Emergency, Lighting, Power, HVAC, Communications, Control, Fire).
 - 1. Label Size as follows:
 - a. Raceways: Kroy or Brother labels 1-inch (25mm) high by 12-inches (305mm) long (minimum).
 - 2. Color: As specified for various systems.
- B. Colored Adhesive Marking Tape for banding Raceways, Wires, and Cables: Self-adhesive vinyl tape not less than 3 mils thick by 1 inch (25mm) to 2 inches (50mm) in width.

- C. Pretensioned Flexible Wraparound Colored Plastic Sleeves for Cable Identification: flexible acrylic bands sized to suit the cable diameter and arranged to stay in place by pre-tensioned gripping action when coiled around the cable.
- D. Wire/Cable Designation Tape Markers: Vinyl or vinyl-cloth, self-adhesive, wraparound, cable/conductor markers with preprinted numbers and letter.
- E. Cable Ties: Fungus-inert, self-extinguishing, one-piece, self-locking nylon cable ties, 0.18-inch (5mm) minimum width, 50-lb minimum tensile strength, and suitable for a temperature range from minus 50°F to 350°F (10°C to 176°C). Provide ties in specified colors when used for color coding.
- F. Underground Plastic Markers: Bright colored continuously printed plastic ribbon tape of not less than 6 inches wide by 4 mil thick, printed legend indicating type of underground line, manufactured for direct burial service. Tape shall contain a continuous metallic wire to allow location with a metal detector.
- G. Aluminum, Wraparound Marker Bands: 1-inch (25mm) width, 0.014 (5mm) inch thick aluminum bands with stamped or embossed legend, and fitted with slots or ears for permanently securing around wire or cable jacket or around groups of conductors.
- H. Brass or aluminum Tags: 2" (50mm) by 2" (50mm) by .05-inch (2mm) metal tags with stamped legend, punched for fastener.
- I. Indoor/Outdoor Number and Letters: Outdoor grade vinyl label with acrylic adhesive designed for permanent application in severe indoor and outdoor environments.
- J. Text Sizes:
 - 1. The following information shall be used for text heights, fonts, and size, unless otherwise noted.
 - a. Font: Normal 721 Swiss Bold
 - b. Adhesive Labels: 3/16 inch (5mm) minimum text height
 - c. Vinyl / Plastic Laminate Labels: 3/4" inch (19mm) minimum text height

2.2 NAMEPLATES AND SIGNS

- A. Engraved, Plastic-Laminated Labels, Signs and Instruction Plates: Engraving stock melamine plastic laminate, 1/16-inch (2mm) minimum thick for signs up to 20 square inches (13 square cm), or 8 inches (200mm) in length; 1/8 inch (3mm) thick for larger sizes. Labels shall be punched for mechanical fasteners.
- B. Text Sizes:
 - 1. The following information shall be used for text heights, fonts, and size, unless otherwise noted.
 - a. Text Height: 3/8 inch (10mm) minimum
- C. Baked–Enamel Signs for interior Use: Preprinted aluminum signs, punched, or drilled for fasteners, with colors, legend, and size required for application. Mounting 1/4" grommets in corners.
- D. Exterior, Metal-Backed, Butyrate Signs: Weather-resistant, nonfading, preprinted, cellulose-acetate butyrate signs with 0.0396 inch (10mm) galvanized-steel backing; and with colors, legend, and size required for application. Mounting 1/4" grommets in corners.
- E. Safety Signs: Comply with 29 CFR, Chapter XVII, Part 1910.145.
- F. Fasteners for Plastic-Laminated Signs; Self-tapping stainless steel screws or number 10/32 stainless steel machine screws with nuts and flat and lock washers.

2.3 PRODUCT COLORS

A. Adhesive Markings and Field Labels:

1. All Labels: Black letters on white or clear face
2. Normal Power and General Labels: Black letters on white face or black letters on clear face
3. Control Labels: Black letters on white face or black letters on clear face
4. Medium Voltage (greater than 100 volts): Black letters on white face or black letters on clear face
5. Fire Alarm: Red letters on white face or red letters on clear face
6. Emergency: Red letters on white face or red letters on clear face

B. Nameplates and Signs:

1. NORMAL POWER: Black letters on white face
2. Control Labels: Black letters on white face
3. EMERGENCY: White letters on red face
4. GROUNDING: White letters on green face.
5. CAUTION or UPS: Black letters on yellow face

C. Raceways and Conduit:

1. Provide color coded conduit as indicated below. Conduit shall be colored by the manufacturer:
 - a. Normal Power and General Distribution: Silver
 - b. Emergency Power Distribution System:
 - 1) All Emergency: Orange
 - 2) Legally Required Standby: Yellow
 - 3) Optional Standby: Orange
 - 4) Life Safety and Critical Branch: Yellow
 - 5) Equipment Branch: Orange
 - c. Fire Alarm System: Red
 - d. Temperature Controls: Refer to mechanical cover sheet for color
 - e. Ground: Green

D. Box Covers:

1. Box covers shall be painted to correspond with system type as follows:
 - a. Normal Power and General: Silver
 - b. Emergency Power and Distribution:
 - 1) All Emergency: Orange
 - 2) Legally Required Standby: Yellow
 - 3) Optional Standby: Orange
 - 4) Life Safety and Critical Branch: Yellow
 - 5) Equipment Branch: Orange
 - c. Fire Alarm System: Red
 - d. Temperature Controls: Refer to mechanical cover sheet for color
 - e. Ground: Green

2. Box cover colors shall match conduit colors listed above.

E. Conductor Color Identification: Refer to Part 3 for additional information.

3. PART EXECUTION

3.1 INSTALLATION

- A. Lettering and Graphics: Coordinate names, abbreviations, colors, and other designations used in electrical identification work with corresponding designations specified or indicated. Install numbers, lettering, and colors as approved in submittals and as required by code.
- B. Electrical System Color Chart: This Contractor shall furnish and install framed 8" x 12" charts of the color-coded identification scheme used for the electrical system in all electrical rooms and next to the main fire alarm panel.
- C. Install identification devices in accordance with manufacturer's written instruction and requirements of NEC.
- D. Sequence of Work: Where identification is to be applied to surfaces that require finish, install identification after completion of finish work. All mounting surfaces shall be cleaned and degreased prior to identification installation.
- E. Circuit Identification: Tag or label conductors as follows:
 - 1. Multiple Power or Lighting Circuits in Same Enclosure: Where multiple branch circuits are terminated or spliced in a box or enclosure, label each conductor with source and circuit number.
 - 2. Multiple Control Wiring and Communication/Signal Circuits in Same Enclosure: For control and communications/signal wiring, use wire/cable marking tape at terminations in wiring boxes, troughs, and control cabinets. Use consistent letter/number conductor designations throughout on wire/cable marking tape.
 - 3. Match identification markings with designations used in panelboards shop drawings, Contract Documents, and similar previously established identification schemes for the facility's electrical installations.
- F. Apply warning, caution and instruction signs as follows:
 - 1. Install warning, caution or instruction signs where required by NEC, where indicated, or where reasonably required to assure safe operation and maintenance of electrical systems and of the items to which they connect. Install engraved plastic-laminated instruction signs with approved legend where instructions or explanations are needed for system or equipment operation. Install metal-backed butyrate signs for outdoor items.
 - 2. Emergency Operating Signs: Install, where required by NEC, where indicated, or where reasonably required to assure safe operation and maintenance of electrical systems and of the items to which they connect, engraved laminate signs with white legend on red background with minimum 3/8-inch (10mm) high lettering for emergency instructions on power transfer, load shedding, or other emergency operations.
- G. Apply circuit/control/item designation labels of engraved plastic laminate for pushbuttons, pilot lights, alarm/signal components, and similar items, except where labeling is specified elsewhere.
- H. Install labels parallel to equipment lines at locations as required and at locations for best convenience of viewing without interference with operation and maintenance of equipment.

- I. Install ARC FLASH WARNING signs on all power distribution equipment per Section 26 05 73.
- J. Circuits with more than 600V: Identify raceway and cable with "DANGER—HIGH VOLTAGE" in black letters 2 (50mm) inches high on orange background at 10'-0 foot (3m) intervals.
 - 1. Entire floor area directly above conduits running beneath and within 12 inches (305mm) of a basement or ground floor that is in contact with earth or is framed above unexcavated space.
 - 2. Wall surfaces directly external to conduits concealed within wall.
 - 3. All accessible surfaces of concrete envelope around conduits in vertical shafts, exposed in building, or concealed above suspended ceilings.
- K. Underground Electrical Lines: For exterior underground power, control, signal, and communication lines, install continuous underground plastic line marker located directly above line at 6 (150mm) to 8 (205mm) inches below grade. A single plastic line marker is permitted when the width of the common trench does not exceed 16 inches (405mm); provide a second plastic line marker to mark each edge of the trench when 16 inches (405mm) of width is exceeded. Limit line markers to direct-buried cables. Install line marker for underground wiring, both direct-buried cables and cables in raceway.

3.2 LIGHTING CONTROL AND RECEPTACLE COVER PLATES

- A. Product:
 - 1. Adhesive labels and field markings
 - 2. Nameplates and signs
- B. Identification to be engraved directly on the stainless steel coverplates. Letter and number size to 1/8-inch (3mm) high.
- C. Provide identification on all switch and receptacle cover plates. Identification shall indicate source and circuit number serving the device (e.g. "C1A #24"). Identification for switch cover plates shall be installed on the inside cover.

3.3 CONDUIT AND EXPOSED CABLE LABELING

- A. Product:
 - 1. Adhesive labels and field markings
- B. Conduit Identification: Pre-printed, flexible, self-adhesive vinyl labels with legend at 25 foot (3 meter) intervals to identify all conduits run exposed or located above accessible ceilings. Conduits located above non-accessible ceiling or in floors and walls shall be labeled within 3 feet of becoming accessible. Labels for multiple conduits shall be aligned. Refer to color requirements in Part 2 when applicable in addition to the following:
 - 1. 1000 Volt or less Normal/Emergency Power: Indicate feeder identification and voltage.
 - 2. Fire Alarm: Indicate "FIRE ALARM".
 - 3. Grounding: Indicate "GROUND" and equipment and designation.
- C. Blank conduit ends or outlet boxes for future extension of system shall have permanent identification marker indicating purpose of conduit or box and where the raceway originated.

3.4 BOX LABELING

- A. Products:
 - 1. Adhesive labels and field markings

- B. Identify Junction, Pull and Connection Boxes: Labeling shall be 3/8-inch (10mm) Kroy tape or Brother self-laminating vinyl label, letters/numbers color coded same as conduits. In rooms that are painted out, provide labeling on inside of cover.
- C. All junction, pull, and connection boxes shall be identified as follows:
 - 1. For power and lighting circuits, indicate system voltage and identity of contained circuits ("120V, 1LA1-3,5,7").
 - 2. For other wiring, indicate system type and description of wiring ("FIRE ALARM NAC #1").

3.5 CONDUCTOR COLOR CODING

- A. Products:
 - 1. All wire and cables shall be color coded by the manufacturer.
 - 2. All wires and cables, 6 AWG or larger, used in motor circuits, main feeders, sub-main feeders, and branch circuits shall be coded by the application of plastic tape. The tape shall be 3-M, Plymouth or Permacel in colors specified below. The tape shall be applied at each conductor termination with two 1-inch (25mm) tape bands at 6-inch (150mm) centers. Contractor option to use colored cabling in lieu of the tape at each end for conductor 6 AWG to 500 KCM. Wire and cables smaller than 6 AWG shall be color coded by the manufacturer.
- B. Color coding shall be applied at all panels, switches, junction boxes, pull boxes, vaults, manholes etc., where the wires and cables are visible and terminations are made. The same color coding shall be used throughout the entire electrical system, therefore maintaining proper phasing throughout the entire project.
- C. Colored cable ties shall be applied in groups of three ties of specified color to each conductor at each terminal or splice point starting 3 inches (76mm) from the termination and spaced at 3- inches (76mm) centers. Tighten to a snug fit, and cut off excess length.
- D. Where more than one nominal voltage system exists in a building or facility, each ungrounded conductor of a multi-wire branch circuit, where accessible, shall be identified by phase and system.
- E. Conductors shall be color coded as follows:
 - 1. 120/240 Volt, 3-Wire:
 - a. A-Phase – Black
 - b. B-Phase – Red
 - c. Neutral – White
 - d. Ground Bond – Green
 - 2. 208Y/120 Volt, 4-Wire:
 - a. A-Phase – Black
 - b. B-Phase – Red
 - c. C-Phase – Blue
 - d. Neutral – White
 - e. Ground Bond – Green
 - 3. 480Y/277 Volt, 4-Wire:
 - a. A-Phase – Brown
 - b. B-Phase – Orange
 - c. C-Phase – Yellow
 - d. Neutral – Gray
 - e. Ground Bond – Green

4. 120 Volt, 2-Wire Isolated (Ungrounded) Power System:
 - a. A-Phase – Orange with distinctive colored stripe other than white, green or gray along the entire length of the conductor
 - b. B-Phase – Brown with distinctive colored stripe other than white, green or gray along the entire length of the conductor
 - c. Ground Reference – Green
5. 120/208 Volt, 3-Wire, Isolated (Ungrounded) Power System:
 - a. A-Phase – Orange with distinctive colored stripe other than white, green or gray along the entire length of the conductor
 - b. B-Phase – Brown with distinctive colored stripe other than white, green or gray along the entire length of the conductor
 - c. C-Phase – Yellow with distinctive colored stripe other than white, green or gray along the entire length of the conductor
 - d. Ground Reference – Green
6. 0 to 1500 Volt, Direct Current DC Power System:
 - a. Ungrounded Positive Polarity: Red or black with permanent red stripe marked along the entire length. Provide shrink wrap sleeves at terminations indication (POS, POSITIVE, or POS (+)).
 - b. Ungrounded Negative Polarity: Black. Provide shrink wrap sleeves at terminations indication (NEG, NEGATIVE, or NEG (-)).
 - c. Grounded Conductor in Grounded DC systems (refer to paragraphs a and b above for marking of ungrounded conductors):
 - 1) When Positive Polarity is Grounded: White along entire length. Provide shrink wrap sleeves at terminations indication (POS. POSITIVE, or POS (+)).
 - 2) When Negative Polarity is Grounded: White along entire length. Provide shrink wrap sleeves at termination indication (NEG, NEGATIVE, or NEG (-)).
7. Grounding Conductors:
 - a. Equipment grounding conductors, main/system/supply-side bonding jumpers: Green.
 - b. Isolated Equipment Ground Conductors: Green with colored distinctive yellow stripe along the entire length of the conductor. Isolated ground for feeders, use colored tape with alternating bands of green and yellow to provide a minimum of three bands of green and two bands of yellow.
8. Cabling for Remote Control, Signal, and Power Limited Circuits:
 - a. Fire Alarm: Refer to Fire Alarm and Automatic Detection Section 28 31 00 for cable color requirements Red.
 - b. Low Voltage Switching: Per manufacturer recommendations and code requirements.
 - c. Building Automation Systems and Control: Refer to the Temperature Control Contactor notes located on the mechanical cover sheet.

3.6 CONTROL EQUIPMENT IDENTIFICATION

- A. Products:
 - 1. Nameplates and signs
- B. Provide identification on the front of all control equipment such as combination starters, starters, VFDs, contactors, motor control centers, etc.
- C. Identification shall be provided for all connections to equipment furnished by this Contractor, other contractors, or the Owner.
- D. Labeling shall include:
 - 1. Equipment type and contract documents designation of equipment being served.
 - 2. Location of equipment being served if it is not located within sight.
 - 3. Voltage and phase of circuit(s).
 - 4. Panel and circuit number(s) serving the equipment.
 - 5. Method of automatic control, if included ("AUTO CONTROL BY FCMS").
 - 6. Available fault current; refer to one-line diagram or panel schedule of panel serving equipment.
 - 7. Date of fault current study, refer to one-line diagram

EXHAUST FAN EF-1
("LOCATED ON ROOF")
480V, 3-PHASE
FED FROM "1HA1-1"
AUTO CONTROL BY FCMS
22,000 AMPS AVAILABLE FAULT CURRENT
DATE OF STUDY: 1 JAN 2017

3.7 EQUIPMENT CONNECTION IDENTIFICATION

- A. Products:
 - 1. Nameplates and signs
- B. Provide identification for hard wired electrical connections to equipment such as disconnects switches, starters, etc. Plug and cord type connections do not require this specific label.
- C. Identification shall be provided for all connections to equipment furnished by this Contractor, other contractors, or the Owner. The following list of equipment is specifically being listed to receive an equipment connection label; this list does not limit the equipment that shall receive a label:
 - 1. Mechanical heating, ventilation, and air conditioning equipment; chillers, boilers, pumps, air handling ventilation units, condensing units, unit heaters, and similar equipment
 - 2. Plumbing equipment
 - 3. Fire protection equipment including fire pumps
 - 4. Elevator
 - 5. Kitchen equipment (hardwired)
 - 6. Industrial machinery
- D. Labeling shall include:
 - 1. Equipment type and contract documents designation of equipment being served
 - 2. Location of equipment being served if it is not located within sight.
 - 3. Voltage and rating of the equipment.
 - 4. Panel and circuit numbers(s) serving the equipment

5. Available fault current; refer to one-line diagram or panel schedule of panel serving equipment.
6. Date of fault current study; refer to one-line diagram

UNIT HEATER UH-1
 ("LOCATED IN STORAGE ROOM 200")
 480V: 3-PHASE
 FED FROM "1HA1-1"
 22,000 AMPS AVAILABLE FAULT CURRENT
 DATE OF STUDY: 1 JAN 2017

3.8 POWER DISTRIBUTION EQUIPMENT IDENTIFICATION

A. Products:

1. Nameplates and signs

B. Provide identification on the front of all power distribution equipment such as panelboards, switchboards, switchgear, motor control centers, generators, UPS, storage battery disconnects, transfer switches, etc. Labels shall be visible on the exterior of the gear, correspond to the one-line diagram nomenclature, and identify each cubicle of multi-section gear.

1. Interior Equipment: The identification material shall be engraved plastic-laminated labels.
2. Exterior Equipment: The identification material shall be engraved vinyl labels.
3. Labeling shall include:
 - a. Equipment type and contract documents designation of equipment.
 - b. Voltage of the equipment.
 - c. Name of the upstream equipment and location of the upstream equipment if it is not located within sight.
 - d. Rating and type of the overcurrent protection device serving the equipment if it is not located within sight ("FED BY 400A/3P BREAKER").

DISTRIBUTION PANEL DP-H1
 480Y/277V
 FED FROM SWITCHBOARD "SB-1" (LOCATED IN MAIN ELEC ROOM)

4. Provide the following on a separate label, installed below the label above:
 - a. Available fault current; refer to one-line diagram or panel schedules
 - b. Date of fault current study; refer to one-line diagram

22,000 AMPS AVAILABLE FAULT CURRENT
 DATE OF STUDY: 1 JAN 2017

C. Service Equipment Label: A separate nameplate for the service entrance equipment and include:

1. Nominal system voltage
2. Maximum available fault current; refer to one-line diagram for values
3. Clearing time of overcurrent protection devices based on available fault current. Refer to calculations and report from Section 26 05 73 for value.
4. Date of fault current study; refer to one-line diagram

5. Date of label

480Y/277V
39,800 AMPS AVAILABLE FAULT CURRENT
0.07 SECOND CLEARING TIME
DATE OF STUDY: 1 JAN 2017
DATE OF LABEL: 4 JUL 2017

D. Arc Energy Reduction Label:

1. Provide a separate engraved plastic laminate label centered at the top of each vertical section of the electrical gear indicating the following when applicable.
 - a. Label: "This equipment is designed with a system listed below".
 - b. Applicable Systems:
 - 1) Zone-selective interlocking system for selective coordination and arc energy reduction
 - 2) Differential relaying system for selective coordination and arc energy reduction
 - 3) Arc energy reducing maintenance switch
 - 4) Energy reducing active arc flash mitigation system

E. Nominal System Voltage Label:

1. Where more than one nominal voltage system exists in a building or facility, the identification of color coding used in the panelboard or equipment shall be permanently posted on the interior of the door or cover.

F. Distribution panelboards and switchboards shall have each overcurrent protection device identified with name and location of the load being served ("AHU-1 LOCATED IN PENTHOUSE 1").

G. Branch panelboards shall be provided with typed panel schedules upon completion of the project. Existing panelboards shall have their existing panel schedules typed, with all circuit changes, additions or deletions also typed on the panel schedules. A copy of all panel schedules for the project shall be turned over as part of the O&M Manuals. Refer to Section 26 05 00 for other requirements.

3.9 TRANSFORMER EQUIPMENT IDENTIFICATION

A. Products:

1. Nameplates and signs

B. Provide identification on the front of all transformers. The identification nameplate shall be an engraved plastic-laminated label.

C. Labeling shall include:

1. Equipment type and contract documents designation of equipment
2. Name of the upstream equipment.
3. Voltage and rating of the equipment.
4. Location of the upstream equipment if it is not located within sight.

TRANSFORMER TR-15
480V: 208Y/120V 15KVA
FED FROM SWITCHBOARD "SB-1" (LOCATED IN ELEC 123)

3.10 ELECTRICAL WORKING CLEARANCE IDENTIFICATION

- A. Products:
 - 1. Safety Yellow paint and custom stencils
- B. Provide custom identification of electrical equipment working clearances in mechanical, electrical, storage, janitorial, and similar non-public areas.
- C. Identification shall include a painted rectangular box (on the finished floor) in front of the electrical equipment to define the code-required working clearance. Provide additional diagonal stripping inside the rectangle box. All painted stripping shall be safety yellow paint with 3 inch (76mm) wide stripes.
 - 1. Width of area: Width of equipment or as required by code
 - 2. Depth of area: Depth as required by code

3.11 SERIES RATING IDENTIFICATION

- A. Products:
 - 1. Nameplates and signs
- B. Upstream devices of series rated components not enclosed in a single NEMA type enclosure shall be identified with a nameplate reading "CAUTION - SERIES RATED SYSTEM - IDENTICAL COMPONENT REPLACEMENT REQUIRED".
- C. Downstream devices of series rated components not enclosed in a single NEMA type enclosure shall be identified with a nameplate reading "CAUTION - SERIES RATED SYSTEM - ADDITIONAL SERIES COMBINATION RATING: XX,XXX RMS SYMMETRICAL AMPERES" where XX,XXX shall be the series combination rating.

END OF SECTION

SECTION 26 05 73

POWER SYSTEM STUDY

1. PART GENERAL

1.1 SECTION INCLUDES

- A. Medium and low voltage distribution system power study.
- B. Short-circuit analysis and report.
- C. Arc-flash hazard analysis and report.

1.2 RELATED SECTIONS

- A. Section 26 05 00 - Basic Electrical Requirements
- B. Section 26 24 13 - Switchboards
- C. Section 26 24 16 - Panelboards
- D. Section 26 32 13 - Packaged Engine Generator Systems
- E. Section 26 36 00 - Transfer Switch

1.3 SUBMITTALS

- A. Analyses shall be performed by an agent authorized by the manufacturer of equipment specified in the related specification sections and shall bear the seal/signature of the licensed Professional Engineer who performed the analysis.
- B. The input for the power system study shall be based on the contract documents, with estimated conductor lengths provided by the Electrical Contractor. IMEG will provide a preliminary Power Tools for Windows project file for information, if requested.
- C. Documentation of the analyses shall be submitted in a bound booklet format and shall accompany the shop drawing submittals for equipment provided under the related work specification sections. These shop drawings will not be reviewed without this documentation. Submit a sample arc-flash hazard label for Owner review and approval prior to printing.
- D. Power system study project model shall be submitted on electronic media for review and the Owner's operating and maintenance records.

1.4 SCOPE

- A. Provide a power system study of the electrical system shown on the plans. The study shall include arc-fault analysis, selective coordination analysis and arc flash hazard analysis.
- B. Contractor is required to provide a fully coordinated system for the normal and emergency electrical system **OR** essential electrical system and the associated normal side of each transfer switch and all other locations indicated on the one line diagram. Contractor shall provide overcurrent protective devices with the appropriate models, frame sizes, trip units, etc. as required to provide a selectively coordinated system.

2. PART PRODUCTS

- 2.1 Power systems study shall be completed in Power Tools for Windows (PTW) 8.0 or later version or pre-approved equivalent program.

3. PART EXECUTION

3.1 SHORT-CIRCUIT ANALYSIS

- A. Provide a complete short-circuit analysis from the utility service to and including the entire building distribution as shown on the drawings.
- B. Analysis shall include the entire distribution system from the point of connection to the utility power source to the distribution panels and branch circuit panelboards.
- C. Documentation shall be made in one-line diagram form showing the magnitude and location of each calculated fault. Fault current calculations shall be made at the main bus of each switchboard, distribution panel, and branch circuit panel. A summary of the fault currents available shall also be submitted.

3.2 COORDINATION ANALYSIS

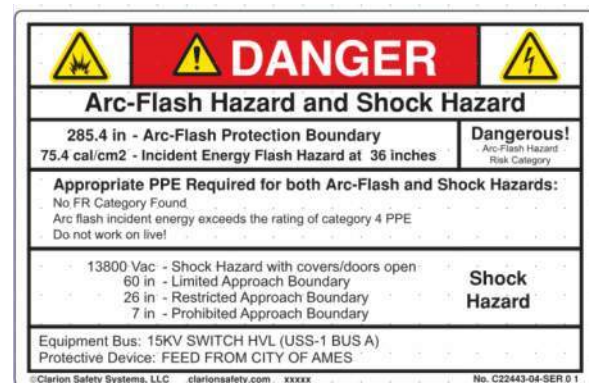
- A. Provide a coordination analysis, comparing time/current curves of the protective devices to be installed to assure selectivity between main and downstream devices for code-required branches and branches identified on one-line drawings. Overcurrent protective devices serving the emergency electrical system shall coordinate for the period of time that a fault's duration extends beyond 0.01 0.1 second. Overcurrent protective devices serving the normal shall coordinate for the period of time that a fault's duration extends beyond 0.01 0.1 second.
- B. The analysis shall include primary protective device, secondary main switchboard device(s), switchboard branch feeder devices, generator breaker, distribution panel, panelboard main devices, and branch feeder devices.
- C. The coordination plots provided shall indicate graphically the coordination proposed for the system on full-size log forms and shall define the types of protective devices selected, together with proposed time dial and pickup settings required. The plots shall include titles, representative one-line diagrams, legend, complete parameters for transformer(s), and complete operating bands for circuit breaker trip devices, fuses, etc.
 - 1. The long-time region of the coordination plots shall designate the pickups required for the circuit breakers.
 - 2. The short-time region shall indicate the magnetizing in-rush and ASA-withstand-transformer parameter, the circuit breaker, short-time and instantaneous trip devices, fuse-manufacturing tolerance bands, significant symmetrical fault currents, etc.
 - 3. Each primary protective device required for the transformer shall be selected so the characteristics or operating band is within the transformer parameters, which shall include a parameter equivalent to 58% of the withstand point to afford protection for secondary line-to-ground faults. The transformer damage curve shall be included for the transformer when the selected protective device is not within the associated parameters.
 - 4. Molded case circuit breakers shall be separated from each other and the associated primary protective device by a 16% current margin for coordination and protection in the event of secondary line-to-line faults.
 - 5. Include zone selective interlocking, differential relaying, and other selective coordination technology in the study when required by other specification sections.
 - 6. The protective device characteristics or operating bands shall be suitably indicated to reflect the actual symmetrical fault currents sensed by the device.

7. The drawings and specifications indicate the general requirements for motors, motor-starting equipment, and medium-voltage and low-voltage equipment, but additional specific requirements of equipment furnished shall be determined in accordance with the results of the coordination study.
 - a. The study shall include verification of equipment ratings and settings. The Contractor shall keep the study up-to-date with any project changes which affect the study and submit the revised study for review. A final electronic copy shall be submitted with the record drawings.
- D. Provide summary table of adjustable overcurrent protective devices settings for the operating and maintenance manual.

3.3 ARC FLASH HAZARD ANALYSIS

- A. The arc flash hazard analysis shall be performed according to the IEEE 1584 equations that are presented in NFPA70E-2018, Annex D.
- B. The flash protection boundary and the incident energy shall be calculated at all significant locations in the electrical distribution system (switchboards, switchgear, unit substations, motor-control centers, panelboards, busway, and splitters) where work could be performed on energized parts.
- C. Safe working distances shall be based on the calculated arc flash boundary considering an incident energy of 1.2 cal/cm².
- D. When appropriate, the short circuit calculations and the clearing times of the phase overcurrent devices will be retrieved from the short-circuit analysis and coordination study models. Ground overcurrent relays should not be taken into consideration when determining the clearing time when performing incident energy calculations
- E. The short-circuit calculations and the corresponding incident energy calculations for multiple system scenarios must be compared, and the greatest incident energy must be uniquely reported for each equipment location. Calculations must be performed to represent the maximum and minimum contributions of fault current magnitude for all normal and emergency operating conditions. The minimum calculation will assume that the utility contribution is at a minimum and will assume a minimum motor contribution (all motors off). Conversely, the maximum calculation will assume a maximum contribution from the utility and will assume the maximum amount of motors to be operating. Calculations shall take into consideration the parallel operation of synchronous generators with the electric utility, where applicable.
- F. The incident energy calculations must consider the accumulation of energy over time when performing arc flash calculations on buses with multiple sources. Iterative calculations must take into account the changing current contributions, as the sources are interrupted or decremented with time. Fault contribution from motors and generators should be decremented as follows:
 1. Fault contribution from induction motors should not be considered beyond 3 to 5 cycles.
 2. Fault contribution from synchronous motors and generators should be decayed to match the actual decrement of each as closely as possible (e.g., contributions from permanent magnet generators will typically decay from 10 per unit to 3 per unit after 10 cycles).
- G. For each equipment location with a separately enclosed main device (where there is adequate separation between the line side terminals of the main protective device and the work location), calculations for incident energy and flash protection boundary shall include both the line and load side of the main breaker.
- H. Include Arc Energy Reduction (AER) analysis in the study when required by other specification sections.
- I. When performing incident energy calculations on the line side of a main breaker (as required per the above), the line side and load side contributions must be included in the fault calculation.

- J. Miscoordination should be checked among all devices within the branch containing the immediate protective device upstream of the calculation location, and the calculation should utilize the fastest device to compute the incident energy for the corresponding location.
- K. Arc flash calculations shall be based on actual overcurrent protective device clearing time. Maximum clearing time will be capped at 2 seconds based on IEEE 1584-2002 section.
- L. Where it is not physically possible to move outside the flash protection boundary in less than 2 seconds during an arc flash event, a maximum clearing time based on the specific location shall be utilized.
- M. Create and install NFPA 70E compliant labels describing the arc flash hazard level at all switchboards, panelboards, and other locations in the electrical distribution system where work could be performed on energized parts.
- N. The label shall include the incident energy calculated in the analysis and the hazard category or appropriate personal protective equipment (PPE) required to perform maintenance on the system when energized. Labels shall be vinyl or laminated, with a self-adhesive backing.
- O. Examples showing the minimum required information follow:



- P. A list of all hazard categories and the corresponding PPE requirements shall be posted in the main electric room, engineering office, or other location. The list shall be plastic laminate or typewritten and housed in a plastic frame.

3.4 ADJUSTMENTS

- A. Manufacturer's authorized representative or Contractor shall set all adjustable protective devices to values indicated in the approved coordination study.
- B. Wherever the arc flash incident energy exceeds Arc Flash Category 2 (i.e. $> 8 \text{ cal/cm}^2$), provide options for adjusting breaker trip times, if possible, to reduce energies to Category 2 or below.

3.5 TRAINING

- A. Provide four hours of Owner training to explain the implications of arc-flash requirements and work permit procedure.

END OF SECTION

SECTION 26 08 00

COMMISSIONING OF ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings, Agreement, Part 0, Special Conditions and Forms and Division 01 Specifications Sections, apply to this Section
- B. Related Sections include the following:
 - 1. Section 01 91 13 - General Commissioning Requirements.
 - 2. Section 22 08 00 - Commissioning of Plumbing.
 - 3. Section 23 08 00 - Commissioning of HVAC.
 - 4. All other Division 22, 23, and 26 Sections.

1.2 SUMMARY

- A. Commissioning work shall be a team effort to ensure that all electrical equipment and systems have been completely and properly installed, function together correctly to meet the design intent, and document system performance. Commissioning shall coordinate system documentation, equipment start-up, and performance testing.
- B. The Commissioning Agent (CA) shall have responsibility for coordinating and directing each step of the commissioning process.
- C. Commissioning work of Division 26 shall include, but not be limited to:
 - 1. Testing and start-up of the equipment.
 - 2. Completion of pre-functional/startup checklists.
 - 3. Cooperation with the CA.
 - 4. Providing qualified personnel for participation in commissioning tests.
 - 5. Completion of Contractor directed functional testing and associated forms.
 - 6. Completion of CA witnessed functional testing.

7. Providing equipment, materials, and labor as necessary to correct construction and/or equipment deficiencies found during the commissioning process.
 8. Providing training and demonstrations for the systems specified in this Division of the specifications.
- D. The work included in the commissioning process involves a complete and thorough evaluation of the operation and performance of all components, systems, and sub-systems. The following equipment and systems shall be included:
1. Interior & Exterior Lighting
 2. Lighting Controls
 3. Electrical Distribution Equipment
 4. Standby Generator and ATS
- E. Timely and accurate documentation is essential for the commissioning process to be effective. Documentation required as part of the commissioning process shall be as specified in Section 01 9113 - General Commissioning Requirements.
- F. Detailed testing shall be performed on all installed equipment and systems to ensure that operation and performance conform to contract documents. The following testing is required as part of the commissioning process:
1. Pre-functional/startup checklists are comprised of a full range of checks and tests to determine that all components, equipment, systems, and interfaces between systems operate in accordance with contract documents. These checks and tests are completed by the Division 26 sub-contractors and documented using pre-functional/startup checklists.
 2. Functional performance tests (FPT) shall determine if the Electrical system is operating in accordance with the design intent. This includes all operating modes, interlocks, control responses, and specific responses to abnormal or emergency conditions. FPT shall be done by Contractor as "Contractor directed" testing and then tested again during CA witnessed testing.
- G. Acceptance testing of the indoor and outdoor lighting, as required by Title 24, is not the responsibility of the CA. The Acceptance Tests and associated certificate of acceptance documentation are to be completed by a certified lighting control acceptance test technician (CLCATT) and submitted to the local enforcement agency. The CA may witness the acceptance tests.
- H. Comprehensive training of O&M personnel shall be performed by the electrical sub-contractor, and where appropriate, by other sub-contractors, and vendors prior to turnover of building to the Owner. The training shall include classroom instruction, along with hands-on instruction on the installed equipment and systems.

1.3 ROLES AND RESPONSIBILITIES

- A. Refer to Section 01 91 13 - General Commissioning Requirements for CxT roles and responsibilities. Division 26 subcontractors are members of the CxT.

PART 2 - PRODUCTS

2.1 TEST EQUIPMENT

- A. See Section 01 9113 – General Commissioning Requirements.

2.2 TEST EQUIPMENT - PROPRIETARY

- A. See Section 01 9113 – General Commissioning Requirements.

PART 3 - EXECUTION

3.1 GENERAL

- A. A commissioning kick-off meeting of all commissioning team members shall be held at a time and place designated by the Owner. The purpose shall be to familiarize all parties with the commissioning process, and to ensure that the responsibilities of each party are clearly understood.
- B. The Contractor shall complete all phases of work so the systems can be started, tested, and commissioning procedures undertaken. This includes the complete installation of all equipment, materials, fixtures, wire, insulation, controls, etc., per the contract documents and related directives, clarifications, and change orders.
- C. A commissioning plan shall be developed by the CA. The Contractor shall assist the CA in preparing the commissioning plan by providing all necessary information pertaining to the actual equipment and installation. If Contractor initiated system changes have been made that alter the commissioning process, the CA shall notify the Owner.
- D. Acceptance procedures are normally intended to begin prior to completion of a system and/or sub-systems, and shall be coordinated with the Division 26 subcontractor. Start of acceptance procedures before system completion does not relieve the Contractor from completing those systems as per the schedule.

3.2 PARTICIPATION IN COMMISSIONING

- A. The Contractor shall provide skilled personnel to start-up and debug all systems within Division 26. These same personnel shall be made available to assist the CA in completing the commissioning program. Work schedules, time required for testing, etc., shall be requested by the CA and coordinated by the Contractor. Contractor shall ensure that the qualified personnel are available and present during the agreed upon schedules and of sufficient duration to complete the necessary tests, adjustments, and/or problem resolutions.
- B. System performance problems and discrepancies may require additional personnel time, CA time, reconstruction of systems, and/or replacement of system components. The additional Contractor personnel time shall be made available for subsequent commissioning periods until the required system performance is obtained at no additional cost to the Owner.

- C. The CA reserves the right to question the appropriateness and qualifications of the personnel relative to each item of equipment, system, and/or sub-system. Qualifications of personnel shall include expert knowledge relative to the specific equipment involved and a willingness to work with the CA. Contractor shall provide adequate documentation and tools to start-up and test the equipment, system, and/or sub-system.

3.3 DEFICIENCY RESOLUTION

- A. In some systems, maladjustments, misapplied equipment, and/or deficient performance under varying loads will result in additional work being required to commission the systems. This work shall be completed under the direction of the Owner, with input from the Contractor, equipment supplier, and CA. Whereas all members shall have input and the opportunity to discuss, debate, and work out problems, the Owner shall have final jurisdiction over any additional work done to achieve performance.
- B. Corrective work shall be completed in a timely fashion to permit the completion of the commissioning process. Experimentation to demonstrate system performance may be permitted. If the CA deems the experimentation work to be ineffective or untimely as it relates to the commissioning process, the CA shall notify the Owner, indicating the nature of the problem, expected steps to be taken, and suggested deadline(s) for completion of activities. If the deadline(s) pass without resolution of the problem, the Owner reserves the right to obtain supplementary services and/or equipment to resolve the problem. If a retest of a functional test fails, any costs incurred for further retesting shall be the Contractor's responsibility, including the CA's labor and travel expenses.

END OF SECTION

SECTION 26 09 13

POWER MONITORING AND CONTROL SYSTEM

1. PART GENERAL

1.1 SECTION INCLUDES

- A. Power monitoring and control system is defined to include, but is not limited to, remote devices for monitoring, control and protection, communication interface hardware, inter-communications wiring, network software, printer, and personal computer workstations.
- B. The system shall utilize Ethernet as the high-speed backbone network that supports direct connection of personal computer workstations anywhere on the network. Each personal computer workstation shall have equal access to information provided by the power monitoring devices for data display, data logging, alarming, event recording, and other monitoring operations.

1.2 RELATED SECTIONS AND WORK

- A. Refer to the One-Line Diagram for rating, location and configuration.
- B. Section 26 24 13 - Switchboards

1.3 QUALITY ASSURANCE

- A. Manufacturer: Company with three (3) years of experience in power measurements and controls.

1.4 REFERENCES

- A. ANSI C12 - Code for Electrical Metering
- B. ANSI C57.13 - Requirements for Instrument Transformers

1.5 SUBMITTALS

- A. Submit shop drawings and product data under provisions of Section 26 05 00.
- B. Provide product data showing the type, size, rating, catalog number, manufacturer's names, and/or data sheets for all items to ensure compliance with these specifications. Submit operation and programming manual.
- C. Submit shop drawings of the complete layout of the entire system, showing wiring and all equipment.

1.6 REGULATORY REQUIREMENTS

- A. System: UL listed.

1.7 SYSTEM DESCRIPTION.

- A. The power monitoring and controls (PMCS) shall consist of electronic power monitoring devices as designated on the project drawings and described herein. The system shall be capable of monitoring, displaying, logging, and communicating the true RMS measurements in this specification as a minimum level of performance. The system shall be designed so the maximum response time from an event or reading to displaying shall be 5 seconds.
- B. Each personal computer workstation connected to the network shall have web-based access to information provided by the PMCS.

- C. Minimum accuracy of readings shall be:
 - 1. Frequency ± 0.01 Hz.
 - 2. Current and voltage $\pm 0.5\%$ of reading.
 - 3. Energy $\pm 1\%$ of reading.
- D. The high-speed network shall allow integration of programmable logic controllers that may directly access data provided by the power monitoring devices for implementing automatic control, load shedding and curtailment.

1.8 PROJECT RECORD DOCUMENTS

- A. Provide installation and maintenance manuals under provisions of Section 26 05 00. Include name, address and telephone number of service location within 100 miles of project.

2. PART PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

- A. Square D - POWERLOGIC and ION Enterprise
- B. Cutler-Hammer Power Xpert
- C. General Electric
- D. Siemens

2.2 POWER MONITORING NETWORK

- A. The PMCS shall be connected by means of an Ethernet high-speed backbone. The high-speed network shall consist of gateways, switches, patch cords, backbone cabling, and any required equipment.
- B. Ethernet gateways or communications cards shall be provided and installed by the PMCS vendor as required. Ethernet network connections shall be established using industry standard Ethernet protocol, such as TCP/IP.
- C. Patch Cords: Cat 6; color to be determined by the Owner.
- D. Backbone Media:
 - 1. Distances not exceeding 295 feet (100 meters): Provide Cat 6 cable in 3/4" conduit. Cable color selection by Owner.
 - 2. Distances equal to or exceeding 295 feet (100 meters): Provide six-strand multimode fiber optics installed in 1-1/4" conduit, and interface hardware.
- E. Wireless Ethernet and interface hardware shall be provided and installed by the PMCS vendor in NEC classified areas.
- F. Ethernet Gateways:
 - 1. The Ethernet gateways shall be modular in design to allow for easy future expansion or modification of the system. Ethernet gateway shall support Ethernet UTP (10/100 Mbps). Each Ethernet gateway shall provide a web-based interface for device configuration, diagnostics, and access for users to power monitoring information from any location on a local area network (LAN) or wide area network (WAN).
- G. The PMCS shall be connected by mean of the facilities Ethernet backbone. Provide Ethernet gateway or communication cards as required to connect system to network jacks installed as part of the facility's Ethernet network. Network connections shall be established using industry standard Ethernet protocol, such as TCP/IP. All components shall work with facility's Ethernet switches, router, and hub technology.

2.3 INTERFACE TO EXTERNAL SYSTEMS

- A. The high-speed network utilized by the PMCS system shall permit easy interface with the Facilities Management and Control System (FMCS).
- B. Data located in the power monitoring devices and PLC registers and associated inputs/outputs shall be made available to the FMCS vendor via meters and/or programmable controller register lists. Hardware and software required by the FMCS to retrieve this data from the PMCS data highway shall be the responsibility of the FMCS vendor.

2.4 PERSONAL COMPUTER WORKSTATION

- A. Provide the web access software for 2 personal computer workstations.
- B. Provide the software to allow printing from an Owner-furnished network printer.

2.5 PMCS APPLICATION SOFTWARE

- A. The PMCS manufacturer shall supply application software that provides the operator access to all meter data, systems reports, breaker/contactors/switch status and manual control, communication alarms, captured waveforms, and logged data.
- B. All software shall be configured by the vendor and delivered ready to use. The configuration shall include preparation of all required graphics, displays, and interactive one-line diagrams. When additional devices are added in the future, the user shall be able to add the communication address and device type, and the software shall automatically display all data from the device in a format identical to that used by existing devices of the same type.
- C. In addition to the PMCS application software programs, each PC shall permit the use of other Windows-based programs as desired by the user.
- D. Application software shall be supplied to support system configuration, monitoring of the devices, data logging, alarming, and other operations associated with the PMCS. The software provided shall include the following software option(s):
 - 1. System Monitoring (multiple devices at a time):
 - a. Application designed to monitor the entire system of power monitoring devices in the background for alarms, events, and data logging, allowing the operator to perform other tasks with the workstation.
 - b. Display information from the PMCS in a variety of standard formats, including real time data and trend displays, historical reports, graphical displays with real-time data updates, support of .pdf, .doc, .txt, .html, .htm, .xls and .ppt file formats, and waveform plots.
 - c. Log PMCS data to printer and hard disk at user-specified intervals and provide exporting functions to allow usage of the logged data by other software products.
 - d. Color-coded alarms for digital quantities and analog quantities, each with user-selectable indication including visual, audible, and/or required acknowledgment. Additionally, multi-level alarms shall be supported for analog quantities.
 - e. Events shall be recorded in an Event Log file that shall can hold at least 1000 events, the date/time of the event, and a descriptive text. Log shall provide an indication of and a link to all waveform capture views associated to an event.
 - f. Report the status of metering devices inputs and outputs, transformer temperature monitor relays (fan, alarm, and emergency shutdown relays), electronic trip unit's status, status I/O associated with programmable logic controllers, etc.

- g. Password protected resets accumulated real, accumulated reactive energy, energy management alarms, minimum and maximums, and other circuit quantities associated with the power monitoring devices.
- h. Graphical waveform displays for the voltages, phase currents, and residual current monitored by metering devices.
- i. Include harmonic information in the graphic waveform displays for metering devices including total harmonic distortion (THD), RMS magnitudes, peak values, crest factors (CF), magnitudes of the individual harmonics, telephone interference fact (TIF), etc.
- j. Waveform analysis software that can be used to analyze, organize, and archive waveform information that will be acquired using the PMCS shall be provided. The software shall provide the ability to zoom in/out of waveforms. The software shall include provisions for spectrum plots, power spectral densities, FFTs, and other operations that aid in analyzing power quality in the system, de-rating factors, equipment diagnostics, etc.

2.6 PMCS APPLICATION REPORTS

- A. Capable of custom report creation. Standard report templates shall include historical tables and trends, energy profile, cost allocation, power factor, harmonics, and alarm analysis.
- B. Graphical views of historical trending shall support both pan and zoom. All standard metering parameters shall be logged, including minimum, maximum, and average.
- C. Reports shall be generated on demand or as a scheduled task to run automatically at specified intervals.
- D. Shall have the ability to view data from different devices on the same trend plot simultaneously.
- E. Shall have the ability to filter end user access to reports based on user name/login.
- F. Display of total harmonic distortion, RMS magnitudes, peak values, crest factors (CF), and magnitudes of individual harmonics.
- G. Provide graphical waveform displays for the phase voltages, phase currents, and residual currents monitored by meters. Additional displays shall include overlay of three (3) phases of voltage, three (3) phases of current, and each phase voltage and current overlaid.

2.7 SOFTWARE SERVICE AGREEMENT

- A. The electrical equipment manufacturer shall include a three (3) year Software Service Agreement, which provides the customer with software upgrades for the software specified above as they are available.

2.8 POWER MONITORING DEVICES INSTALLATION

- A. All metering devices, electronic trip units, transformer temperature monitors, motor protection devices, shall be installed by the equipment manufacturer for all circuits as indicated by the project drawings.
- B. All control power, CT, PT, and data communications wire shall be factory wired and harnessed within the equipment enclosure. Where external circuit connections are required, terminal blocks shall be provided, and the manufacturer's drawings must clearly identify the interconnection requirements, including wire type to be used.
- C. Provide control transformers, current transformers, and fused potential transformers sized as required.

2.9 POWER MONITORING DEVICE CHARACTERISTICS

A. **[DEM]:** Energy Meter:

1. The following instantaneous readings shall be monitored, displayed, and communicated by the energy meter:
 - a. Frequency
 - b. Current, per phase RMS, 3-phase average RMS, apparent RMS, peak demand
 - c. Voltage, phase-to-phase and phase-to-neutral
 - d. Power factor, per phase and 3-phase total
 - e. Real power (kW), 3-phase total, peak demand, cumulative (kWH)
 - f. Reactive power (kVAR), 3-phase total
2. The current and voltage signals shall be digitally sampled at a rate high enough to provide true-RMS sensing. All setup parameters required by the energy meter shall be stored in nonvolatile memory and retained in the event of a control power interruption. The meter shall maintain in nonvolatile memory maximum and minimum values for each of the instantaneous values reported, as well as the time and date of the highest peak for all peak demand readings.
3. The energy meter shall be equipped with a display to provide local access to all metered quantities where indicated on plans.
4. Reset of the following electrical parameters shall also be allowed from the front of the meter:
 - a. Peak demand current
 - b. Peak demand power
 - c. Energy (MWH)
 - d. Reactive energy (MVARH)
5. Approved Manufacturers: Square D Power Logic PM710, Cutler Hammer, Siemens PAC3100, General Electric PQMII.

B. **[EEM]:** External Energy Meter:

1. External energy meters shall have the same functions as the energy meter specified above. The external energy meters shall have communication capabilities to send information on the PMCS network.
2. Approved Manufacturers: Square D Power Logic Enhanced Enercept Meter 3020E, Cutler Hammer, Siemens PAC4200, General Electric.

C. **[DPM]:** Power Meter:

1. The following instantaneous readings shall be monitored, displayed, and communicated by the power meter:
 - a. Frequency, monthly maximum and minimum
 - b. Current, per phase RMS, 3-phase average RMS, apparent RMS, peak demand (15-minute sliding window)
 - c. Voltage, phase-to-phase and phase-to-neutral
 - d. Power factor, per phase and 3-phase total
 - e. Real power (kW), 3-phase total, peak demand, cumulative (kWH)
 - f. Reactive power (kVAR), 3-phase total
 - g. Total harmonic distortion (current and voltage)

2. The current and voltage signals shall be digitally sampled at a rate high enough to provide true-RMS sensing through the 31st harmonic. All setup parameters required by the power meter shall be stored in nonvolatile memory and retained in the event of a control power interruption. The meter shall maintain, in nonvolatile memory, maximum and minimum values for each of the instantaneous values reported, as well as the time and date of the highest peak for all peak demand readings.
3. The power meter shall be equipped with a display to provide local access to all metered quantities.
4. Reset of the following electrical parameters shall also be allowed from the front of the display or energy meter:
 - a. Peak demand current
 - b. Peak demand power
 - c. Energy (MWH)
 - d. Reactive energy (MVARH)
5. Waveform Capture Capability: Waveform capture shall be for three (3) cycles and initiated manually using software.
6. The data points shall be sampled in a manner that allows the original power signals with proper magnitude and phase relationships to be reconstructed. Reconstruction of the original power signal from the stored data points shall have sufficient accuracy to allow steady-state power harmonic analysis that provides valid information on harmonic content for up to the 81st harmonic of the fundamental power frequency.
7. The power meter shall have one (1) digital input and one (1) digital solid state output/KY pulse output.
8. The power meter shall be provided with a six (6) digital input and two (2) digital output (relay) output accessory card.
9. Approved Manufacturers: Square D Power Logic PM820 PM850, Cutler Hammer, Siemens PAC4200 PAC9360, General Electric EPM9450.

D. [PQM]: Power Quality Meter:

1. The following instantaneous readings shall be monitored, displayed, and communicated by the power quality meter:
 - a. Frequency, monthly maximum and minimum
 - b. Current, per phase RMS, 3-phase average RMS, apparent RMS, peak demand (15-minute sliding window)
 - c. Voltage, phase-to-phase and phase-to-neutral
 - d. Power factor, per phase and 3-phase total
 - e. Real power (kW), 3-phase total, peak demand, cumulative (kWH)
 - f. Reactive power (kVAR), 3-phase total
 - g. Total harmonic distortion (current and voltage)
 - h. Power analysis values
2. The current and voltage signals shall be digitally sampled at a rate high enough to provide true-RMS sensing through the 85th harmonic. All setup parameters required by the power quality meter shall be stored in nonvolatile memory and retained in the event of a control power interruption. The meter shall maintain, in nonvolatile memory, maximum and minimum values for each of the instantaneous values reported, as well as the time and date of the highest peak for all peak demand readings.
3. The power quality meter shall be equipped with a display to provide local access to the all metered quantities.

4. Reset of the following electrical parameters shall also be allowed from the front of the meter:
 - a. Peak demand current
 - b. Peak demand power
 - c. Energy (MWH)
 - d. Reactive energy (MVARH)
5. Waveform Capture Capability: Waveform capture shall be for 60 cycles and initiated either manually using software or by user-defined alarm conditions.
6. The data points shall be sampled in a manner that allows the original power signals with proper magnitude and phase relationships to be reconstructed. Reconstruction of the original power signal from the stored data points shall have sufficient accuracy to allow steady-state power harmonic analysis that provides valid information on harmonic content for up to the 81st harmonic of the fundamental power frequency.
7. Disturbance Detection: Shall have sag and swell detection capability and log the waveform event.
8. The power meter shall have four (4) digital inputs and one (1) digital solid state output/KY pulse output.
9. The power quality meter shall be provided with a four (4) digital input and four (4) analog (4-20mA) output accessory card.
10. Approved Manufacturers: Square D Power Logic CM3350 CM4000T, Cutler Hammer IQ ANALYZER 6000 XPERT Series, Siemens 9510, General Electric EPM9450 EPM9650

E. Electronic Trip Units:

1. Electronic trip units shall be provided as designated on the project drawings.
2. They shall provide the following breaker/trip unit information to the PMCS network:
 - a. Breaker sensor rating
 - b. Rating plug
 - c. Date/time of last trip
 - d. Type of last trip (overload, short circuit, ground fault)
 - e. Magnitude of phase and ground fault at time of last trip
 - f. Number of overload trips
 - g. Number of short circuit trips
 - h. Number of ground fault trips
3. The electronic trip units designated [P] in the one-line diagram shall provide equivalent information to the digital power meter specified above. The electronic trip units designated [H] in the one-line diagram shall provide equivalent information to the power quality meter specified above.

F. Transformer Temperature Monitors:

1. The transformer temperature monitors shall provide the following information to the PMCS network:
 - a. Coil temperatures - Phases A, B and C
 - b. Hottest coil temperature
 - c. Fan relay status
 - d. Alarm relay status
 - e. Emergency over-temperature relay status
 - f. Setpoints for fans, alarm, and over-temperature relays

2. Transformer temperature monitors shall be provided for each dry-type and cast resin transformer shown on the project drawings.

G. Electronic Motor Protective Devices:

1. Electronic motor protective devices as noted on the project drawings shall be able to model (learn) the thermal loading of the motor and cooldown characteristics to maximize protection during continuous and load cycling operation. Each motor circuit noted on the drawings shall be equipped with a PMCS interface.
2. Historical operating information, such as running hours since last commissioning, number of starts/trips since last commissioning, number of overload trips/ground fault trips, and similar data, shall be displayed on the front of the device and be available via data communications to programmable logic controllers and personal computer workstations throughout the PMCS network for control, alarming, etc.
3. The motor protective devices shall provide fault diagnosis data such as pre-trip motor and ground fault currents, unbalance ratio, and maximum stator RTD temperature.

2.10 SYSTEM DISPLAY UNITS

- A. System display units shall be provided to display the data available from selected electronic trip units connected on the individual data transfer network.
- B. The system display unit shall utilize a 4 line by 20 character, high contrast display with backlighting. The level of backlighting as well as the contrast shall be adjustable.
- C. The system display shall be equipped with a screen saver feature to extend the life of the display.
- D. Data shall be displayed in a logically organized manner, complete with the proper scaling and units.
- E. The system display unit shall allow for easy operation by providing a keypad with large keys for operator selections. The keys shall have a raised perimeter and tactile feedback to provide a positive response, even with gloved-hand operation.
- F. The keys shall be clearly marked to indicate the function and separated into meaningful groups, with display prompting to assist the user in operation.
- G. Each system display unit shall be configured by the manufacturer with all necessary data. It shall be possible to change the configuration for each system display unit using the keypad provided on each display. Access to configuration functions shall be password protected to prevent unauthorized or accidental modification.
- H. The system display unit shall permit the reset of the stored min-max values in the power monitoring devices. It shall also permit the reset of the accumulated energy values and the time and date stamps stored in the metering devices. These resets shall be limited to authorized persons by means of password protection.

2.11 AUTOMATIC CONTROL

- A. Programmable logic controllers (PLCs) that communicate with the meter devices, electronic trip units, transformer temperature monitors, motor protective devices, and other compatible devices for performing control operations shall be provided.
- B. Each PLC shall include ladder programs that will direct the automatic control operations as specified.
- C. Processor, input, output, and network interface cards shall be provided as necessary to implement the sensing and automatic control operations.

- D. Data pertaining to the automatic control system shall be transmitted via the PMCS network to the remote personal computers.
- E. At a minimum, the application software at the personal computer shall provide the following:
 - 1. Interactive color-graphics, one-line of automatic control system (breaker status, relays status, etc.).
 - 2. All automatic control operations (open/close breaker, relay operation, etc.) shall be date/time stamped and recorded in an event log.
 - 3. Setup and display alarm conditions for automatic control operations shall be possible, with each alarm condition entered in the event log.
 - 4. Manual operator intervention via the keyboard or interactive one-line graphics shall be provided such that any point in the process may be controlled. Manual intervention shall be password protected to prevent inadvertent or unauthorized override of the control scheme.
 - 5. Protective relaying functions, anti-paralleling interlocks, or load limits shall not be defeatable.

3. PART EXECUTION

3.1 INSTALLATION

- A. PMCS components, including system display units, metering devices, electronic trip units, transformer temperature monitors, and electronic motor protective devices, shall be installed by the manufacturer, and wired and tested in the equipment as indicated on the drawings. All control power, CT, PT, and data communications wire shall be factory wired and harnessed within the equipment enclosure.
- B. Where external circuit connections are required, terminal blocks shall be provided and the manufacturer's drawings must clearly identify the interconnection requirements, including wire type to be used.
- C. All wiring required to externally connect equipment lineups shall be installed by the Electrical Contractor.

3.2 STARTUP AND TRAINING

- A. Onsite startup and training of the PMCS shall be included in the project bid. Startup shall include a complete working demonstration of the PMCS, with simulation of possible operating conditions that may be encountered.
- B. Training shall include any documentation and hands-on exercises necessary to enable electrical operations personnel to assume full operating responsibility for the PMCS after completion of the training period.
- C. The project bid shall include two (2) days startup assistance and three (3) days training to include two training sessions, with the second training session being two (2) months after occupancy.
- D. The power monitoring manufacturer shall provide a full-time telephone technical help center for customers.

END OF SECTION

SECTION 26 09 33

LIGHTING CONTROL SYSTEMS

1. PART GENERAL

1.1 SECTION INCLUDES

- A. Line and low voltage standalone lighting controls
- B. Emergency transfer devices
- C. Distributed lighting control
- D. Central lighting controls
- E. Architectural dimmer rack and accessories
- F. DC dimming systems
- G. Time switches

1.2 RELATED WORK

- A. Section 01 91 00 - Commissioning
- B.** Section 23 09 00 - Facility Management Control System (FMCS)
- C. Section 26 51 00 - Lighting
- D. Section 27 41 00 - Audio/Visual System

1.3 QUALITY ASSURANCE

- A. Manufacturers shall be regularly engaged in the manufacture of lighting control equipment and ancillary equipment, of types and capacities required, whose products have been in satisfactory use in similar service for not less than five (5) years.
- B. All components and assemblies are to be factory pre-tested prior to delivery and installation.
- C. Comply with NEC as applicable to electrical wiring work.
- D. Comply with applicable portions of NEMA standards pertaining to types of electrical equipment and enclosures.
- E. Panels and accessory devices are to be UL listed under UL 916 Energy Management Equipment. Panels and accessories used for control of life safety and critical branch circuits shall be listed under UL 924 Emergency Lighting and Power Equipment.
- F. All assemblies are to be in compliance with FCC emissions standards specified in Part 15 Subpart J for Class A applications.

1.4 REFERENCES

- A. FCC Rules and Regulations, Part 15, Subpart J - Radio Frequency Interference
- B. FS W S 896 Switch, Toggle
- C. International Energy Conservation Code (IECC)
- D. NEMA WD 1 - General Color Requirements for Wiring Devices
- E. NEMA WD 7 - Occupancy Motion Sensors
- F. NFPA 70 - National Electrical Code (NEC)
- G. UL Standard 916 Energy Management Equipment
- H. UL 924 - Emergency Lighting and Power Equipment
- I. UL 1472 – Solid-State Dimming Controls

1.5 SUBMITTALS

- A. Submit product data under provisions of Section 26 05 00.

- B. Submit a comprehensive package including devices, hardware, software, product specification, finishes, dimensions, installation instructions, warranty, system software requirements, and roles and responsibilities of all persons and groups involved in installation, execution, and commissioning.
- C. Provide floor plan showing location, orientation, and coverage area of each control device, sensor, and controller/interface. For areas requiring multiple sensor devices for appropriate coverage, submit specific manufacturer-approved sensor layout as an overlay directly on the project drawings, either in print or approved electronic form.
- D. Submit a list of devices and equipment that will be installed for each sequence of operation.
- E. Submit project specific control wiring diagrams showing all equipment, line voltage, and control wiring requirements for all components including, but not limited to, dimmers, relays, low voltage switches, occupancy sensors, control stations, dimmer panels, relay panels, and communication interfaces and programming instructions for each sequence of operation. Include network cable specification and end-of-line termination details, if required.
- F. Project specific network riser diagram including floor and building level details. Illustrate points of connection to integrated systems. Coordinate integration with mechanical and/or other trades.
- G. Verify acceptance of communications connection to building automation system. Submit BACnet IP parameters.

1.6 EXTRA STOCK

- A. Provide extra stock under provisions of Section 26 05 00.
- B. Sensors, Controls, Power Supplies, and Relays: Five (5) percent of quantity installed. Minimum of two (2) of each configuration and type.
- C. Relays and Dimmer Modules: Five (5) percent of quantity installed. Minimum of two (2) of each size and type.
- D. Control Stations: One (1) of each configuration and type, except for LCD touch screens requiring factory setup prior to installation.

1.7 PROJECT RECORD DOCUMENTS

- A. Submit project record documents under provisions of Section 26 05 00.
- B. Accurately record location of all controls and devices. Include description of switching sequences and circuiting arrangements.

1.8 OPERATION AND MAINTENANCE DATA

- A. Submit emergency, operation, and maintenance data under provisions of Section 26 05 00. Data shall also include the following:
 - 1. Schedule for routine maintenance, inspection, and calibration of all lighting control devices and system components. Recommended schedule for inspection and recalibration of sensors.
 - 2. Complete narrative describing intended operation and sequence for each control scenario and system component, updated to reflect all changes resulting from commissioning of systems. Narrative shall indicate recommended settings for devices where applicable.
 - 3. Replacement part numbers for all system components.

- B. Identify installed location and labeling for each luminaire controlled by automated lighting controls.
- C. Submit software operating and maintenance manuals, program software backup on compact disc or compatible media with data files, device address list, and a printout of software application and graphic screens, where applicable.

1.9 SYSTEM DESCRIPTION

- A. Performance Statement: This specification section and the accompanying lighting design documents describe the minimum material quality, required features, and operational requirements of the lighting control system (LCS). These documents do not convey every wire that must be installed and every equipment connection that must be made. Based on the performance required of the system, as presented in these documents, the Contractor and system manufacturer/vendor are solely responsible for determining all equipment, wiring, and programming required for a complete and operational system. The nLight or Wattstopper is the basis of design for this project.
- B. Provide an integrated lighting controls system consisting of panels, power supplies, controllers, sensors, relays, switches, devices, wiring, etc. necessary to perform the Lighting Control Sequence of Operation as defined on the plans and specifications. Contractor is responsible for confirming that all components and luminaires interoperate as a single system.
 - 1. Sequence of Operation: Describes the required operation and performance for lighting control in each space. Sequences of operation are indicated on the drawings.
 - 2. Drawings: The drawings include sequences of operation, locations of control interface devices, sensors, and control zones. Wiring and additional equipment to make a complete and functioning system has not been shown, but shall be submitted with the shop drawings.
- C. The following control types and features are acceptable. Acceptable control locations are shown on the drawings.
 - 1. Line Voltage Control: Control equipment consists of traditional line voltage wiring devices and equipment such as switches, dimmers and combination occupancy/vacancy sensor switches, etc.
 - 2. Distributed Control: Control equipment is in the space/zone being controlled; not reliant on centralized controllers.
 - a. All locations shall have the ability to be networked for remote control and monitoring, but network connections are not required.
 - 3. Centralized Control: Control equipment is in a central location serving multiple spaces/zones and provides time-based schedule and remote control.
 - a. The lighting control system (LCS) shall be networked with BACnet IP capabilities.
 - b. The lighting control system (LCS) shall have DMX512 capabilities.
 - 4. Digital Addressable Lighting Interface (DALI): DALI provides digital communications to each addressable ballast / driver or group. Lamp and device faults are sent to DALI server.
 - 5. Wireless Control: Equipment that uses radio frequency to transmit lighting control signals.

1.10 MOCKUP

- A. Provide and install luminaires with power and control connections in mockup rooms as identified in Division 1. Approved luminaires and controls in mockup may be reused as part of complete work if in original condition.

1.11 COMMISSIONING

- A. Commissioning of a system or systems specified in this section is part of the construction process. Documentation and testing of these systems, as well as training of the Owner's operation and maintenance personnel, is required in cooperation with the Owner's Representative and the Commissioning Agent. Project closeout is dependent on successful completion of all commissioning procedures, documentation, and issue closure. Refer to Division 1 for detailed commissioning requirements.
- B. The Contractor shall provide all services necessary for compliance with the IECC Section C408 Commissioning. The commissioning shall include, but not be limited to, a commissioning plan, preliminary commissioning report, construction documents, manuals, final commissioning report, and lighting system functional testing.
- C. This project will have selected building systems commissioned. The Contractor is responsible to execute commissioning. The commissioning process, equipment, and systems to be commissioned are defined in Division 1. A third-party Commissioning Agent will direct the commissioning process.
- D. The Contractor shall notify the Commissioning Agent, Architect/Engineer and Owner's Representative ten (10) working days prior to scheduled commissioning date.
- E. The commissioning process requires meeting attendance. Refer to Division 1 for meeting requirements.
- F. The system shall be functionally tested by a factory-authorized engineer and comply with the Sequence of Operation. All loads shall be tested live for continuity and freedom from defects, and all control wiring shall be tested for continuity and connections prior to energizing the system.

1.12 WARRANTY

- A. Manufacturer shall warrant products under normal use and service to be free from defects in materials and workmanship for a period of two (2) years from date of commissioning.
- B. Occupancy, vacancy, daylight sensors and controls shall have a five (5) year warranty from date of Substantial Completion.

2. PART PRODUCTS

2.1 LIGHTING CONTROLS

- A. All items of material having a similar function (e.g., switches, dimmers, sensors, contactors, relays, etc.) shall be of the same manufacturer, unless specifically stated otherwise on drawings or elsewhere in the specifications.
- B. Color of lighting controls and sensors shall match the receptacle wiring devices specified in the space.
- C. The functions described in the lighting sequence of operation shall dictate the actual lighting control device required to accomplish the functions described for the space.

2.2 LIGHTING CONTROL STATION

- A. **[SW]** The lighting control station shall contain the controls required by the lighting sequence of operation in a common coverplate. The controls may consist of switches, dimmers, occupancy sensors, pushbuttons, etc.
 - 1. In spaces where the wall control station is shown in multiple locations, the sequence of operation shall be the same at all locations, unless noted otherwise.

2. The controls supplier shall prepare control station shop drawings showing arrangement of controls, dimensioned elevations, wiring diagram, and recommended backboxes. The shop drawing submittal should be identified with the lighting sequence that the station provides. Submit data sheets on the switches, dimmers, sensors, buttons, etc. contained in the control station.

2.3 DEVICE COLOR

- A. All switch, lighting controls, and coverplate colors shall be the same as wiring devices, unless indicated otherwise.

2.4 COVERPLATES

- A. All switches and lighting controls shall be complete with coverplates that match material and color of the wiring device coverplates in the space.
- B. Where several devices are ganged together, the coverplate shall be of the ganged style for the number of devices used.
- C. Install nameplate identification as indicated in Section 26 05 53.
- D. Plate-securing screws shall be metal with head color matching the wall plate finish.

2.5 WALL SWITCHES

- A. Refer to Electrical Symbols List for device type.
- B. **[SW-1P]:** Single Pole Switch:
 1. Single throw, 120/277-volt, 20-amp maintained contact. Toggle handle, side and back wired.
 2. Approved Manufacturers: Hubbell HBL1221, Leviton 1221-2, Pass & Seymour PS20AC1, Cooper AH1221.
- C. **[SW-1P-K]:** Key Lock Single Pole Switch:
 1. Single throw, 120/277-volt, 20-amp maintained contact. Side and back wired. Provide key to Owner.
 2. Approved Manufacturers: Hubbell HBL1221L, Leviton 1221-2L, Pass & Seymour PS20AC1-L, Cooper AH1221L.
- D. **[SW-1P-M]:** Momentary Contact Single Pole Switch:
 1. 120/277-volt, 20 amp. Three position, two circuit. Center off toggle spring return handle.
 2. Approved Manufacturers: Hubbell HBL1557, Leviton 1257, Pass & Seymour 1251, Cooper 1995.
- E. **[SW-1P-WP]:** Weatherproof Single Pole Switch:
 1. Single throw, 120/277-volt, 20-amp maintained contact. Toggle handle, side and back wired. Provide with weatherproof coverplate.
 2. Approved Manufacturers: Hubbell1221/HBL1795, Leviton 1221-2, Taymac MM180, Pass & Seymour PS20AC1/CA1-GL, Cooper 2221.
- F. **[SW-2P]:** Two Pole Switch:
 1. Single throw, 120/277-volt, 20-amp maintained contact. Toggle handle, side and back wired.

2. Approved Manufacturers: Hubbell HBL 1222, Leviton 1222-2, Pass & Seymour PS20AC2, Cooper 2222.

G. **[SW-2P-K]:** Key Lock Two Pole Switch:

1. Single throw, 120/277-volt, 20-amp maintained contact. Side and back wired. Provide key to Owner.
2. Approved Manufacturers: Hubbell HBL1222L, Leviton 1222-2L, Pass & Seymour PS20AC2-L, Cooper AH1222L.

H. **[SW-3W-K]:** Key Lock Three Way Switch:

1. Single throw, 120/277-volt, 20-amp maintained contact. Side and back wired. Provide key to Owner.
2. Approved Manufacturers: Hubbell HBL1223L, Leviton 1223-2L, Pass & Seymour PS20AC3-L, Cooper AH1223L.

2.6 LOCAL DAYLIGHTING CONTROLS

A. Standalone Interior Photo Sensors:

1. **[SW-LS]:** Daylight Level Sensor - On/Off Control - One Zone:
 - a. On/Off control. Range of 10-200 FC. Adjustable deadband prevents cycling. Adjustable time delay. 120/277 volt.
 - b. Approved Manufacturers: Watt Stopper LS-102, Sensor Switch CM-PC, Hubbell Automation DLCPC Series, Greengate PPS-4.
2. **[SW-LS-3Z]:** Daylight Level Sensor and Controller - On/Off Control - Three Zones:
 - a. On/off control of up to three 10-amp zones. Range of 10 to 200 FC. Adjustable deadband prevents cycling. Adjustable time delay. 120/277 volt.
 - b. Approved Manufacturers: Watt Stopper LCO-203/LS-290C, Hubbell Automation LUXSTATOCM/LUXSTATLS, LC&D Micro GR/2404 iDH/Pcell, Sensor Switch N-CMPC.
3. **[SW-LS-D]:** Daylight Level Sensor and Controller - 0-10V Dimming - One Zone:
 - a. Dimming control of one 0-10V zone. Range of 10 to 200 FC. Adjustable deadband prevents cycling. Adjustable time delay. Coordinated with dimming ballast prior to submittal.
 - b. Approved Manufacturers: Watt Stopper LS-301, Hubble Automation DLC7, Sensor Switch N-CMADC.
4. **[SW-LS-D-3Z]:** Daylight Level Sensor and Controller - Dimming - Three Zones:
 - a. Dimming control of up to three zones of 0-10V. Range of 10 to 200 FC. Adjustable deadband prevents cycling. Adjustable time delay. Coordinate with dimming ballasts prior to submittal.
 - b. Approved Manufacturers: Watt Stopper LCD-203/LS-290C, Hubbell Automation LUXSTATDCM/LUXSTATLS, LC&D Micro GR/2404 iDIM/Pcell, Sensor Switch N-CMADC.

5. **[SW-LS-M]:** Daylight Level Sensor and Controller - Multilevel/Bi-level On/Off Control - Dual Zones:
 - a. Multilevel/bi-level on/off control of up to two 10-amp zones. Range of 10 to 200 FC. Adjustable deadband prevents cycling. Adjustable time delay. 120/277 volt.
 - b. Approved Manufacturers: Watt Stopper LCO-203/LS-290C, Hubbell Automation DLCPCC/DLCPCI, Sensor Switch CM-PC-DZ.
6. Sensor shall detect changes in ambient light level and provide triggering of lighting groups in area based on sequence of operation.
7. Sensor shall be configurable via DIP switches at device or via handheld wireless remote programming unit. Settings shall include:
 - a. Ambient sensitivity range between 1 and 1,000 foot-candles.
 - b. Time delay of 5 to 300 seconds.
 - c. Trigger setpoints with deadband adjustment.
8. Sensor shall provide on/off setpoints in quantity as specified on drawings and as shown in the sequence of operation.
9. Sensor shall be ceiling- or wall-mounted for range and viewing angle meeting application requirements as outlined in the sequence of operation.
10. Output signal from sensor shall be linear with light level.

B. [SW-LS-PC]: Standalone Exterior Photo Sensors:

1. Sensor shall be within a weatherproof enclosure, with design operation in temperatures of -30°F to +130°F. Sensor shall have threaded stem for box mounting, with knuckle to permit aiming of receptor after installation. Sensor shall be mounted facing north.
2. Sensor shall contain an integral switching contactor rated for 277-volt operation, with loads of up to 1,800 VA. Contacts shall be configured for zero-crossing closure to provide 100,000 cycle minimum operation.
3. Sensor shall detect changes in daylight levels to provide triggering of exterior lighting equipment based on the sequence of operation.
4. Sensor shall be field configurable at the device or via handheld wireless remote controller. Configurable settings shall include:
 - a. Ambient sensitivity range of 5 to 1,500 foot-candles.
 - b. Adjustable setpoint.
 - c. Deadband adjustment by percentage of setpoint.
 - d. Time delay of up to five minutes.
5. Sensor shall be equipped with a lens cover that can be applied for system testing during daylight conditions.
6. Approved Manufacturers: Paragon, Tork, Intermatic.

2.7 INDOOR OCCUPANCY AND VACANCY SENSORS

- A. General Description: Wall- or ceiling-mounting, solid-state units with a separate power supply/relay unit.
1. Operation: Unless otherwise indicated, turn lights on when covered area is occupied and off when unoccupied, with a time delay for turning lights off, adjustable over a minimum range of 1 to 30 minutes. Vacancy sensors require a manual switch operation to turn lights on and off, with a time delay for turning lights off when unoccupied.
 2. Sensor Output: Contacts rated to operate the connected relay, complying with UL 773A. Sensor shall be powered from the relay unit.
 3. Relay Unit: Dry contacts rated for 20 A ballast load at 120 and 277 VAC, for 13-amp tungsten at 120 VAC, and for 1 hp at 120 VAC. Power supply to sensor shall be 24 V dc, 150-mA, Class 2 power source as defined by NFPA 70.
 4. Mounting:
 - a. Sensor: Suitable for mounting in any position on a standard outlet box.
 - b. Relay: Externally mounted through a 1/2-inch knockout in a standard electrical enclosure. Mount relay above accessible ceiling near entry door to room or area.
 - c. Time Delay and Sensitivity Adjustments: Recessed and concealed.
 5. Indicator: LED to show when motion is being detected during testing and normal operation of the sensor.
 6. Bypass Switch: Override the on function in case of sensor failure.
 7. Power Supply and Slave Packs: Provide as required for sensor quantity and switching scheme. Mount to standard 1/2" knockout on electrical box above accessible ceiling near entry door to room or area. Sensor power shall be from emergency circuit if emergency lighting is in the area.
 8. Detection Coverage (Room): Detect occupancy anywhere in an area based on hand motion.
 9. Detection Coverage (Corridor): Detect occupancy based on a half-step motion.
 10. Warranty: Five (5) year warranty.
- B. Dual-Technology Type: Detect occupancy by using a combination of PIR and ultrasonic or acoustic detection methods in area of coverage. Particular technology or combination of technologies that controls on and off functions shall be selectable in the field by operating controls on unit.
1. **[SW-VS-D] or [SW-OC-D]:** 360 Degree Coverage Pattern:
 - a. Frequency greater than 40 KHz. Dual sensing verifications (requires both technologies to activate), either technology maintains on status. Integrated ambient light level sensor (2 to 200 FC range), adjustable sensitivity and time delay, integrated isolated relay contact. Sensor shall control all circuits in area, unless noted otherwise. Initial settings: ambient sensor 40 FC.
 - b. Approved Manufacturers: Watt Stopper DT 300 Series, Hubbell OMNI-DT2000 or ATD2000C, Greengate OAC-DT, Leviton OSC##-MOW, Sensor Switch CM PDT 10.

2. **[SW-VS-D-W] or [SW-OC-D-W]:** Wall Mounted on Adjustable Swivel Mount:
 - a. Wall or ceiling sensor with adjustable settings to allow manual on/auto off or auto on/auto off. Integrated ambient light level sensor (2 to 100 FC range).
 - b. Approved Manufacturers: Watt Stopper DT-200 Series, Hubbell LODTRP, Leviton OSM12--M series, Sensor Switch WvPDT 16 Series.
3. **[SW-O]:** Wall Switch:
 - a. Wall switch with manual on/auto off. 120/277 VAC load rating of 0-800 W for ballast, LED or tungsten. 5-, 15-, 30-minute adjustable OFF delay. Coverage of minor motion in 12' x 15' pattern.
 - b. Approved Manufacturers: Watt Stopper DW-100 Series, Hubbell LHMTS, Leviton OSSMT series, Sensor Switch WSD-PDT SA Series.
4. **[SW-O2]:** Wall Switch:
 - a. Multi-relay wall switch with manual on/auto off for two separate loads. 120/277 VAC load relay rating of 0-800 W for ballast, LED or tungsten. 5-, 15-, 30-minute adjustable OFF delay. Coverage of minor motion in 12' x 15' pattern.
 - b. Approved Manufacturers: Watt Stopper DW-200 Series, Hubbell LHMTD, Leviton OSSMD series, Sensor Switch WSD-PDT 2P Series.
5. Sensitivity Adjustment: Separate for each sensing technology.
6. Detection Coverage:
 - a. Task Areas: Detect occupancy anywhere in an area based on hand motion.
 - b. Circulation Areas: Detect occupancy anywhere in an area based upon half-step walking motion.
- C. Mask sensors where necessary to prevent nuisance switching from adjacent areas.
- D. PIR Type: Detect occupancy by sensing a combination of heat and movement in area of coverage.
 1. **[SW-OC-P-HA]:** High Bay - Aisle Coverage Pattern:
 - a. 20' to 40' mounting height. Minimum 1.3:1 walking motion coverage pattern to height ratio. Adjustable sensitivity and time delay, integral isolated relay contact. Sensor shall control all luminaires in area. Initial settings: Time delay 10 minutes.
 - b. Approved Manufacturers: Watt Stopper HB-300 Series, Hubbell FHB 140 or HMHB series, Leviton OSFHU, Greengate OEF-P.
 2. **[SW-OC-P-HB]:** High Bay - 360 Degree Coverage Pattern:
 - a. 20' to 40' mounting height. Minimum 1.3:1 walking motion coverage pattern to height ratio. Adjustable sensitivity and time delay, integral isolated relay contact. Sensor shall control all luminaires in area.
 - b. Approved Manufacturers: Watt Stopper HB-300 Series, Hubbell FHB 140 or HMHB series, Leviton OSFHU, Greengate OEF-P.

3. **[SW-O]:** Wall Switch Occupancy Sensor:
 - a. Passive infrared, zero crossing circuitry, integrated ambient light sensor (10 to 150 FC range), adjustable sensitivity and time delay, no minimum load requirements, manual or auto on operation, Initial settings: 10 minutes, ambient sensor 40 FC. Manual ON for vacancy sensing.
 - b. Approved Manufacturers: Watt Stopper PW-100 Series, Sensor Switch WSX, Hubbell LHIRS1 or AP1277, Leviton ODS15, Greengate OSW-P-0451.
4. **[SW-O2]:** Dual Wall Switch Occupancy Sensor:
 - a. Passive infrared, zero crossing circuitry. Switches control two separate circuits or relays. Integrated ambient light sensor (10 to 150 FC range), adjustable sensitivity and time delay, no minimum load requirements, manual or auto on operation, Initial settings: 10 minutes, ambient sensor 40 FC. Manual ON for vacancy sensing.
 - b. Approved Manufacturers: Watt Stopper PW-200 Series, Sensor Switch WSD-2, Hubbell LHIRD2 or AP127712, Leviton ODS, Greengate OSW-P-0451.
5. **[SW-OC-P-P]:** Ceiling Mounted - 360 Degree Coverage Pattern:
 - a. Passive infrared, zero crossing circuitry, integrated ambient light sensor (4 to 190 FC Range), adjustable sensitivity and time delay, integral isolated relay contact. Sensor shall control all circuits in the area unless noted otherwise. Initial settings: ambient sensor 40 FC.
 - b. Approved Manufacturers: Watt Stopper CI Series, Sensor Switch CM-9, Hubbell Automation Omni-IR, Leviton OSC Series, Greengate OMR-P Series.
6. **[SW-OC-P-P2]:** Ceiling Mounted - 100 Degree Coverage Pattern:
 - a. Passive infrared, zero crossing circuitry, integrated ambient light sensor (4 to 190 FC Range), adjustable sensitivity and time delay, integral isolated relay contact. Sensor shall control all circuits in the area unless noted otherwise. Initial settings: ambient sensor 40 FC.
 - b. Approved Manufacturers: Watt Stopper WPIR Series, Sensor Switch CM-9, Hubbell LOIRWV or ATD1600W.
7. **[SW-OC-P-W]:** Wall Mounted - 100 Degree Coverage Pattern:
 - a. Passive infrared, zero crossing circuitry, integrated ambient light sensor (4 to 190 FC range), adjustable sensitivity and time delay, integral isolated relay contact. Sensor shall control all circuits in the area unless noted otherwise. Initial settings: Ambient sensor 40 FC.
 - b. Approved Manufacturers: Watt Stopper WPIR Series, Sensor Switch CM-9, Hubbell LOIRWV or ATD1600W.
8. With daylight filter and lens to afford coverage applicable to space to be controlled.
- E. Ultrasonic Type: Ceiling mounting. Detect occupancy by sensing a change in pattern of reflected ultrasonic energy in area of coverage.
 1. **[SW-OC-U]:** 360 Degree 20' x 20' Hand Motion Coverage Pattern:
 - a. Frequency greater than 32 KHz solid state, adjustable sensitivity and time delay, integral isolated 1-amp relay contact, temperature and humidity resistant receivers. Sensor shall control all circuits in area, unless noted otherwise.

- b. Approved Manufacturers: Watt Stopper WT-1100 series, Hubbell OMNI-US or ATU series, Leviton OSC series, Greengate ODC-U series.
- 2. **[SW-OC-U2]:** 35' x 30' Hand Motion Coverage Pattern:
 - a. Frequency greater than 32 KHz solid state, adjustable sensitivity and time delay, integral isolated relay contact, temperature and humidity resistant receivers. Sensor shall control all circuits in area, unless noted otherwise.
 - b. Approved Manufacturers: Watt Stopper WT-2200 series, Hubbell OMNI-US or ATU series, Leviton OSC series, Greengate ODC-U series.
- 3. **[SW-OC-U-A]:** 360 Degree Two-Sided Corridor Coverage Pattern:
 - a. Frequency greater than 32 KHz solid state, adjustable sensitivity and time delay, integral isolated relay contact, temperature and humidity resistant receivers. Sensor shall control all circuits in area, unless noted otherwise.
 - b. Approved Manufacturers: Watt Stopper WT-2250 Series, Hubbell OMNI-US or ATU series, Greengate ODC-U Series.
- 4. **[SW-OC-U-W]:** Wall Mounted:
 - a. Wall switch with adjustable settings to allow manual on/auto off or auto on/auto off.
 - b. Approved Manufacturers: Watt Stopper UW-100 Series, Hubbell AU1277I,
- 5. Crystal controlled with circuitry that causes no detection interference between adjacent sensors.

2.8 EMERGENCY TRANSFER DEVICES

- A. Loss of power on normal circuit shall switch load to emergency power source.
- B. Provide suitable NEMA 1 enclosure and mounting per manufacturer specification.
- C. **[ETD]:** Emergency Lighting Control Override - Single Luminaire:
 - 1. Rated 10 amps at 277 volt LED.
 - 2. Approved Manufacturers: Bodine GTD, Iota ETS, Watt Stopper ELCU-100.
- D. **[ETD-2]:** Emergency Lighting Control Override - Branch Loads:
 - 1. Rated 20 amp at 277 volt LED.
 - 2. Approved Manufacturers: Bodine GTD20, Chloride Lightstar, Dual-Lite ATSD, Nine24 ELCR, Highlites HEPC.
- E. **[ETD-D]:** Emergency Lighting Dimming Control Override:
 - 1. Loss of power on normal circuit shall switch luminaires on at 100% rated light output.
 - 2. Approved Manufacturers: Nine24 BLTCv3, nLight nPP16D (ER)

2.9 LIGHTING CONTROL SYSTEM – DIGITAL ADDRESSABLE LIGHTING INTERFACE (DALI)

- A. Acceptable manufacturers listed below meet the qualifications as outlined within this specification. Contractor is responsible for verifying that selected manufacturer is capable of furnishing the complete system as specified herein.
1. Starfield Controls, Inc.
 2. Tridonic Inc.

2.10 TIME SWITCH

- A. **[TC-30]:** Time switch, 7-day, electronic, 30 setpoints available, LCD display, 12 or 24-hour format, minimum 200 hours battery backup, one SPDT 15-amp contact, UL listed.
1. Approved Manufacturers: Paragon EC71/30S, Tork EW101S, Intermatic ET70115C.
- B. **[TC-7]:** Time switch, 7-day, 2 channel, electronic, two SPDT 15-amp contacts, two separate programs with 16 setpoints available, LCD display, 12 or 24-hour format, minimum 100 hours carry-over, UL listed.
1. Approved Manufacturers: Paragon EC72, Tork DTS 200A, Intermatic ET70215C.
- C. **[TC-1]:** Astronomical time switch, 7-day, 1 channel, electronic, one SPDT 5-amp contact, LCD display, 12 or 24-hour format, minimum 100 hours carryover, UL listed.
1. Approved Manufacturers: Paragon EC71ST, Tork DWZ100A, Intermatic ET70115C.
- D. **[TC-S]:** Timer, 24-hour, 20-amp continuous contacts, 1 N.O. and 1 N.C. contacts, spring wound backup, 120 volt, override switch, UL listed.
1. Approved Manufacturers: Paragon 4213-OS, Tork 7200L, Intermatic T173CR.

2.11 CONDUCTORS AND CABLES

- A. Control Wiring:
1. Where installed with the line-voltage wiring, control wiring shall be copper conductors not smaller than No. 16 AWG with insulation voltage rating and temperature rating equal to that of the line-voltage wiring, complying with Division 26 Section 26 05 13 "Wire and Cable."
 2. Tap conductors to switches or relays: Stranded copper conductors of 16 AWG or solid 16 or 18 AWG with insulation rating equal to that of the line-voltage wiring.
 3. Tap conductors to dimming drivers: Solid copper conductors of 18 AWG with insulation voltage rating equal to that of the line-voltage wiring and insulation temperature rating not less than 90°C.
 4. Network cabling as required by manufacturer.
- B. Splices and Taps:
1. Tapping or wire trap connectors shall be used to splice all Class 1 and Class 2 control wiring. Twist-on, wire-nut type connectors are not allowed.

3. PART EXECUTION

3.1 PRE-CONSTRUCTION MEETING

- A. Schedule a pre-construction meeting with the controls representative, installing contractor, Architect/Engineer, and Owner to explain the proposed lighting control centralized, wireless, and distributed systems.

3.2 EXAMINATION

- A. Verify that surfaces are ready to receive work.
- B. Verify field dimensions and coordinate physical size of all equipment with the architectural requirements of the spaces into which they are to be installed. Allow space for adequate ventilation and circulation of air.
- C. Verify that required utilities are available, in proper location, and ready for use.
- D. Beginning of installation means installer accepts existing conditions.

3.3 INSTALLATION

- A. Install in accordance with manufacturer's instructions and approved shop drawings.
- B. All wiring shall be installed in conduit. Class II low voltage control wiring may be open wiring and shall maintain 150 mm (6 inch) spacing from electronic ballast and other RFI/EMI sources.
- C. All branch load circuits shall be live tested before connecting the loads to the lighting control panel.

3.4 SUPPORT SERVICES

- A. System Startup:
 - 1. Manufacturer shall provide factory authorized technician to confirm proper installation and operation of all system components.
- B. Testing:
 - 1. System shall be completely functional tested by a factory-authorized technician. All loads shall be tested live for continuity and freedom from defects, and all control wiring shall be tested for continuity and connections prior to energizing the system components.
 - 2. Programming of initial zones, schedules, lighting levels, control station groups, and sensor settings shall be performed by a factory-authorized technician. Lighting Control Sequence of Operation shall serve as a basis for programming. However, all final decisions regarding groups and schedules shall be at the direction of the Owner. The following procedures shall be performed at a minimum:
 - a. Confirm occupancy sensor placement, sensitivity, and time delay settings to meet specified performance criteria.
 - b. Confirm daylight sensor placement, sensitivity, deadband, and delay settings to meet specified performance criteria.
 - c. Confirm that schedules and time controls are configured to meet specified performance criteria and Owner's operating requirements.
 - 3. Verify occupancy/vacancy and daylight sensor operation is correct after furniture and equipment is installed in each area. Make adjustments to sensor settings and time delays to allow proper operation.

4. Verify occupancy/vacancy sensors are located to provide complete coverage for the area served with no nuisance switching.
 - a. Relocate sensors or provide additional sensors as necessary to provide adequate coverage.
 - b. Mask occupancy sensors where necessary to prevent nuisance switching from adjacent areas.
- C. Training:
 1. Manufacturer shall provide competent factory-authorized technician to train Owner personnel in the operation, maintenance and programming of the lighting control system. Submit training plan with notification seven (7) days prior to proposed training dates.
 2. Training duration shall be no less than three (3) days, with one (1) day being scheduled at least two (2) weeks after initial training.
- D. Documentation:
 1. Manufacturer shall provide system documentation including:
 - a. System one-line showing all panels, number and type of control stations and sensors, communication line, and network or BMS/BAS interface unit.
 - b. Drawings for each panel showing hardware configuration and numbering.
 - c. Panel wiring schedules.
 - d. Typical diagrams for each component.

3.5 SYSTEM COMMISSIONING

- A. Contractors' tests shall be scheduled and documented in accordance with the commissioning requirements. Refer to Section 01 09 00, General Commissioning, for further details.
- B. System verification testing is part of the commissioning process. Verification testing shall be performed by the Contractor and witnessed and documented by the Commissioning Agent. Refer to Section 01 09 00, General Commissioning, for system verification tests and commissioning requirements.
- C. Training of the Owner's operation and maintenance personnel is required in cooperation with the Owner's Representative. The instruction shall be scheduled in coordination with the Owner's Representative after submission and approval of formal training plans. Refer to Section 01 09 00, General Commissioning, for Contractor training requirements.

END OF SECTION

SECTION 26 20 00

SERVICE ENTRANCE

1. PART GENERAL

1.1 SECTION INCLUDES

- A. Arrangement with Utility Company for permanent electric service
- B. Overhead Underground service entrance

1.2 RELATED SECTIONS AND WORK

- A. Refer to the One-Line Diagram for additional information.

1.3 QUALITY ASSURANCE

- A. Utility Company: Southern California Edison Ventura.
- B. Contact: 805-654-7444.
- C. Install service entrance in accordance with Utility Company's rules and regulations.

1.4 SUBMITTALS

- A. Submit shop drawings and product data under provisions of Section 26 05 00.
- B. Submit Utility Company prepared drawings (if applicable).

1.5 SYSTEM DESCRIPTION

- A. System Voltage: 480Y/277 480 volts, three phase, three- four-wire, 60 Hertz.

2. PART PRODUCTS

2.1 METERING EQUIPMENT

- A. Meter: Furnished by the Utility Company.
- B. Meter Base: Furnished by the Contractor, as approved by the Utility Company. (Manufacturers: Milbank, Superior, Duncan, or Anchor).
- C. Metering Transformer Compartment: Furnished as part of the main switchboard to Utility Company's specifications.

2.2 IDENTIFICATION

- A. Provide a permanent plaque or sign denoting all services, feeders, and branch circuits supplying the building or structure and the area served by each. Install plaque or sign at each service disconnecting means.

3. PART EXECUTION

3.1 INSTALLATION

- A. Make arrangements with Utility Company to obtain permanent electric service to the Project.

- B. Primary distribution equipment and pad-mounted transformers shall be furnished and installed by the Utility Company.
- C. Primary conductors shall be furnished, installed, and terminated by the Utility Company. Primary conduit shall be furnished and installed by the Contractor, as shown on the drawings, to the Utility Company's requirements.
- D. Underground: Install service entrance conduits in concrete envelope from Utility Company's pad mounted transformer to meter cabinet and building service entrance equipment. Utility Company will connect service conductors to transformer secondary lugs.
- E. Overhead: Install a rigid metal weather head and service entrance conductors. Service entrance conductors shall have a 3' drip loop beyond the weather head. Overhead service shall comply with NEC 230 Part II.
- F. Concrete Pad for Transformer: Furnished and installed by the Contractor to Utility Company's specifications.

END OF SECTION

SECTION 26 22 00

DRY TYPE TRANSFORMERS

1. PART GENERAL

1.1 SECTION INCLUDES

- A. Dry type two winding transformers [TR-#]
- B. Dry type isolation transformers [TR-#]
- C. Dry type harmonic mitigating transformers [TR-#]

1.2 REFERENCES

- A. NEMA - ST 1 - Specialty Transformers
- B. NEMA ST 20 - Dry Type Transformers for General Applications
- C. ANSI/IEEE C57.12.01 - General Requirements for Dry Type Distribution and Power Transformers
- D. ANSI/IEEE C57.12.91 - Test Code for Dry Type Distribution and Power Transformers
- E. Department of Energy 10 CFR Part 431 – Energy Conservation Program for Commercial Equipment: Distribution Transformers Energy Conservation Standards; Final Rule.
- F. NEMA TP 2 - Standard Test Method for Measuring the Energy Consumption of Distribution Transformers
- G. NEMA TP 3 - Standard for the Labeling of Distribution Transformer Efficiency

1.3 SUBMITTALS

- A. Submit product data under provisions of Section 26 05 00.
- B. Include outline and support point dimensions of enclosures and accessories, unit weight, voltage, KVA, and impedance ratings and characteristics, loss data, efficiency at 35, 50, 75 and 100 percent rated load, sound level, tap configurations, insulation system type, and rated temperature rise.

1.4 DELIVERY, STORAGE, AND HANDLING

- A. Store and protect products under provisions of Section 26 05 00.
- B. Store in a warm, dry location with uniform temperature. Cover ventilating openings to keep out dust.
- C. Handle transformers using only lifting eyes and brackets provided for that purpose. Protect units against entrance of rain, sleet, or snow if handled in inclement weather.

2. PART PRODUCTS

2.1 DRY TYPE TWO WINDING TRANSFORMERS

- A. Dry Type Transformers: NEMA ST 20, factory-assembled, air-cooled dry type, copper wound, transformers; ratings as shown on the drawings. Transformers supplied under this project shall meet the US Department of Energy (DOE) 2016 Efficiency requirements or the most current DOE CFR in effect.

- B. Insulation system and average winding temperature rise for rated KVA as follows:

Ratings	<u>Class</u>	<u>Rise (degree C)</u>
Less than 15	185	As shown on the drawings
15 or higher	220	As shown on the drawings

- C. Case temperature shall not exceed 40°C rise above ambient at its warmest point.

- D. Winding Taps, Transformers Less than 15 KVA: Two 5 percent below rated voltage, full capacity taps on primary winding.
- E. Winding Taps, Transformers 15 KVA and Larger: Two (2) 2-1/2% below and two (2) 2-1/2% above rated voltage, full capacity taps on primary winding.
- F. Sound Levels: Average audible sound level shall not exceed the values given below when tested to NEMA ST 20 standards:

	Average Sound Level, Decibels			
	Self-Cooled Ventilated			Self-Cooled Sealed
Equivalent Winding kVA Range	K-Factor = 1 K-Factor = 4 K-Factor = 9	K-Factor = 13 K-Factor = 20	Forced Air w/ Fans Running	
0-9	40	40	67	45
9.01-30.00	45	45	67	50
30.01-50.00	45	48	67	50
50.01-150.00	50	53	67	55
150.01-300.00	55	58	67	57
300.01-500.00	60	63	67	59
500.01-700.00	62	65	67	61
700.00-1000.00	64	67	67	63

- G. Ground core and coil assembly to enclosure by means of a visible flexible copper grounding strap.
- H. Mounting: Transformers 75 KVA and less shall be suitable for wall, floor, or trapeze mounting; transformers larger than 75 KVA shall be suitable for floor or trapeze mounting.
- I. Coil Conductors: Continuous copper windings with terminations brazed or welded.
- J. Enclosure: NEMA ST 20; Type 1. Provide lifting eyes or brackets.
- K. Isolate core and coil from enclosure using vibration-absorbing mounts.
- L. Nameplate: NEMA TP 3; Include transformer connection data and overload capacity based on rated allowable temperature rise.

2.2 HARMONIC MITIGATING TRANSFORMERS

- A. Dry Type Harmonic Mitigating Transformers: ANSI/NEMA ST 20; factory-assembled, air-cooled dry, copper wound, type 200% rated neutral transformers; ratings as shown on the drawings. Transformers supplied under this project shall meet the US Department of Energy (DOE) 2016 Efficiency requirements or the most current DOE CFR in effect.
- B. Insulation system and average winding temperatures rise for rated KVA as follows:

KVA Rating	Insulation Class	Temperature Rise (degree C)
1-9	185	115
10-500	220	130

- C. Case temperature shall not exceed 40°C rise above ambient at its warmest point.
- D. Winding Taps, Transformers: Two (2) 2-1/2 percent below and two (2) 2-1/2 percent above rated voltage, full capacity taps on primary winding.

- E. Sound Levels: Average audible sound level shall not exceed the values given below when tested to NEMA ST 20 standards:

	Average Sound Level, Decibels			
	Self-Cooled Ventilated			Self-Cooled Sealed
Equivalent Winding kVA Range	K-Factor = 1 K-Factor = 4 K-Factor = 9	K-Factor = 13 K-Factor = 20	Forced Air w/ Fans Running	
0-9	40	40	67	45
9.01-30.00	45	45	67	50
30.01-50.00	45	48	67	50
50.01-150.00	50	53	67	55
150.01-300.00	55	58	67	57
300.01-500.00	60	63	67	59
500.01-700.00	62	65	67	61
700.00-1000.00	64	67	67	63

- F. Provide +/- 15% phase on the primary windings (total 30% phase shift) of harmonic mitigating transformers wired in parallel from the same distribution source.
- G. Ground core and coil assembly to enclosure by means of a visible flexible copper grounding strap.
- H. Provide electrostatic winding shield with separate insulated grounding connection.
- I. Mounting: Transformers 75 KVA and less shall be suitable for wall, floor, or trapeze mounting; transformers larger than 75 KVA shall be suitable for floor or trapeze mounting.
- J. Coil Conductors: Continuous copper windings with terminations brazed or welded.
- K. Enclosure: NEMA ST 20; Type 1. Provide lifting eyes or brackets.
- L. Isolate core and coil from enclosure using vibration-absorbing mounts.
- M. Nameplate: NEMA TP 3; Include transformer connection data.

2.3 ACCESSORIES

- A. Electronic Isolation Shield:
1. Provide electrostatic winding shield with separate insulated grounding connection as shown on the drawings.

3. PART EXECUTION

3.1 INSTALLATION

- A. Set transformer plumb and level.
- B. Use flexible conduit, 2 feet minimum length, for connections to transformer case. Make conduit connections to side panel of enclosure.
- C. Mount transformers on four 3"x3"x1/2" thick, 50 durometer rubber vibration isolating pads suitable for isolating the transformer noise from the building structure.

3.2 FIELD QUALITY CONTROL

- A. Check for damage and tight connections prior to energizing transformer.
- B. Measure primary and secondary voltages and make appropriate tap adjustments. Adjustments shall be made at completion of project and at approximately 6 months following project acceptance when requested by the Owner.

END OF SECTION

SECTION 26 24 13

SWITCHBOARDS

1. PART GENERAL

1.1 SECTION INCLUDES

- A. Main and distribution switchboards: **[SB-#], [SB-#]**

1.2 RELATED SECTIONS AND WORK

- A. Refer to the One-Line Diagram for size, rating, and configuration.

1.3 REFERENCES

- A. ANSI C12 - Code for Electricity Metering
- B. ANSI C39.1 - Requirements for Electrical Analog Indicating Instruments
- C. ANSI C57.13 - Requirements for Instrument Transformers
- D. NEMA AB 1 - Molded Case Circuit Breakers
- E. NEMA KS 1 - Enclosed Switches
- F. NEMA PB 2 - Dead Front Distribution Switchboards
- G. NEMA PB 2.1 - Instructions for Safe Handling, Installation, Operation and Maintenance of Deadfront Switchboards Rated 600 Volts or less

1.4 SUBMITTALS

- A. Submit product data under provisions of Section 26 05 00.
- B. Include front and side views of enclosures with overall dimensions shown; conduit entrance locations and requirements; nameplate legends; size and number of bus bars per phase, neutral, and ground; switchboard instrument details; instructions for handling and installation of switchboard; and electrical characteristics including voltage, frame size and trip ratings, withstand ratings, and time-current curves of all equipment and components.
- C. Submit manufacturer's instructions under provisions of Section 26 05 00.

1.5 SPARE PARTS

- A. Keys: Furnish four each to the Owner.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Deliver products to the site under provisions of Section 26 05 00.
- B. Deliver in 48-inch maximum width shipping splits, unless approved otherwise by both the Contractor and Architect/Engineer, individually wrapped for protection, and mounted on shipping skids.
- C. Store and protect products under provisions of Section 26 05 00.
- D. Store in a clean, dry space. Maintain factory wrapping or provide an additional heavy canvas or heavy plastic cover to protect units from dirt, water, construction debris, and traffic.
- E. Handle in accordance with NEMA PB2.1 and manufacturer's written instructions. Lift only with lugs provided for the purpose. Handle carefully to avoid damage to switchboard internal components, enclosure, and finish.

1.7 OPERATION AND MAINTENANCE DATA

- A. Submit operation and maintenance data under provisions of Section 26 05 00.
- B. Include spare parts data listing; source and current prices of replacement parts and supplies; and recommended maintenance procedures and intervals.

2. PART PRODUCTS

2.1 GENERAL

- A. Approved Manufacturers:
 - 1. Square D Class 2700 QED-2, QMB, I-Line, Powerstyle
 - 2. General Electric
 - 3. Siemens
 - 4. Cutler Hammer

2.2 RATINGS

- A. Definitions:
 - 1. Fully rated equipment shall be defined as equipment where all devices in that equipment shall carry a minimum of the AIC rating that is specified.
- B. The switchboards for this project shall be fully rated unless otherwise specifically noted in the Drawings or Specifications.

2.3 SWITCHBOARD CONSTRUCTION AND RATINGS

- A. Factory-assembled, dead front, metal-enclosed, and self-supporting switchboard assembly conforming to NEMA PB2, and complete from incoming line terminals to load-side terminations.
- B. Switchboard electrical ratings and configurations as shown on the drawings.
- C. Line and Load Terminations: Accessible from the front only of the switchboard, suitable for the conductor materials used.
- D. Main Section Devices: Individually mounted and compartmented.
- E. Distribution Section Devices: Group mounted.
- F. Auxiliary Section Devices: Individually mounted and compartmented.
- G. Bus Material: Copper with tin plating, sized in accordance with NEMA PB 2.
- H. Bus Connections: Bolted, accessible from front only for maintenance. Plug-on connections may be utilized with Architect/Engineer's pre-approval by addenda.
- I. Copper bus bars shall be fully isolated, braced for minimum ampere rms symmetrical rating as indicated on drawings.
- J. The bus shall extend the full height of the distribution sections to provide space for future breakers.
- K. Provide a 1 X 1/4-inch copper ground bus through the length of the switchboard.
- L. Provide metering transformer compartment for Utility Company's use. Compartment size, bus spacing and drilling, door, and locking and sealing requirements shall be in accordance to Section 26 20 00 and Utility Company specifications.

- M. Enclosure shall be NEMA PB 2; Type 1 - General-Purpose. Sections shall align at front and rear.
- N. Switchboard Height: NEMA PB 2; 92 inches, excluding floor sills, lifting members and pull boxes.
- O. Maximum Dimensions: As indicated on drawings.
- P. Finish: Manufacturer's standard light gray enamel over external surfaces. Coat internal surfaces with minimum two coats corrosion-resisting paint, or plate with cadmium or zinc.
- Q. Pull Box: Same construction as switchboard, size as shown on the drawings. Top and sides shall be removable. Insulating, fire-resistive bottom with separate openings for each circuit to pass into switchboard.
- R. Pull Section: Same construction as switchboard, size as shown on the drawings. Depth and height to match switchboard. Arrange as shown on the drawings.
- S. Future Provisions: In addition to the spare devices shown, provide a minimum of 15 inches of fully equipped space for future devices with bussing and bus connections, suitably insulated and braced for short circuit currents. Continuous current rating as indicated on the drawings.
- T. Suitable for use as service entrance equipment.

2.4 SWITCHING, OVER-CURRENT PROTECTIVE DEVICES, AND ARC ENERGY REDUCTION

- A. Molded Case Circuit Breakers: Provide circuit breakers with integral thermal and instantaneous magnetic trip in each pole. **Provide breaker interrupting ratings as indicated on the plans. Where necessary to meet interrupting ratings, breakers shall be provided with automatically resetting current limiting elements in each pole.**
- B. Solid State Molded Case Circuit Breakers: **(All breakers identified on plans as solid-state with 2,500 ampere frame sizes and below.)** Provide molded case switch with electronic sensing, timing, and tripping circuits for fully adjustable time current characteristic settings including ground fault trip, instantaneous trip, long time trip, long time delay, short time trip, and short time delay. Trip setting shall be field programmable with a sealable clear cover. Provide stationary mounting. Ground fault sensing shall be breaker integral with circuit breaker. Provide zero sequence type ground fault sensor. **Provide breaker interrupting ratings as indicated on the plans.**
- C. Solid-State Insulated Case Circuit Breakers: **(All breakers identified on plans as solid state with frame sizes above 2,500 ampere.)** Provide insulated case switch with two-step stored energy closing. Provide manual charging handle, and electric charging motor where indicated as electrically operated. Provide with rating plug as required on drawings and electronic circuits for true rms current sensing, timing, and tripping for fully adjustable time current characteristics including ground fault trip, instantaneous trip, long time trip, long time delay, short time trip, and short time delay. Trip settings shall be field programmable with a sealable clear cover. Ground fault sensing shall be summation type integral to breaker. Provide stationary mounting. **Provide breaker interrupted ratings as indicated on the plans.**
- D. Arc Energy Reduction:
 - 1. Provide an arc energy reduction system to reduce the clearing time of an arc flash event. The arc energy reduction system shall be provided for overcurrent protection devices rated 1,200 amps or larger.
- E. Arc Energy Reduction with Selective Coordination:
 - 1. Provide an arc energy reduction system to reduce the clearing time of an arc flash event. The arc energy reduction system shall be provided for overcurrent protection devices rated 1,200 amps or larger.

2. Zone-Selective Interlocking System: Provide a zone-selective interlocking system for the electrical equipment. The system shall provide the following functions:
 - a. Selective coordination
 - b. Permanent arc energy reduction
3. The following arc energy reduction system options are acceptable:
 - a. Zone-selective interlocking with permanent arc energy reduction
 - b. Differential relaying with permanent arc energy reduction
 - c. Listed energy-reducing active arch flash mitigating system

2.5 INSTRUMENTS AND SENSORS

- A. Current Transformers: ANSI C57.13; 5 ampere secondary, bar or window type, with single secondary winding, unless otherwise required for application, and secondary shorting device, primary/secondary ratio as required, burden and accuracy consistent with connected metering and relay devices, 60 Hertz.
- B. Potential Transformers: ANSI C57.13; 120-volt single secondary, disconnecting type with integral fuse mountings, primary/secondary ratio as required, burden and accuracy consistent with connected metering and relay devices, 60 Hertz.
- C. Ground Fault Sensor: Zero sequence type.
- D. Ground Fault Relay: Adjustable ground fault sensitivity from 200 to 1200 amperes, time delay adjustable from 0 to 15 seconds. Provide monitor panel with lamp to indicate relay operation, TEST and RESET control switches.
- E. Double-ended Equipment Ground Fault Protection: Provide a modified differential ground fault protection scheme. Adjustable ground fault sensitivity from 200 to 1200 amperes, time delay adjustable from 0 to 15 seconds. Provide monitor panel with lamp to indicate relay operation, TEST and RESET control switches.
- F. **[DPM]**: Digital AC Power Monitor. Capable of measuring, calculating and directly displaying; Volts (L-L, L-N), Amps, KW, KWH. Monitor shall be true RMS measurement with programmable set-up parameters. All set-up parameters data shall be stored in non-volatile memory to protect from power outages.

3. PART EXECUTION

3.1 INSTALLATION

- A. Install switchboard in locations shown on the drawings, in accordance with manufacturer's written instructions and NEMA PB 2.1.
- B. Tighten accessible bus connections and mechanical fasteners after placing switchboard.
- C. Install fuses in each switch.

3.2 FIELD QUALITY CONTROL

- A. Inspect completed installation for physical damage, proper alignment, anchorage, and grounding.
- B. Measure insulation resistance of each bus section phase to phase and phase to ground for one minute each. Test voltage shall be 1000 volts, and minimum acceptable value for insulation resistance is 2 megohms.
- C. Check tightness of accessible bolted bus joints using a calibrated torque wrench. Tightness shall be in accordance with manufacturer's recommended values.

- D. Physically test key interlock systems to ensure proper function.

3.3 ADJUSTING AND CLEANING

- A. Adjust all operating mechanisms for free mechanical movement.
- B. Touch up scratched or marred surfaces to match original finish.
- C. Provide time/current trip curves for all adjustable protection devices that require setting. Also provide curves and equipment information for associated new and existing fixed devices that require coordination with new protection devices. Submit time/current curves in hard copy or electronic format.
- D. Adjust trip and time delay settings to values as scheduled, or as instructed by the short circuit and coordination studies.
- E. Where two levels of ground fault are provided, test ground fault circuit breakers to prove selective coordination in accordance with manufacturer's directions. Provide testing documentation with Operating & Maintenance Manual submittals.

END OF SECTION

SECTION 26 24 16

PANELBOARDS

1. PART GENERAL

1.1 SECTION INCLUDES

- A. Service and distribution panelboards: **[DP-#], [DP-#]**
- B. Lighting and appliance branch circuit panelboards: **[Panel '###']**

1.2 RELATED SECTIONS AND WORK

- A. Refer to the One-Line Diagram and Panel Schedules for size, rating, and configuration.

1.3 REFERENCES

- A. NEMA AB 1 - Molded Case Circuit Breakers
- B. NEMA FU 1 – Low voltage cartridge fuses
- C. NEMA KS 1 - Enclosed Switches
- D. NEMA PB 1 - Panelboards
- E. NEMA PB 1.1 - Instructions for Safe Installation, Operation and Maintenance of Panelboards Rated 600 Volts or Less
- F. NEMA PB 1.2 - Application Guide for Ground-fault Protective Devices for Equipment
- G. UL 248 – Low-Voltage Fuses
- H. UL 67 - Panelboards

1.4 SUBMITTALS

- A. Submit shop drawings for equipment and component devices under provisions of Section 26 05 00.
- B. Include outline and support point dimensions, voltage, main bus ampacity, integrated short circuit ampere rating, circuit breaker and fusible switch arrangement and sizes.
- C. Selective coordination study to prove that all essential electrical systems, emergency systems and legally required standby system panelboards are selectively coordinated with all supply side overcurrent protective devices.

1.5 SPARE PARTS

- A. Keys: Furnish four (4) each to the Owner.

2. PART PRODUCTS

2.1 RATINGS

- A. Definitions:
 - 1. Fully rated equipment shall be defined as equipment where all devices in that equipment shall carry a minimum of the AIC rating that is specified.
- B. The panelboards for this project shall be fully rated unless otherwise specifically noted in the Drawings or Specifications.

2.2 MAIN AND DISTRIBUTION PANELBOARDS

A. General

1. Approved Manufacturers:

- a. Square D QMB, I-Line
- b. General Electric Spectra ADS
- c. Siemens F2, P4
- d. Cutler Hammer PRL4, PRL5

B. Panelboards: NEMA PB 1; type as shown on the drawings.

C. Enclosure: NEMA PB 1; Type 1.

D. Provide cabinet front with concealed trim clamps and hinged trim on door to allow access to wiring gutters without removal of trim and flush lock. Finish in manufacturer's standard gray enamel.

E. Provide panelboards with copper bus, ratings as scheduled on the drawings. Provide copper ground bus in all panelboards.

F. All spaces shown on the one-line diagram shall be fully prepared spaces for future breakers.

G. Minimum Integrated Short Circuit Rating: 100,000 amperes rms symmetrical for 240-volt panelboards; 50,000 amperes rms symmetrical for 480-volt panelboards, or as shown on the drawings.

H. Molded Case Circuit Breakers: Provide circuit breakers with integral thermal and instantaneous magnetic trip in each pole.

I. Molded Case Circuit Breakers with Current Limiters: Provide circuit breakers with replaceable current limiting elements, in addition to integral thermal and instantaneous magnetic trip in each pole.

J. Current Limiting Molded Case Circuit Breakers: Provide circuit breakers with integral thermal and instantaneous magnetic trip in each pole, coordinated with automatically resetting current limiting elements in each pole. Interrupting rating 100,000 symmetrical amperes, let-through current and energy level less than permitted for same size Class RK-5 fuse.

K. Solid State Molded Case Circuit Breakers: **(All breakers identified on plans as solid-state with 1,200 ampere frame sizes and below.)** Provide molded case switch with electronic sensing, timing, and tripping circuits for fully adjustable time current characteristic settings including ground fault trip, instantaneous trip, long time trip, long time delay, short time trip, and short time delay. Trip setting shall be field programmable with a sealable clear cover.

L. Arc Energy Reduction:

1. Provide an arc energy reduction system to reduce the clearing time of an arc flash event. The arc energy reduction system shall be provided for overcurrent protection devices rated 1,200 amps or larger.
2. Energy-Reducing Maintenance Switch: Provide an energy-reducing maintenance switch visual status indication when engaged. Install the maintenance switch in the first section of the electrical equipment.

M. Suitable for use as service entrance equipment.

N. Maximum Dimensions: As indicated on drawings.

2.3 BRANCH CIRCUIT PANELBOARDS

A. General

1. Approved Manufacturers:

- a. Square D NQ, NF
- b. General Electric AQ, AE
- c. Siemens P1
- d. Cutler Hammer PRL1, PRL2

- B. Lighting and Appliance Branch Circuit Panelboards: NEMA PB 1; circuit breaker type.
- C. Enclosure: NEMA PB 1; Type 1.
- D. Provide cabinet front with door-in-door construction, concealed hinge, and flush lock all keyed alike. hinged trim to allow access to wiring gutters without removal of trim and flush lock all keyed alike. Hinged trim shall be secured with screws. Finish in manufacturer's standard gray enamel.
- E. Provide panelboards with copper bus, ratings as scheduled on the drawings. Provide copper ground bus in all panelboards.
- F. All unlabeled circuits shown on the panelboard schedule shall be fully prepared spaces for future breakers.
- G. All multiple-section panelboards shall have the same dimensional back box and cabinet front size.
- H. Minimum Integrated Short Circuit Rating: As shown on the drawings.
- I. Provide handle lock-on devices for all breakers serving exit sign and lighting circuits with emergency battery units. Provide handle lock-on devices and red handles for breakers serving fire alarm panels.
- J. Molded Case Circuit Breakers: Bolt-on type thermal magnetic trip circuit breakers, with common trip handle for all poles. Provide circuit breakers UL listed as Type SWD for lighting circuits. Provide UL Class A ground fault interrupter circuit breakers where scheduled on the drawings. Do not use tandem circuit breakers.
- K. Current Limiting Molded Case Circuit Breakers: Provide circuit breakers with integral thermal and instantaneous magnetic trip in each pole, coordinated with automatically resetting current limiting elements in each pole. Interrupting rating 100,000 symmetrical amperes, let-through current and energy level less than permitted for same size Class RK-5 fuse.

2.4 COLUMN WIDTH PANELBOARDS

A. General

1. Approved Manufacturers:

- a. Square D NQ, NF
- b. General Electric AQ, AEC
- c. Siemens P1
- d. Cutler Hammer PRL1-LX, PRL2-LX

- B. Lighting and Appliance Branch Circuit Panelboards: NEMA PB 1; circuit breaker type.
- C. Enclosure: NEMA PB 1; Type 1.
- D. Provide cabinet front with door-in-door construction, concealed hinge, and flush lock all keyed alike. hinged trim to allow access to wiring gutters without removal of trim and flush lock all keyed alike. Finish in manufacturer's standard gray enamel.

- E. Provide panelboards with copper bus, ratings as scheduled on the drawings. Provide copper ground bus in all panelboards.
- F. All unlabeled circuits shown on the panelboard schedule shall be fully prepared spaces for future breakers.
- G. All multiple-section panelboards shall have the same dimensional back box and cabinet front size.
- H. Minimum Integrated Short Circuit Rating: As shown on the drawings.
- I. Molded Case Circuit Breakers: Bolt-on type thermal magnetic trip circuit breakers, with common trip handle for all poles. Provide circuit breakers UL listed as Type SWD for lighting circuits. Provide UL Class A ground fault interrupter circuit breakers where scheduled on the drawings. Do not use tandem circuit breakers.

3. PART EXECUTION

3.1 INSTALLATION

- A. Install panelboards plumb as indicated on the drawings in conformance with NEMA PB 1.1.
- B. Height: 6 feet to handle of highest device.
- C. Provide filler plates for unused spaces in panelboards.
- D. Provide custom typed circuit directory for each branch circuit panelboard. Label shall include equipment name or final approved room name, room number, and load type for each circuit (examples: SUMP SP-1 or ROOM 101 RECEPT). Revise directory to reflect circuit changes required to balance phase loads. Printed copies of the bid document panel schedules are not acceptable as circuit directories.
- E. Stub five (5) empty one-inch conduits to accessible location above ceiling out of each recessed panelboard.
- F. Install fuses in fusible switch assemblies.

3.2 FIELD QUALITY CONTROL

- A. Measure steady state load currents at each panelboard feeder. Should the difference at any panelboard between phases exceed 20 percent, rearrange circuits in the panelboard to balance the phase loads within 20 percent. Take care to maintain proper phasing for multi-wire branch circuits.
- B. Visual and Mechanical Inspection: Inspect for physical damage, proper alignment, anchorage, and grounding. Check proper installation and tightness of connections for circuit breakers, fusible switches, and fuses.

END OF SECTION

SECTION 26 27 16

CABINETS AND ENCLOSURES

1. PART GENERAL

1.1 SECTION INCLUDES

- A. Hinged cover enclosures
- B. Cabinets
- C. Terminal blocks and accessories
- D. Custom utility pedestals **[CUP-#]**

1.2 REFERENCES

- A. NEMA 250 - Enclosures for Electrical Equipment (1000 Volts Maximum)
- B. ANSI/NEMA ICS 1 - Industrial Control and Systems
- C. ANSI/NEMA ICS 4 - Terminal Blocks for Industrial Control Equipment and Systems
- D. ANSI/NEMA ICS 6 - Enclosures for Industrial Control Equipment and Systems

1.3 SUBMITTALS

- A. Submit product data under provisions of Section 26 05 00.
- B. Shop Drawings for Equipment Panels: Include wiring schematic diagram, wiring diagram, outline drawing and construction diagram as described in ANSI/NEMA ICS 1.
- C. Include cabinets and enclosures in composite electronic coordination files. Refer to Section 26 05 00 for coordination drawing requirements.
- D. Custom Utility Pedestal:
 - 1. Provide dimensioned diagram of cabinet including front, side, and floor plan views. Show layout of power and control components in elevation views.
 - 2. Provide schematic diagram of power, control functions, panelboards, and other components.
 - 3. Submit installation instructions.

2. PART PRODUCTS

2.1 HINGED COVER ENCLOSURES

- A. Construction: NEMA 250; Type 1 indoor and 3R outdoor, 14 gauge steel.
- B. Finish: Manufacturer's standard polyester powder paint finish.
- C. Covers: Continuous hinge with stainless steel hinge pin. Covers longer than 24 inches shall have 3-point latching.
- D. Locks: Flush 1/4 turn cylinder key latch 3-point latch kit with padlock handle quick-release latch.
- E. Provide interior white painted metal panel for mounting terminal blocks and electrical components.

2.2 CABINETS

- A. Cabinet Boxes: Galvanized steel with dimensions as indicated on the drawings.

- B. Cabinet Fronts: Steel, flush or surface type with concealed trim clamps, concealed hinge and flush lock keyed to match branch circuit panelboard; finish in gray baked enamel.

2.3 TERMINAL BLOCKS AND ACCESSORIES

- A. Terminal Blocks: ANSI/NEMA ICS 4; UL listed.
- B. Power Terminals: Unit construction type, closed-back type, with tubular pressure screw connectors, rated 600 volts.
- C. Signal and Control Terminals: Modular construction type, channel mounted; tubular pressure screw connectors, rated 300 volts.

2.4 FABRICATION

- A. Shop assemble enclosures and cabinets housing terminal blocks or electrical components in accordance with ANSI/NEMA ICS 6.
- B. Provide conduit hubs or knockouts on enclosures.
- C. Provide protective pocket inside front cover with schematic diagram, connection diagram, and layout drawing of control wiring and components within enclosure.

2.5 [CUP-#] CUSTOM UTILITY PEDESTAL

- A. General:
 - 1. Approved Manufacturers - Cabinet:
 - a. Milbank
 - b. Approved custom utility pedestal vendor
 - c. Individual components field installed by contractor
 - 2. Approved Manufacturers - Panelboard, contactors, photocell, relays:
 - a. Square D
 - b. General Electric
 - c. Siemens
 - d. Cutler Hammer
 - 3. Approved Manufacturers - Control Components, Time Clocks:
 - a. Paragon
 - b. Intermatic
 - c. Tork
- B. Enclosure:
 - 1. Vandal-resistant cabinet, stainless steel NEMA 3R, while in use, with lockable cover, UL listed, and [natural, black, white, custom color powder coat finish].
 - 2. Utility Section: Separate isolated utility metering compartment with hinged lockable cover.
 - 3. Customer Section:
 - a. Separate isolated customer section with NEMA 3R while in use hinged lockable cover.
 - b. Dead front construction with hinged cover to live components.

4. Provide protective pocket inside front cover with schematic diagram, wiring diagram, and layout drawings of control wiring and components within enclosure.
- C. Customer Distribution: Separate customer distribution section for power and control equipment.
 1. Main disconnect sized per one-line diagram and suitable for use as service disconnect.
 2. Dry type transformer sized per one-line diagram.
 3. Panelboard:
 - a. Copper bus, neutral, and ground bus
 - b. Bus rating: per one-line diagram
 4. Panelboard with contactor control of bus:
 - a. Copper bus, neutral, and ground bus
 - b. Bus rating: per one line diagram
 - c. Contactor: NEMA ICS 2 and UL 508; electrically held, 2 wire control. Provide with hand-off-auto switch located in customer dead front panel.
 - d. Control Sequence:
 - 1) Timeclock, photocell on. Timeclock, photocell off
 - 2) Or as indicated on drawings.
 5. Time Switch:
 - a. Time switch, 7 day, electronic, 30 setpoints available, LCD display, 12 or 24-hour format, minimum 200 hours battery backup, one SPDT 15-amp contact, UL listed.
 - b. Time switch, 7 day astronomic, 1 channel, electronic, one SPDT 5-amp contact, LCD display, 12 or 24-hour format, minimum 100 hours carryover, UL listed.
 6. Labeling:
 - a. Provide engraved plastic laminate label inside cover for the following items:
 - 1) Power source and location
 - 2) Branch circuit breakers, loads served
 - 3) Hand-off-Auto and other control devices
 7. Provide with line side surge arrestor.
 8. Provide with photocell.
 9. Transfer Switch - Automatic, Manual double throw, or Key interlock:
 - a. NEMA ICS 2: 2, 3, or 4 pole, electrically operated
 - b. Provide two (2) N.O. and two (2) N.C isolated contacts
 - c. Approved Manufacturers:
 - 1) Asco
 - 2) Russ Electric
 - 3) GE Zenith

10. Generator Connection: Permanent cable connection to automatic transfer switch.
11. Provide with optional pedestal mounting base.
12. Environment Control: Provide cabinet with unit heaters.
13. Surge Protection Devices:
14. Provide with fire rated plywood panel for mounting of customer equipment: 3/4 inch dimension as shown on plans.
15. Provide with viewable window for meter section.
16. Provide with factory concentric knockouts for conduit entry locations.
17. Maintenance Receptacle:
 - a. 125-volt, 20 amp, 3-wire grounding type with test and reset buttons in impact resistant thermoplastic face. Provide NEMA 3R rated while-in-use aluminum cover located on side of enclosure, located in dead front cover over customer section.

3. PART EXECUTION

3.1 INSTALLATION

- A. Install cabinets and enclosures plumb; anchor securely to wall and structural supports at each corner, minimum.
- B. Provide accessory feet for free-standing equipment enclosures.
- C. Install trim plumb.
- D. Custom Utility Pedestal:
 1. Concrete Pad: Provide flush with grade-mounted concrete pad with rebar reinforcement. Pad size: Cabinet size plus 12 inches to allow for mow/landscape apron, 8 inch deep.
 2. Provide stainless steel anchor bolts and install per manufacturer's instructions.
 3. Provide generator start signal cabling to generator.

END OF SECTION

SECTION 26 27 26

WIRING DEVICES

1. PART GENERAL

1.1 SECTION INCLUDES

- A. Device plates and box covers
- B. Modular connectors
- C. Receptacles
- D. Countertop and furniture receptacle assemblies
- E. Pin and sleeve devices
- F. Floor boxes
- G. Service fitting
- H. Pedestal style box
- I. Poke-through fittings
- J. Pendant cord/connector devices
- K. Cord and plug sets
- L. Cord reel

1.2 QUALITY ASSURANCE

- A. Provide similar devices from a single manufacturer.
- B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in the NEC Article 100, by a testing agency to Authorities Having Jurisdiction and marked for intended use.
- C. Comply with the CEC.

1.3 REFERENCES

- A. DSCC W-C-896F – General Specification for Electrical Power Connector
- B. FS W-C-596 - Electrical Power Connector, Plug, Receptacle, and Cable Outlet
- C. NEMA WD 1 – General Color Requirements for Wiring Devices
- D. NEMA WD 6 – Wiring Devices – Dimensional Requirements
- E. UL 498 – Standard for Attachment Plugs and Receptacles
- F. UL 943 – Standard for Ground Fault Circuit Interrupters
- G. CEC -- California Electrical Code

1.4 SUBMITTALS

- A. Submit product data under provisions of Section 26 05 00.
- B. Provide product data showing configurations, finishes, dimensions, and manufacturer's instructions.
- C. Submit manufacturer occupancy sensor coverage patterns applicable to this project. For areas requiring multiple sensor devices for appropriate coverage, submit specific manufacturer approved sensor layout as an overlay directly on the project drawings, either in print or approved electronic form.
- D. Provide a non-returnable sample of each countertop and furniture-mounted receptacle assembly as part of the submittal process.

1.5 COORDINATION

- A. Receptacles for Owner Furnished Equipment: Match plug configurations.
- B. Cord and Plug Sets: Match equipment requirements.

- C. Coordinate installation of receptacle assemblies in countertops and furniture with the contractor providing the countertop or furniture. Contractor shall coordinate penetrations and conduit routing in countertops and furniture with drawings and other obstacles below the installation surface.

2. PART PRODUCTS

2.1 DEVICE COLOR

- A. All switch, receptacle, outlet, and coverplate colors shall be per manufacturer availability and verified with Architect, unless indicated otherwise.

2.2 COVERPLATES

- A. All switches, receptacles, and outlets shall be complete with the following:
 - 1. Unbreakable #302 painted stainless steel coverplates in finished spaces where walls are finished.
 - 2. #302 painted stainless steel coverplates in unfinished spaces for flush boxes.
 - 3. Galvanized painted steel coverplates in unfinished spaces for surface mounted boxes.
- B. Where several devices are ganged together, the coverplate shall be of the ganged style for the number of devices used.
- C. Install nameplate identification as indicated in Section 26 05 53.
- D. Plate securing screws shall be metal with head color matching the wall plate finish.
- E. Coverplate touch surfaces shall have an antimicrobial additive that suppresses the growth of harmful bacteria, mold, mildew, and fungi. Cover plate color shall match the device color.
 - 1. Approved Manufacturers: Cooper CuVerro, Leviton 84 series
 - 2. Install antimicrobial cover plates in following departments:
 - a. Kitchen

2.3 MODULAR CONNECTORS

- A. Devices listed below are traditional wired devices. Contractor option to provide equivalent modular connector-type devices (Hubbell Snap Connect, Pass & Seymour Plug Tail, Leviton Lev-Lock, Copper ArrowLink) where applicable.
- B. Wiring devices with modular wiring type quick connectors shall comply with the following in addition to the above:
 - 1. Wired with #12 THHN Cu, solid, 3 or 4 wire as required for device, minimum 6" lead length.
 - 2. Connector contacts shall be crimped or welded.

2.4 RECEPTACLES

- A. Refer to Electrical Symbols List for device type.
- B. Devices that are shaded on the drawings shall be red.

- C. **[REC-DUP]:** NEMA 5-20R Duplex Receptacle:
1. 125-volt, 20 amp, 3-wire grounding type with impact resistant thermoplastic face and steel back strap.
 2. 125-volt, 20 amp, 3-wire grounding type with impact resistant thermoplastic face and brass back strap.
 3. Approved Manufacturers: Hubbell 5352, Leviton 5362-S, Pass & Seymour 5362, Cooper 5362.
- D. **[REC-DUP-GFI]:** NEMA 5-20R Ground Fault Duplex Receptacle:
1. 125-volt, 20 amp, 3-wire grounding type with test and reset buttons in impact resistant thermoplastic face.
 2. Device shall perform self-test of GFCI circuitry in accordance with UL 943.
 3. Approved Manufacturers: Hubbell GF20L, Leviton GFNT2, Pass & Seymour 2097, Cooper SGF20.
- E. **[REC-DUP-WP]:** NEMA 5-20R Weatherproof Ground Fault Duplex Receptacle:
1. 125-volt, 20 amp, 3-wire grounding type with test and reset buttons in impact resistant thermoplastic face. Provide NEMA 3R rated while-in-use cast aluminum cover.
 2. Device shall perform self-test of GFCI circuitry in accordance with UL 943.
 3. Approved Manufacturers: Hubbell GFTR20/(RW57300) WP826, Leviton GFWT2/(5977-CL) M5979, Pass & Seymour 2097TRWR/(WIUC10-C) WIUCAST1, Cooper WRS GF20/(WIU-1) WIUMV-1.
- F. **[REC-DUP-XP]:** NEMA 5-20R Explosion Proof Duplex Receptacle:
1. 125-volt, 20 amp, 3-wire grounding type, Class 1, Division 1 rated. Spring-loaded cover with gasket. Mount in cast box with threaded openings.
 2. Approved Manufacturers: Appleton EFSC175, Crouse-Hinds ENRC21201, Killark UGR5-20231.
- G. **[REC-ISO]:** NEMA 5-20R Isolated Ground Duplex Receptacle:
1. 125-volt, 20 amp, 3-wire grounding type with orange impact resistant thermoplastic face. Stainless coverplate with 'Isolated Ground' stenciled in black.
 2. Approved Manufacturers: Hubbell IG20, Leviton 5362-IG, Pass & Seymour IG5362, Cooper IG5362.
 3. 125-volt, 20-amp, tamper resistant, 3-wire grounding type with impact resistant thermoplastic face. One Type A USB charging rated at 5VDC 2.1A. One Two Type C USB charging rated at 5VDC 5.0A. Mounted in double gang backbox.
 4. Approved Manufacturers: Hubbell USB USB20C5
- H. **[REC-ARC]:** NEMA 5-20R Receptacle with Arc Fault Circuit Interrupts
1. 125-volt, 20 amp, 3-wire grounding type hospital grade, arc fault circuit interrupter receptacle with test and reset buttons in impact resistant thermoplastic face.
 2. Approved Manufacturers: Leviton AFTR2.

- I. **[REC-SIM-520R]:** NEMA 5-20R Simplex Receptacle:
1. 125-volt, 20 amp, 3-wire grounding type with impact resistant thermoplastic face.
 2. Approved Manufacturers: Hubbell HBL5361, Leviton, 5361, Pass & Seymour 5361, Cooper 5361.
- J. **[REC-SIM-530R]:** NEMA 5-30R Simplex Receptacle:
1. 125-volt, 30 amp, 3-wire grounding type, phenolic face.
 2. Approved Manufacturers: Hubbell HBL9308, Leviton 5371, Pass & Seymour 3802, Cooper 5716N.
- K. **[REC-SIM-550R]:** NEMA 5-50R Simplex Receptacle:
1. 125-volt, 50 amp, 3-wire grounding type, phenolic face.
 2. Approved Manufacturers: Hubbell HBL9360, Cooper 1253.
- L. **[REC-SIM-620R]:** NEMA 6-20R Simplex Receptacle:
1. 250-volt, 20 amp, 2-pole, 3-wire grounding type with thermoplastic face.
 2. Approved Manufacturers: Hubbell HBL5461, Leviton 5461, Pass & Seymour 5871, Cooper 5461.
- M. **[REC-SIM-630R]:** NEMA 6-30R Simplex Receptacle:
1. 250-volt, 30 amp, 2-pole, 3-wire grounding type with thermoplastic face.
 2. Approved Manufacturers: Hubbell HBL9330, Leviton 5372, Pass & Seymour 3801, Cooper 5700N.
- N. **[REC-SIM-650R]:** NEMA 6-50R Simplex Receptacle:
1. 250-volt, 50 amp, 2-pole, 3-wire grounding type with thermoplastic face.
 2. Approved Manufacturers: Hubbell HBL9367, Leviton 5374, Pass & Seymour 3804, Cooper 5709N.
- O. **[REC-SIM-1420R]:** NEMA 14-20R Simplex Receptacle:
1. 125/250-volt, 20 amp, 3-pole, 4-wire grounding type with thermoplastic face.
 2. Approved Manufacturers: Hubbell HBL8410, Pass & Seymour 3820, Cooper 5759.
- P. **[REC-SIM-1430R]:** NEMA 14-30R Simplex Receptacle:
1. 125/250-volt, 30 amp, 3-pole, 4-wire grounding type with thermoplastic face. Flush mounted at +24 AFF.
 2. Approved Manufacturers: Hubbell HBL9430A, Leviton 278, Pass & Seymour 3864, Cooper 5744N.
- Q. **[REC-SIM-1450R]:** NEMA 14-50R Simplex Receptacle:
1. 125/250-volt, 50 amp, 3-pole, 4-wire grounding type with thermoplastic face. Flush mounted at +4" AFF.

2. Approved Manufacturers: Hubbell HBL9450A, Leviton 279, Pass & Seymour 3894, Cooper 5754N.
- R. **[REC-SIM-1460R]:** NEMA 14-60R Simplex Receptacle:
1. 125/250-volt, 60 amp, 3-pole, 4-wire grounding type with thermoplastic face.
 2. Approved Manufacturers: Hubbell HBL9460A, Leviton 9460, Pass & Seymour, Cooper 9460N.
- S. **[REC-SIM-1520R]:** NEMA 15-20R Simplex Receptacle:
1. 250-volt, 20 amp, 3-phase, 3-pole, 4-wire grounding type with thermoplastic face.
 2. Approved Manufacturers: Hubbell HBL8420, Leviton, Pass & Seymour, Cooper.
- T. **[REC-SIM-1530R]:** NEMA 15-30R Simplex Receptacle:
1. 250-volt, 30 amp, 3-phase, 3-pole, 4-wire grounding type with thermoplastic face.
 2. Approved Manufacturers: Hubbell HBL8430A, Leviton 8430, Pass & Seymour 5740, Cooper 8430N.
- U. **[REC-SIM-1550R]:** NEMA 15-50R Simplex Receptacle:
1. 250-volt, 50 amp, 3-phase, 3-pole, 4-wire grounding type with thermoplastic face.
 2. Approved Manufacturers: Hubbell HBL8450A, Leviton 8450, Pass & Seymour 5750, Cooper 8450N.
- V. **[REC-SIM-1560R]:** NEMA 15-60R Simplex Receptacle:
1. 250-volt, 60 amp, 3-phase, 3-pole, 4-wire grounding type with thermoplastic face.
 2. Approved Manufacturers: Hubbell HBL9460A, Pass & Seymour 5760, Cooper 8460N.
- W. **[REC-SIM-L520R]:** NEMA L5-20R Simplex Receptacle, Locking Type:
1. 125-volt, 20 amp, 2-pole, 3-wire grounding type with impact resistant thermoplastic face.
 2. Approved Manufacturers: Hubbell, Leviton, Pass & Seymour L520, Cooper CWL520R.
- X. **[REC-SIM-L530R]:** NEMA L5-30R Simplex Receptacle Locking Type:
1. 125-volt, 30 amp, 2-pole, 3-wire grounding type with impact resistant thermoplastic face.
 2. Approved Manufacturers: Hubbell, Leviton, Pass & Seymour L530, Cooper CWL530R.
- Y. **[REC-SIM-L620R]:** NEMA L6-20R Locking Type Simplex Receptacle:
1. 250-volt, 20 amp, 2-pole, 3-wire grounding type with thermoplastic face.
 2. Approved Manufacturers: Hubbell HBL2320, Leviton 2320, Pass & Seymour L620R, Cooper CWL620R.
- Z. **[REC-SIM-L630R]:** NEMA L6-30R Locking Type Simplex Receptacle:
1. 250-volt, 30 amp, 2-pole, 3-wire grounding type with thermoplastic face.

2. Approved Manufacturers: Hubbell HBL2620, Leviton 2620, Pass & Seymour L630R, Cooper CWL630R.
- AA. **[REC-SIM-L1420R]:** NEMA L14-20R Locking Type Simplex Receptacle:
1. 125/250-volt, 20 amp, 3-pole, 4-wire grounding type with thermoplastic face.
 2. Approved Manufacturers: Hubbell HBL 2410, Pass & Seymour L1420, Cooper CWL1420R.
- BB. **[REC-SIM-L1430R]:** NEMA L14-30R Locking Type Simplex Receptacle:
1. 125/250-volt, 30 amp, 3-pole, 4-wire grounding type with thermoplastic face.
 2. Approved Manufacturers: Hubbell HBL 2710, Leviton 2710, Pass & Seymour L1430R, Cooper CWL1430R.
- CC. **[REC-SIM-L1520R]:** NEMA L15-20R Locking Type Simplex Receptacle:
1. 250-volt, 20 amp, 3-phase, 3-pole, 4-wire grounding type with thermoplastic face.
 2. Approved Manufacturers: Hubbell HBL2420, Leviton 2420, Pass & Seymour L1520R, Cooper CWL1520R.
- DD. **[REC-SIM-L1530R]:** NEMA L15-30R Locking Type Simplex Receptacle:
1. 250-volt, 30 amp, 3-phase, 3-pole, 4-wire grounding type with thermoplastic face.
 2. Approved Manufacturers: Hubbell HBL2720, Leviton 2720, Pass & Seymour L1530R, Cooper CWL1530R.
- EE. **[REC-SIM-L1620R]:** NEMA L16-20R Locking Type Simplex Receptacle:
1. 480-volt, 20 amp, 3-pole, 4-wire grounding type with thermoplastic face.
 2. Approved Manufacturers: Hubbell HBL2431, Pass & Seymour L1620R, Cooper CWL1620R.
- FF. **[REC-SIM-L1630R]:** NEMA L16-30R Locking Type Simplex Receptacle:
1. 480-volt, 30 amp, 3-pole, 4-wire grounding type with thermoplastic face.
 2. Approved Manufacturers: Hubbell HBL2730, Leviton 2730, Pass & Seymour L1630R, Cooper CWL1630R.
- GG. **[REC-SIM-L2120R]:** NEMA L21-20R Locking Type Simplex Receptacle:
1. 120/208Y 3 phase 20-amp 5 wire grounding type.
 2. Approved Manufacturers: Hubbell HBL2510, Cooper CWL2120R, Pass & Seymour L2120R.
- HH. **[REC-SIM-L2130R]:** NEMA L21-30R Locking Type Simplex Receptacle:
1. 120/208Y 3 phase 30-amp 5 wire grounding type.
 2. Approved Manufacturers: Hubbell HBL2750, Cooper CWL2130R, Pass & Seymour L2130R.

- II. **[REC-SIM-XP]:** NEMA 5-20R Explosion Proof Simplex Receptacle:
1. 125-volt, 20 amp, 3-wire grounding type, Class 1, Division 1, Group C rated. Factory sealed, dead end.
 2. Approved Manufacturers: Appleton CPE1-2375, Crouse-Hinds CPS152201, Killark KRS-215-220.
- JJ. **[REC-TAMP]:** NEMA 5-20R Tamper Resistant Duplex Receptacle:
1. 125-volt, 20 amp, 3-wire grounding type with impact resistant thermoplastic face.
 2. Approved Manufacturers: Hubbell BR20TR, Leviton TBR20, Pass & Seymour TR5362, Cooper TRBR20.
 3. Provide decorative style duplex tamper resistant receptacles in public spaces where walls are finished.
 4. Approved Manufacturers: (Decorative), Hubbell DR20TR, Leviton TDR20, Pass & Seymour TR2635.
- KK. **[REC-TAMP-GFI]:** NEMA 5-20R GFI Tamper Resistant Receptacle:
1. 125-volt, 20 amp, 3-wire grounding type tamper-resistant with test and reset buttons in impact resistant thermoplastic face.
 2. Device shall perform self-test of GFCI circuitry in accordance with UL 943.
 3. Approved Manufacturers: Hubbell GFTR20, Cooper TRSGF20, Pass & Seymour 2097TR, Leviton GFTR2.
- LL. **[REC-TAMP-QUAD]:** NEMA 5-20R Double Duplex Tamper Resistant Receptacle:
1. Consists of two duplex tamper resistant receptacles, double gang box, plaster ring and faceplate.
 2. Approved Manufacturers: Refer to Tamper Resistant Receptacle above.
- MM. **[REC-DUP-O]:** NEMA 5-20R Plug Load Controlled Duplex Receptacle:
1. 125-volt, 20 amp, 3-wire grounding type with impact resistant thermoplastic face and steel back strap. Bottom half of duplex shall be split circuit wired and controlled by remote relay. Controlled receptacle shall have permanent NEMA approved and NEC 2014 compliant marking on face of device.
 2. Approved Manufacturers: Pass & Seymour 5362H, Leviton 5362-1P, Hubbell, Cooper.
- NN. **[REC-QUAD-O]:** NEMA 5-20R Plug Load Controlled Duplex Receptacle:
1. Consists of two duplex tamper resistant receptacles, double gang box, plaster ring and faceplate.
 2. Approved Manufacturers: Refer to Plug Load Controlled Duplex Receptacles above.
- OO. **[REC-QUAD]:** NEMA 5-20R Double Duplex Receptacle:
1. Consists of two duplex receptacles, double gang box, plaster ring and faceplate.
 2. Approved manufacturers: Refer to Duplex Receptacle above.

- PP. **[REC-QUAD-GFI]:** NEMA 5-20R Double Duplex GFI Receptacle:
1. Consists of two duplex GFI receptacles, double gang box, plaster ring and faceplate.
 2. Approved Manufacturers: Refer to Duplex GFI Receptacle above.
- QQ. **[REC-QUAD-USB]:** NEMA 5-20R Double Duplex USB Receptacle:
1. Consists of two duplex USB receptacles, double gang box, plaster ring and faceplate.
 2. Approved Manufacturers: Refer to USB Receptacle above.
- RR. **[REC-QUAD-WP]:** NEMA 5-20R Weatherproof Ground Fault Quad Receptacle:
1. Consists of two duplex, GFI receptacles. Double gang box. Provide NEMA 3R rated while-in-use cast aluminum cover.
 2. Approved Manufacturers:
 - a. Receptacle: Refer to GFCI Receptacle above.
 - b. Cover: Intermatic WP1030MXD, Pass & Seymour WIUCAST2, Thomas & Betts Red Dot 2CKU.
- SS. Back wired devices shall be complete with eight holes that are screw activated with metal clamps for connection to #12 or #10 copper conductors.
- TT. Side wired devices shall have four binding screws that are undercut for positive wire retention.
- UU. Ground fault circuit interrupter (GFCI) receptacles shall comply with UL 943 requiring increased surge immunity, improved corrosion resistance, improved resistance to false tripping and diagnostic indication for miswiring if the line and load conductors are reversed during installation.
- VV. Isolated ground receptacles shall have the equipment ground contacts connected only to the green grounding screw terminal of the device with inherent electrical isolation from the mounting strap.
- WW. Hazardous (Classified) location receptacles shall comply with NEMA FB 11.

2.5 COUNTERTOP AND FURNITURE RECEPTACLE ASSEMBLIES

- A. **[REC-#]:** Pop-up Style Receptacle Assembly Listed for Countertop Applications.
1. 125-volt, 15/20-amp, tamper resistant, 3-wire grounding type with impact resistant thermoplastic face. Two (2) NEMA 5-15R/5-20R, with both simplex devices on same face or opposite face of assembly, gasketed countertop enclosure, UL 948 section 146 spill test. Architect to select finish from standard factory options. Device(s) installation, orientation, and finish shall be coordinated with Architect/Engineer prior to installation. Provide mockup installation for review and acceptance.
 2. Product Specific Coordination:
 - a. The Contractor shall provide provisions as required to maintain the product listing. Refer to the manufacturer's instructions for a complete list of product specific installation requirements.
 - b. Hubbell: Provide GFCI circuit breaker for overcurrent protection device serving branch circuit.

- c. Low Electric: Provide a REC-DUP-GFI in the cabinet cavity below the countertop for the device to plug into. Coordinate installation of the duplex device with the space available in the below countertop cabinet.
- d. Branch Circuit: Provide a 15A/1P circuit breaker for 15 amp rated devices served by a dedicated branch circuit.

3. Approved Manufacturers: Hubbell RCT200, Low Electric PUR20.

B. [REC-#]: Pop-up Style Receptacle Assembly Listed for Furniture Installation.

- 1. 125-volt, 15/20-amp, tamper resistant, 3-wire grounding type with impact resistant thermoplastic face. Two (2) NEMA 5-15R/5-20R, with both simplex devices on same face of assembly. Two (2) Type A USB charging rated at 5VDC 2.1A. Mounted in 5"x5"x5" maximum pop-up enclosure. Architect to select finish from standard factory options.
- 2. Device(s) installation, orientation, and finish shall be coordinated with Architect/Engineer prior to installation. Provide mockup installation for review and acceptance.
- 3. Product Specific Coordination:
 - a. The Contractor shall provide provisions as required to maintain the product listing. Refer to the manufacturer's instructions for a complete list of product specific installation requirements.
 - b. Hubbell: Provide a REC-DUP-GFI in the cabinet cavity below the countertop for the device to plug into. Coordinate installation of the duplex device with the space available in the below countertop cabinet.
 - c. Low Electric: Provide GFCI circuit breaker for overcurrent protection device serving branch circuit.
 - d. Wiremold: Provide GFCI circuit breaker for overcurrent protection device serving branch circuit.
 - e. Branch Circuit: Provide a 15A/1P circuit breaker for 15 amp rated devices served by a dedicated branch circuit.
- 4. Approved Manufacturers: Hubbell WSBUSB2X2, Wiremold DQFPUST, Low Electric PUFPC-2USB.

2.6 PIN AND SLEEVE DEVICES

A. Industrial heavy-duty pin and sleeve devices shall comply with IEC 309-1.

- 1. IEC rated pin and sleeve watertight IP67 receptacle, raintight screw cap with safety chain and matching plug.

B. [REC-Z#]: 120/208 and 277/480-volt, 30 amp, 3-pole, 4-wire Pin and Sleeve Receptacle:

- 1. Approved Manufacturers:

Voltage	Hubbell	Pass & Seymour	Cooper	Leviton
120/208	HBL530R9W / HBL530P9W	PS530R9W / PS530P9W	AH530R9W /AH530P9W	
277/480	HBL530R7W / HBL530P7W	PS530R7W / PS530P7W	AH530R7W /AH530P7W	

C. **[REC-Z#]**: 120/208 and 277/480-volt, 60 amp, 3-pole, 4-wire Pin and Sleeve Receptacle:

1. Approved Manufacturers:

Voltage	Hubbell	Pass & Seymour	Cooper	Leviton
120/208	HBL560R9W / HBL560P9W	PS560R9W / PS560P9W	AH560R9W /AH560P9W	
277/480	HBL560R7W / HBL560P7W	PS560R7W / PS560P7W	AH560R7W /AH560P7W	

D. **[REC-Z#]**: 120/208 and 277/480-volt, 100 amp, 3-pole, 4-wire Pin and Sleeve Receptacle:

1. Approved Manufacturers:

Voltage	Hubbell	Pass & Seymour	Cooper	Leviton
120/208	HBL5100R9W / HBL5100P9W	PS5100R9W / PS560P9W	AH560R9W /AH560P9W	
277/480	HBL5100R7W / HBL5100P7W	PS560R7W / PS560P7W	AH560R7W /AH560P7W	

E. **[REC-Z#]**: 480-volt, 60 amp, 4-pole, 4-wire Pin and Sleeve Simplex Receptacle:

1. Surface-mount enclosure with 15° mounting box, 1-1/2" conduit hub, raintight screw cap with safety chain.
2. Approved Manufacturers: Appleton ACRE6044-150, Crouse-Hinds ARE6475, Killark.

F. **[REC-Z#]**: 480-volt, 100 amp, 4-pole, 4-wire Pin and Sleeve Simplex Receptacle:

1. Surface-mount enclosure with 15° mounting box, 2" conduit hub.
2. Approved Manufacturers: Appleton ACJA-1044-200, Crouse-Hinds, Killark.

G. **[REC-Z#]**: 600-volt, 30 amp, 3-phase, 3-wire Pin and Sleeve Simplex Receptacle:

1. Provide with raintight, weatherproof enclosure.
2. Approved Manufacturers: Appleton ACR3033, Crouse-Hinds AR337, Killark.

2.7 FLOOR BOXES

A. Color: Verify with Architect.

B. Coordinate with Technology drawings for voice/data outlet requirements.

C. Floor Boxes for Installation in Cast-In-Place Concrete Floors: Fully adjustable, cast iron.

D. **[FB-#]**: Flush-mounted, round, cast iron floor box with one (1) **[REC-DUP]**. Fully adjustable, round brass cover with duplex flap cover and brass carpet flange.

1. Approved Manufacturers:

- a. Hubbell B2537 (Box), S3925 (Cover), S3082 (Flange), HBL5362 (Recept)
- b. Wiremold 880 CS1
- c. Steel City 602-SC / P60-DS

- E. **[FB-#]:** Fully adjustable cast iron floor box, dual compartment, flush mount, brass carpet flange. One compartment with brass 2-1/8" x 3/4" combination cover for power connections to partitions by others, connection wire by EC. One compartment with brass 1-1/2" x 1-1/2" duplex thread cover with one (1) 3/4" and one (1) 1" conduit stubbed to above the lay-in ceiling routed to the corridor cable tray.

1. Approved Manufacturers:

- a. Hubbell B4233 (Box), S2425 (Cover), S3625 (Cover), SB3085 (Flange)
- b. Wiremold 880CS2
- c. Steel City 642

- F. **[FB-#]:** Cast iron floor box, dual compartment, flush mount, brass carpet flange. One compartment with one (1) **[REC-DUP]** and brass duplex flap cover. One compartment with brass 2-1/8" x 3/4" combination cover and one (1) 3/4" and one (1) 1" conduit stubbed to above the lay-in ceiling routed to the corridor cable tray.

1. Approved Manufacturers:

- a. Hubbell B4233 (Box), S2425 (Cover), S3825 (Cover), SB3084 (Flange), 5362 (Receipt)
- b. Wiremold 880CS2
- c. Steel City 642

- G. **[FB-#]:** Recessed multi-service floor box - tele/power/data. Equivalent mounting space of four (4) single gang boxes consisting of one (1) **[REC-DUP]**, one (1) voice outlet, one (1) data outlet, and one (1) spare. Cast iron adjustable rectangular floor box with cover. Provide one (1) 1" conduit for information outlet cabling, one (1) 1" conduit for audio/visual cabling, and one (1) 1" conduit as spare. Route low voltage cabling conduits to above the lay-in ceiling the corridor cable tray.

1. Approved Manufacturers:

- a. Wiremold RFB4-CI
- b. Steel City 665-CI
- c. Hubbell LCFBCA

- H. **[FB-#]:** Three service floor box - tele/power/data. Equivalent mounting space of four (4) single gang boxes consisting of one (1) **[REC-DUP]**, one (1) voice outlet, one (1) data outlet, and one (1) spare. Steel adjustable rectangular floor box with flush cover. Provide one (1) 1" conduit for information outlet cabling, one (1) 1" conduit for audio/visual cabling, and one (1) 1" conduit as spare. Route low voltage cabling conduits to above the lay-in ceiling the corridor cable tray.

1. Approved Manufacturers:

- a. Wiremold RFB4
- b. Steel City 665
- c. Hubbell HBLCFB301BASE

2.8 SERVICE FITTING BOX

- A. **[FB-#]:** Service fitting style box with 1" chase nipple. Two (2) **[REC-DUP]**. Install back to back in box.

1. Approved Manufacturers:

- a. Hubbell SC-3099, (2)HBL5362, (2)S8
- b. Steel City SFH-50

B. **[FB-#]**: Cast aluminum service fitting style box mounted to underfloor duct. one (1) **[REC-DUP]**.

1. Approved Manufacturers:

- a. Walker Duct
- b. Square D
- c. Thomas & Betts

2.9 PEDESTAL STYLE BOX

A. **[REC-PED]**: Cast aluminum pedestal style box with 1" hub. One (1) **[REC-DUP]**. Install back to back in box. Provide stainless steel cover plates.

1. Approved Manufacturers:

- a. Hubbell SA6686, HBL5362, (2)Covers
- b. Thomas & Betts

B. **[REC-PED-QUAD]**: Cast aluminum pedestal style box with 1" hub. Two (2) **[REC-DUP]**. Install back to back in box. Provide stainless steel cover plates.

1. Approved Manufacturers:

- a. Hubbell SA6688, (2)HBL5362, (2)Covers
- b. Thomas & Betts

2.10 POKE-THROUGH FITTINGS

A. UL listed as fire-rated poke-through device for 1, 1-1/2 and 2 hour rated floors: include fire stops and smoke barriers in through-floor component. UL514A listed for scrub locations.

B. Terminate in 4-inch square by 2-1/2-inch deep junction box.

C. Suitable for installation with a floor thickness of 2-1/4 to 7 inches.

D. Semi-flush die-cast aluminum carpet flange.

E. Spring loaded receptacle covers.

F. Verify color with Architect.

G. **[REC-FB-#]**: Fire Rated Poke-Through:

- 1. Flush mounted. For use with 3-inch core holes. 125-volt, 20 amp, NEMA 5-20R duplex receptacle with 3/4" conduit and junction box. Provide with two (2) data jacks. With solid brass flange.
- 2. Approved Manufacturers: Hubbell PT2X2, Wiremold, Thomas & Betts.

H. **[REC-FB-#]**: Fire Rated Poke-Through:

- 1. Flush mounted. For use with 4-inch core holes. Provide with 125-volt, 20 amp, NEMA 5-20R duplex receptacles with 3/4" conduit and junction box. Provide with capacity for six data jacks and oversized conduit, with solid brass flange.
- 2. Cast aluminum cover with separate hinged doors to open 180°. Finish as selected by Architect.
- 3. Approved Manufacturers: Hubbell S1PT4X4, Wiremold, Thomas & Betts.

I. **[REC-FB-#]:** Fire-Rated Multi-Service Recessed Poke-Through:

1. Recessed mounted. For use with 6-inch core holes. Provide with two 125-volt, 20 amp, NEMA 5-20R duplex receptacles with 3/4" conduit and junction box. Provide with capacity for eight data jacks and 2" conduit.
2. Cast aluminum cover with separate hinged doors to open 180°. Finish as selected by Architect.
3. Approved Manufacturers: Hubbell S1R6 series, Wiremold 6AT series.

J. **[REC-FB-#]:** Fire-Rated Multi-Service Recessed 8" Poke-Through:

1. Recessed mounted. For use with 8-inch core holes. Provide with two (2) 125-volt, 20 amp, NEMA 5-20R duplex receptacles with 3/4" conduit and junction box. Provide with capacity for 12 data jacks and 2" conduit.
2. Cast aluminum cover with separate hinged doors to open 180°. Finish as selected by Architect.
3. Approved Manufacturers: Hubbell S1R8 series, Wiremold 8AT series.

2.11 PENDANT CORD/CONNECTOR DEVICES

- A. Description: Matching, locking type plug and receptacle body connector, NEMA WD 6, Configurations L5-20P and L5-20R, heavy-duty grade or refer to Details as shown on drawings.
1. Body: Nylon with screw-open cable gripping jaws and provisions for attaching external cable grip.
- B. External Cable Grip: Woven wire mesh type made of high strength galvanized steel wire stand, matched to cable diameter, and with attachment provision designed for corresponding connector.

2.12 CORD AND PLUG SETS

- A. Description: Match voltage and current ratings and number of conductors to requirements of equipment being connected.
1. Cord: Rubber-insulated, stranded copper conductors, with Type SOW-A jacket; with green insulated grounding conductor and equipment rating ampacity plus a minimum of 30 percent.
 2. Plug: Nylon body and integral cable-clamping jaws. Match cord and receptacle type for connection, FS/UL listed.

2.13 CORD REELS

- A. **[CR-#]:** 50' 3#12 AWG type 'SOW-A' cord with adjustable ball stop. 120 volt, NEMA 5-20R, simplex receptacle connector, rated 16 amps continuous.
1. Approved Manufacturers:
 - a. Daniel Woodhead 92433, 9521 w/ Hubbell 5369CY
 - b. Appleton RL153L
 - c. Hubbell HBL HBL45123C20

3. PART EXECUTION

3.1 INSTALLATION

- A. Install convenience receptacles at elevations indicated in the General Installation Notes on the contract drawings.
- B. Install specific-use receptacles at heights shown on the contract drawings. Install devices level, plumb, and square with building lines. Coordinate installation of adjacent devices of separate systems with common mounting heights, including lighting, power, systems, technology, and temperature control device rough-ins.
- C. Drill opening for poke-through fitting installation in accordance with manufacturer's instructions. This Contractor is responsible for taking any measures required to ensure no conduits or other services are damaged. This may include X-ray or similar non-destructive means.
- D. Install receptacles vertically with ground slot up or where indicated on the drawings, horizontally with ground slot to the left.
- E. Install decorative plates on switch, receptacle, and blank outlets in finished areas, using jumbo size plates for outlets installed in masonry walls.
- F. Install galvanized steel plates on outlet boxes and junction boxes in unfinished areas, above accessible ceilings, and on surface-mounted outlets.
- G. Install devices and wall plates flush and level.
- H. Install nameplate identification to receptacle cover plates indicated. Identification shall identify panel name and circuit number. Refer to Specification Section 26 05 53 - Electrical Identification.
- I. Test receptacles and modular wiring connectors for proper polarity, ground continuity and compliance with requirements.
- J. Healthcare devices shall be tested in accordance with NFPA 99 6.3.3 for grounding, voltage, and impedance measurements.
- K. Floor Box Installation:
 - 1. Set boxes level and flush with finish flooring material.
 - 2. Use cast iron floor boxes for installations in slab on grade. Trim shall match floor covering to be used.
 - 3. Provide a minimum horizontal offset of 24 inches between boxes.
 - 4. Provide saw-cutting and patching of existing concrete floors as necessary for floor box installations within existing floors.

END OF SECTION

SECTION 26 28 13

FUSES

1. PART GENERAL

1.1 SECTION INCLUDES

- A. Fuses
- B. Spare Fuse Cabinet

1.2 REFERENCES

- A. UL 198C - High-Interrupting Capacity Fuses; Current Limiting Types
- B. UL 198E - Class R Fuses
- C. FS W-F-870 - Fuseholders (For Plug and Enclosed Cartridge Fuses)
- D. NEMA FU 1 - Low Voltage Cartridge Fuses
- E. NFPA 70 – National Electrical Code
- F. CEC – California Electrical Code

1.3 SUBMITTALS

- A. Submit product data under provisions of Section 26 05 00.

1.4 EXTRA MATERIALS

- A. Provide two fuse pullers.
- B. Provide three of each size and type of fuse installed.

1.5 PROJECT CONDITIONS

- A. Where ambient temperature to which fuses are directly exposed is less than 40°F or more than 100°F, apply manufacturer's ambient temperature adjustment factors to fuse ratings.

2. PART PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS – FUSES

- A. Bussman, Division of Eaton
- B. Edison Fuse, Division of Cooper Industries
- C. Mersen
- D. Littelfuse Inc

2.2 FUSES

- A. Dimensions and Performance: NEMA FU 1, Class as specified or indicated.
- B. Voltage: Provide fuses with voltage rating suitable for circuit phase-to-phase voltage.
- C. Fuses with ratings larger than 600 amperes: Class L (time delay), unless otherwise noted on the drawings.
- D. Fuses with ratings larger than 200 amperes but equal to or less than 600 amperes: Class RK-1 (time delay), unless otherwise noted on the drawings.
- E. Fuses with ratings less than or equal to 200 amperes (not including control transformer fuses): Class RK-5, unless otherwise noted on the drawings.

- F. Control transformer fuses: Class CC (time delay).
- G. Fuses for packaged equipment: Size and type as recommended by equipment manufacturer.

2.3 SPARE FUSE CABINET

- A. Cabinet: Wall-mounted, 0.05-inch- thick steel unit with full-length, recessed piano-hinged door and key-coded cam lock and pull.
 - 1. Size: Adequate for storage of spare fuses specified with 15 percent spare capacity minimum.
 - 2. Finish: Gray, baked enamel.
 - 3. Identification: "SPARE FUSES" in 1-1/2-inch- high letters on exterior of door.
 - 4. Fuse Pullers: For each size of fuse.

3. PART EXECUTION

3.1 INSTALLATION

- A. Install fuses where indicated on the drawings and specifications.
- B. Install fuses in accordance with manufacturer's instruction.
- C. Install fuses in packaged equipment as required by equipment manufacturer.
- D. Install fuse with label oriented such that manufacturer, type, and size are easily read.
- E. Install spare fuse cabinet in the Main Electrical Room.

END OF SECTION

SECTION 26 28 16

DISCONNECT SWITCHES

1. PART GENERAL

1.1 SECTION INCLUDES

- A. Fusible switches
- B. Non-fusible switches
- C. Motor disconnect switch
- D. Mechanically interlocked disconnect
- E. Enclosures

1.2 RELATED SECTIONS AND WORK

- A. Refer to the Disconnect and Starter Schedule for rating and configuration.

1.3 REFERENCES

- A. NEMA KS 1 - Enclosed Switches

1.4 SUBMITTALS

- A. Submit product data under provisions of Section 26 05 00.
- B. Product Data: For each type of enclosed switch, circuit breaker, accessory and component indicated, include dimensions, weights, and manufacturer's technical data on features, performance, and ratings.
- C. Electrical Characteristics: For each type of enclosed switch, enclosure types, current and voltage ratings, short-circuit current ratings, UL listing for series rating of installed devices, features, characteristics, ratings, and factory settings of individual overcurrent protective devices and auxiliary components.

1.5 COORDINATION

- A. Coordinate layout and installation of switches, circuit breakers, and components with other construction, including conduit, piping, equipment, and adjacent surfaces. Maintain required workspace clearances and required clearances for equipment access doors and panels.

2. PART PRODUCTS

2.1 FUSIBLE AND NON-FUSIBLE SWITCHES

- A. **[FDS-#]:** Fusible Switch Assemblies: NEMA KS 1; Type heavy duty, quick-make, quick-break, load interrupter enclosed knife switch with externally operable handle interlocked to prevent opening front cover with switch in ON position. Handle lockable in OFF position. Fuse Clips: Class 'R' fuse clips only, unless indicated otherwise on the drawings.
- B. **[DS-#]:** Non-fusible Switch Assemblies: NEMA KS 1; Type heavy duty, quick-make, quick-break, load interrupter enclosed knife switch with externally operable handle interlocked to prevent opening front cover with switch in ON position. Handle lockable in OFF position.
- C. Enclosures: Type as indicated on the disconnect schedule.
- D. Accessories: As indicated on the disconnect schedule.

2.2 MOTOR DISCONNECT SWITCH

- A. **[DS-#]:** Rotary Switch Assemblies: Rated for making and breaking loads, rotary type enclosed switch with externally operable handle interlocked to prevent opening front cover with switch in ON position. Handle lockable in OFF position.
- B. Enclosures: Type as indicated on the Disconnect Schedule.
- C. Ground lug connection provided in enclosure.
- D. Accessories: As indicated on the Disconnect Schedule.
- E. Listed UL 508 suitable for motor control.

2.3 MECHANICALLY INTERLOCKED DISCONNECT

- A. **[DSS-#]:** Switch and Plug Assemblies: Rated for making and breaking loads, enclosed switch with externally operable interlock to prevent disconnecting receptacle with switch in ON position or inserting receptacle in ON position. Padlock lockable provision to meet OSHA lockout/tagout regulations.
- B. Enclosures: Type as indicated on the Disconnect Schedule.
- C. Ground lug connection provided in enclosure.
- D. Accessories: Matching male pin and sleeve plug, two auxiliary/pilot contacts.
- E. Listed UL 2682 suitable for motor disconnect.

3. PART EXECUTION

3.1 INSTALLATION

- A. Install disconnect switches where indicated on the drawings.
- B. Install fuses in fusible disconnect switches.
- C. Provide adhesive label on inside door of each switch indicating UL fuse class and size for replacement.

END OF SECTION

SECTION 26 29 23

VARIABLE FREQUENCY DRIVES

1. PART GENERAL

1.1 SECTION INCLUDES

- A. Variable frequency drives **[VFD-#]**

1.2 RELATED SECTIONS AND WORK

- A. Refer to the Variable Frequency Drive Schedule for rating and configuration.

1.3 REFERENCES

- A. ANSI/UL Standard 508
- B. ANSI/NEMA ICS 6 - Enclosures for Industrial Controls and Systems
- C. IEEE Standard 519-1992 - Guide for Harmonic Control and Reactive Compensation of Static Power Converters
- D. FCC Rules and Regulations, Part 15, Subpart J - Radio Frequency Interference

1.4 SUBMITTALS

- A. Submit shop drawings and product data under provisions of Section 26 05 00.
- B. Shop Drawings: Include front and side views of enclosures with overall dimensions and weights shown; conduit entrance locations and requirements; and nameplate legends.
- C. Product Data: Provide catalog sheets showing voltage, controller size, ratings and size of switching and overcurrent protective devices, short circuit ratings, dimensions, and enclosure details. Provide data as defined in section 26 05 48 Seismic Requirements for Equipment and Supports.
- D. Manufacturer's Installation Instructions: Indicate application conditions and limitations of use stipulated by Product testing agency specified under Regulatory Requirements. Include instructions for storage, handling, protection, examination, preparation, installation, and starting of Product.
- E. Provide harmonic distortion analysis of total service to prove variable frequency drives proposed do not exceed the latest version of IEEE 519 voltage and current distortion limits as shown in Table 10.2 and 10.3 at the point of common coupling (PCC). The PCC shall be defined as the consumer-utility interface or primary side of the main distribution transformer.

1.5 EXTRA MATERIAL

- A. Furnish under provisions of Section 26 05 00.
- B. Provide two of each air filter.
- C. Provide three of each fuse size and type.
- D. Provide two (2) spare variable frequency drives of the largest size and type scheduled for the Owner's maintenance stock.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Deliver, store, protect and handle products to site under provisions of Section 26 05 00.
- B. Accept controllers on site in original packing. Inspect for damage.

- C. Store in a clean, dry space. Maintain factory wrapping or provide an additional heavy canvas or heavy plastic cover to protect units from dirt, water, construction debris, and traffic.
- D. Handle in accordance with manufacturer's written instructions. Lift only with lugs provided for the purpose. Handle carefully to avoid damage.

1.7 OPERATION AND MAINTENANCE DATA

- A. Submit operation and maintenance data under provisions of Section 26 05 00.
- B. Maintenance Data: Include spare parts data listing, source and current prices of replacement parts and supplies, and recommended maintenance procedures and intervals.
- C. Operation Data: Include instructions for starting and operating controllers, and describe operating limits that may result in hazardous or unsafe conditions.
- D. Shop Drawings: For each VFD.
 - 1. Include dimensioned plans, elevations, sections, and details, including required clearances and service space around equipment. Show tabulations of installed devices, equipment features, and ratings. Include the following:
 - a. Each installed unit's type and details.
 - b. Nameplate legends.
 - c. Short-circuit current rating of integrated unit.
 - d. UL listing for series rating of overcurrent protective devices in combination controllers.
 - e. Features, characteristics, ratings, and factory settings of each motor-control center unit.
 - 2. Wiring Diagrams: Power, signal, and control wiring for VFDs. Provide schematic wiring diagram for each type of VFD.

2. PART PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS: Refer to Variable Frequency Drive Schedule.

2.2 DESCRIPTION

- A. Converts 60 Hertz input power at voltage specified to a variable AC frequency and voltage for controlling the speed of AC squirrel cage motors. The controller shall be suitable for use with standard NEMA B squirrel cage 1.15 service factor induction motors without requiring any modifications to the motor or the drive.
- B. Controller shall have sufficient capacity to provide speed control of the motors shown or noted throughout the specified environmental operating conditions.
- C. Controller shall have the functional components listed below:
 - 1. Door interlocked input circuit breaker/fused switch.
 - 2. Input rectifier section to supply fixed DC bus voltage.
 - 3. Smoothing reactor for DC bus.
 - 4. DC bus capacitors.
 - 5. Control transformer.
 - 6. Separate terminal blocks for power and control wiring.
 - 7. Terminal block for operator controls.
 - 8. Sine weighted PWM generating inverter section.

2.3 RATINGS

- A. Rated Input Voltage: Refer to Variable Frequency Drive Schedule.
- B. Motor Nameplate (Drive Output) Voltage: Refer to Variable Frequency Drive Schedule Refer to Mechanical Schedules.
- C. Displacement Power Factor: Between 1.0 and 0.95, lagging, over entire range of operating speed and load.
- D. Operating Ambient: 0°C to 40°C.
- E. Minimum Relative Humidity Range: 5% to 90% (non-condensing).
- F. Minimum Elevation without Derating: 3300 feet.
- G. Minimum Efficiency at Full Load: 96 percent.
- H. Overload Capability: 1.1 times the base load current for 60 seconds; 2.0 times the base load current for 3 seconds or 180% for 0.5 seconds.
- I. Starting Torque: 100 percent of rated torque or as indicated.
- J. Speed Regulation: Plus or minus 1 percent with no motor derating.

2.4 DESIGN

- A. Pulse Width Modulated (PWM) Variable Frequency Drives:
 - 1. Converter shall be of a diode bridge design with a sine-weighted PWM inverter section.
 - 2. Main semi-conductors in the inverter section of controller shall be IGBT transistors capable of a carrier switching frequency of up to 8 kHz. If derating of the inverter is necessary to run at 8kHz, then the unit's derated currents must equal or exceed the motor full load currents listed in NEC Table 430-150.
 - 3. All controllers supplied with semi-conductors capable of switching at less than 8,000 Hertz shall be supplied with a motor acoustic noise reduction filter.
 - 4. Pulse width modulated (PWM) drives shall be supplied with drive input line reactors with a minimum impedance of 3%. Reactors shall be installed to filter entire drive input circuit.
 - 5. Pulse width modulated (PWM) drives shall be supplied with drive input harmonic filter to reduce the total harmonic distortion to less than the IEEE519-1992 limits at the utility service entrance.
 - 6. Drives that are located beyond the manufacturer's recommended maximum distance from the motor shall be provided with dV/dt (long lead) filters.
- B. All drives shall have built-in diagnostic capability with status and fault indicators mounted on enclosure door. Complete operating instructions for diagnostics shall be mounted inside of the enclosure door.
- C. Drive shall restart after power loss and under-voltage fault. The minimum number of restart attempts required shall be three, field adjustable.
- D. The drive shall allow unlimited switching of the output without damage to the drive or motor.

2.5 PRODUCT FEATURES

- A. Display: Provide integral digital display to indicate all protection faults and drive status (including overcurrent, overvoltage, undervoltage, ground fault, overtemperature, phase loss, input power ON, output voltage, output frequency, and output current).
- B. Protection:
 - 1. Input transient protection by means of surge suppressors.
 - 2. Snubber networks to protect against malfunctions due to system transients,
 - 3. Under- and overvoltage trips; inverter overtemperature, overload, and overcurrent trips.
 - 4. Motor thermal overload relay(s) adjustable and capable of NEMA Class 10 motor protection and sized per motor nameplate data. When multiple motors are connected to the VFD output, each motor shall have a manual starter with properly sized overload protection.
 - 5. Notch filter to prevent operation of the controller-motor-load combination at a natural frequency of the combination.
 - 6. Instantaneous line-to-line and line-to-ground overcurrent trips on input and output.
 - 7. Loss-of-phase protection.
 - 8. Reverse-phase protection.
 - 9. Short-circuit protection (fuses or circuit breaker).
 - 10. Motor overtemperature fault.
- C. Acceleration Rate Adjustment: 0.5 - 30 seconds.
- D. Deceleration Rate Adjustment: 1 - 30 seconds.
- E. Minimum Adjustment Range for the Lower Output Frequency shall be: 0 to 40 Hertz.
- F. Minimum Adjustment Range for the Upper Output Frequency Range shall be: 40 to 90 Hertz.
- G. Minimum Volts/Hertz Range: 3.7 to 8.6 volts/Hertz.
- H. Provide MANUAL-OFF-AUTOMATIC selector switch and manual analog speed control mounted on the front of the enclosure.
- I. Safety Interlocks: Provide terminals for remote contact to inhibit starting under both manual and automatic mode.
- J. Control Interlocks: Provide terminals for remote contact to allow starting in automatic mode.
- K. Provide adjustable skip frequencies on the drive output (minimum of three ranges).
- L. Automatic Reset/Restart: Attempts three restarts after controller fault or on return of power after an interruption, and before shutting down for manual reset or fault correction. Bidirectional autospeed search shall be capable of starting into rotating loads spinning in either direction and returning motor to set speed in proper direction, without damage to controller, motor, or load.
- M. Power-Interruption Protection: After a power interruption, it prevents the motor from re-energizing until the motor has stopped.
- N. Torque Boost: Automatically varies starting and continuous torque to at least 1.5 times the minimum torque to ensure high-starting torque and increased torque at slow speeds.

- O. Motor Temperature Compensation at Slow Speeds: Adjustable current fallback based on output frequency for temperature protection of self-cooled, fan-ventilated motors at slow speeds.
- P. Status Lights: Door-mounted LED indicators shall indicate the following conditions:
 - 1. Power on.
 - 2. Run.
 - 3. Overvoltage.
 - 4. Line fault.
 - 5. Overcurrent.
 - 6. External fault.
- Q. Panel-Mounted Operator Station: Start-stop and auto-manual selector switches with manual speed control potentiometer and elapsed time meter.
- R. Indicating Devices: Meters or digital readout devices and selector switch, mounted flush in controller door and connected to indicate the following controller parameters:
 - 1. Output frequency (Hz).
 - 2. Motor speed (rpm).
 - 3. Motor status (running, stop, fault).
 - 4. Motor current (amperes).
 - 5. Motor torque (percent).
 - 6. Fault or alarming status (code).
 - 7. PID feedback signal (percent).
 - 8. DC-link voltage (VDC).
 - 9. Set-point frequency (Hz).
 - 10. Motor output voltage (V).
- S. Control Signal Interface:
 - 1. Electric Input Signal Interface: A minimum of 2 analog inputs (0 to 10 V or 0/4-20 mA) and 6 programmable digital inputs.
 - 2. Pneumatic Input Signal Interface: 3 to 15 psig.
 - 3. Remote Signal Inputs: Capability to accept any of the following speed-setting input signals from the BMS or other control systems:
 - a. 0 to 10-V dc.
 - b. 0-20 or 4-20 mA.
 - c. Potentiometer using up/down digital inputs.
 - d. Fixed frequencies using digital inputs.
 - e. RS485.
 - f. Keypad display for local hand operation.
 - 4. Output Signal Interface:
 - a. A minimum of 1 analog output signal (0/4-20 mA), which can be programmed to any of the following:
 - 1) Output frequency (Hz).
 - 2) Output current (load).
 - 3) DC-link voltage (VDC).
 - 4) Motor torque (percent).
 - 5) Motor speed (rpm).
 - 6) Set-point frequency (Hz).

5. Remote Indication Interface: A minimum of 2 dry circuit relay outputs (120-V ac, 1A) for remote indication of the following:
 - a. Motor running.
 - b. Set-point speed reached.
 - c. Fault and warning indication (overtemperature or overcurrent).
 - d. PID high- or low-speed limits reached.

- T. Communications: Provide a communications card to interface VFD with Facility Management Control System (FMCS). Coordinate interface requirements with the FMCS provided under Section 23 09 00. Interface shall allow all parameter settings of VFD to be programmed via FMCS control and displayed on FMCS operator workstation. Provide capability for VFD to retain these settings within the nonvolatile memory.

- U. Three- Contactor Automatic Bypass:
 1. Provide contactors, motor running overload protection, under-voltage and loss of phase protection, and short circuit protection for full voltage, non-reversing operation of the motor. Include isolation switch or third contactor to allow maintenance of inverter during bypass operation.
 2. All bypass circuitry shall be located within the same enclosure as the variable frequency drive.
 3. All fire alarm and/or smoke control interconnections (e.g., air handling unit shutdown) shall apply regardless of whether control is through VFD or bypass.
 4. Provide a Drive-Bypass Selector Switch.
 5. Provide nameplate with instructions for switching from drive to bypass and from bypass to drive. Provide instructions for isolating VFD for maintenance.

- V. Control:
 1. With the "Manual-Off-Auto" switch in the "Manual" position and, if applicable, the "Drive-Bypass" in the "Drive" position, the drive shall be controlled by the manual speed potentiometer on the drive door.
 2. With the "Manual-Off-Auto" switch in the "Auto" position and, if applicable, the "Drive-Bypass" in the "Drive" position, the drive shall be controlled by the input signal from an external source.
 3. If applicable, with the "Drive-Bypass" in the "Bypass" position, regardless the position of the "Manual-Off-Auto" switch, the motor shall be connected across the lines and shall be run at full speed.
 4. With the "Manual-Off-Auto" switch in the "Off" position, if applicable, the drive run circuit shall be open and the VFD shall not operate.
 5. If applicable, signal from the fire alarm control panel shall shut down VFD and bypass.
 6. All disconnect switches between VFD and motor(s) shall include an auxiliary contact interlock wired to the VFD fault trip input to shut down the drive upon opening of the disconnect main contacts.

2.6 ACCESSORIES

- A. Devices shall be factory installed in controller enclosure, unless otherwise indicated.

- B. All VFD supplied for fans shall have dynamic or DC injection braking capability to provide a means of rapid deceleration of the AC motor in not more than one (1) minute. Adjust controls to stop the motor within 30 seconds.
- C. All high inertia loads that cannot be stopped in 30 seconds with the VFD dynamic braking or DC injection braking shall be provided with a chopper module and dynamic braking resistor to stop the motor within 30 seconds.
- D. Push-Button Stations, Pilot Lights, and Selector Switches: NEMA ICS 2, heavy-duty type.
- E. Stop and Lockout Push-Button Station: Momentary-break, push-button station with a factory-applied hasp arranged so padlock can be used to lock push button in depressed position with control circuit open.
- F. Control Relays: Auxiliary and adjustable time-delay relays.
- G. Standard Displays:
 - 1. Output frequency (Hz).
 - 2. Set-point frequency (Hz).
 - 3. Motor current (amperes).
 - 4. DC-link voltage (VDC).
 - 5. Motor torque (percent).
 - 6. Motor speed (rpm).
 - 7. Motor output voltage (V).
- H. Historical Logging Information and Displays:
 - 1. Real-time clock with current time and date.
 - 2. Running log of total power versus time.
 - 3. Total run time.
 - 4. Fault log, maintaining last four faults with time and date stamp for each.
- I. Fabrication:
 - 1. Enclosure: NEMA 250, Type 1.
 - 2. Finish: Manufacturer's standard enamel.
- J. Forced Ventilation:
 - 1. Inlet filter, outlet filter.
 - 2. Blower fan sized to maintain VFD at rated operating temperatures for ambient conditions of enclosure location
 - 3. Provide forced ventilation as indicated on plans.

3. PART EXECUTION

3.1 FACTORY TESTING

- A. The VFD manufacturer shall provide certification that heat test has been completed.
- B. The Electrical Contractor shall have a factory service engineer present for the start-up, field calibration, and check-out of each VFD installed. Factory service engineer shall be required to return to the site for recalibration or set-up should unit not function as specified during system commissioning. All costs shall be a part of This Contract. Provide tag with date and signature of factory service Engineer on inside cover of each drive.

3.2 INSTALLATION

- A. Install variable frequency drive equipment in accordance with the manufacturer's instructions.

- B. Floor mount VFD on prefabricated or field fabricated supports with controls no higher than 6'-6" and no lower than 3'-0" AFF. Mount supports on 1/2" thick vibration isolation pads set on concrete housekeeping pads.
- C. Provide engraved phenolic nameplates under the provisions of Section 26 05 53.
- D. Connections: All conduit connections to the VFD shall be by flexible conduit.
- E. Input, output, and control wiring shall each be run in separate conduits.
- F. All interlocking required by the drive manufacturer shall be the responsibility of the Electrical Contractor.

3.3 STARTUP AND COMMISSIONING

- A. Verify all settings, parameters, and adjustments with other contractors prior to startup. Make all adjustments and setting to coordinate with controls and equipment.
- B. Accelerate the motor to full speed and verify operation. Decelerate the motor to a stop and verify operation. Slowly operate the motor over the speed range and check for resonance.
- C. Make all adjustments and settings to coordinate with controls and equipment prior to Substantial Completion. Verify that drive is set for auto restart after power loss and undervoltage fault.
- D. Document settings in the Operations and Maintenance manual.

END OF SECTION

SECTION 26 32 13

PACKAGED ENGINE GENERATOR SYSTEMS

1. PART GENERAL

1.1 SECTION INCLUDES

- A. Packaged engine generator system
- B. Exhaust silencer and fittings
- C. Remote annunciator panel
- D. Battery and charger
- E. Weatherproof enclosure

1.2 REFERENCES

- A. ANSI/NEMA 250 - Enclosures for Electrical Equipment (1000 Volts Maximum)
- B. ANSI/NEMA AB 1 - Molded Case Circuit Breakers
- C. ANSI/NEMA MG 1 - Motors and Generators
- D. NFPA 37 - Installation and Use of Stationary Combustion Engines and Gas Turbines
- E. CEC - California Electrical Code (CEC)
- F. NFPA 99 - Standard for Health Care Facilities
- G. NFPA 110 - Standard for Emergency and Standby Power Systems
- H. Environmental Protection Agency EPA Emission Standards for Compressed Ignition Engines
- I. Noise Emission: Comply with applicable state and local government requirements for maximum noise level at property boundaries due to sound emitted by the generator set, its components and the operation thereof.

1.3 SUBMITTALS

- A. Submit shop drawings and product data under provisions of Section 26 05 00.
- B. Submit shop drawings showing plan and elevation views with overall and interconnection point dimensions, fuel consumption rate curves at various loads, ventilation and combustion air requirements, and electrical diagrams including schematic and interconnection diagrams.
- C. Submit product data showing dimensions, weights, ratings, interconnection points, and internal wiring diagrams for engine, generator, control panel, battery, battery rack, battery charger, exhaust silencer, vibration isolators, day tank, remote radiator, and remote annunciator.
- D. Submit certificates for compliance with EPA Emissions Standards for Compressed Ignition Engines.
- E. Submit manufacturer's installation instructions under provisions of Section 26 05 00.

1.4 EXTRA MATERIALS

- A. Submit maintenance materials under provisions of Section 26 05 00.
- B. Furnish one set of tools required for preventative maintenance of the engine generator system. Package tools in adequately sized metal toolbox.
- C. Provide two additional sets of each fuel, oil, and air filter element required for the engine generator system. Provide additional fuel polishing filters for one year of operation.
- D. Provide one fuse for every type and rating used.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Deliver products to site under provisions of Section 26 05 00.

- B. Store and protect products under provisions of Section 26 05 00.
- C. Accept packaged engine generator set and accessories on site in crates and verify damage.
- D. Protect equipment from dirt and moisture by securely wrapping in heavy plastic.

1.6 SYSTEM DESCRIPTION

- A. Engine generator system to provide source of emergency and standby power.
- B. System Capacity: 150 KW, 187 KVA at an elevation of 1,000 feet above sea level, and ambient temperature between -20°F and 110°F; standby rating using engine-mounted radiator.
- C. Emergency Power Supply System (EPSS) shall be NFPA 110 Type 10 Class 8 Level 2.
- D. Operation: In accordance with ANSI/NFPA 99.

1.7 COORDINATION DRAWINGS

- A. Reference Coordination Drawings article in Section 26 05 00 for required generator electronic CAD drawings to be provided to Coordinating Contractor for inclusion into composite coordination drawings. Show generator, fuel system components, battery system components, and exhaust system in 1/4" scale plan of room.

1.8 PROJECT RECORD DOCUMENTS

- A. Submit record documents under provisions of Section 26 05 00.
- B. Accurately record location of engine generator and mechanical and electrical connections.

1.9 OPERATION AND MAINTENANCE DATA

- A. Submit operation and maintenance data under provisions of Section 26 05 00.
- B. Include instructions for normal operation, routine maintenance requirements, service manuals for engine and day tank, oil sampling and analysis for engine wear, and emergency maintenance procedures.

1.10 QUALIFICATIONS

- A. Manufacturer: Company specializing in packaged engine generator system with minimum five (5) years documented experience.
- B. Supplier: Authorized distributor of engine generator manufacturer with service facilities within 50 miles of the project site.

1.11 WARRANTY

- A. Provide a five (5) year warranty under provisions of Section 26 05 00.

1.12 MAINTENANCE SERVICE

- A. Furnish service and maintenance of packaged engine generator system for one (1) year from Date of Substantial Completion. Maintenance service shall be performed by skilled employees of manufacturer's designated service organization. Include quarterly exercising, and routine preventive maintenance as recommended by manufacturer and adjusting as required for proper operation. Maintenance agreements shall include parts, supplies, and labor.

2. PART PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

- A. Caterpillar.
- B. Cummins Power Generation.
- C. Kohler.
- D. MTU On Site Energy
- E. Generac
- F. GE Waukesha

2.2 **[GEN-#]:** PACKAGED ENGINE-GENERATOR SET

- A. Packaged engine-generator set shall be a coordinated assembly of compatible components.
- B. Safety Standard: Comply with ASME B15.1 and UL 2200.
- C. Nameplates: Each major system component shall be equipped with a nameplate to identify manufacturer's name and address, model and serial number, and component rating in integrated set and as required by the contract documents.
- D. Fabricate engine-generator set mounting frame and attachment of components to resist generator-set movement during a seismic event when generator-set mounting frame is anchored to building structure.
- E. Mounting Frame: Adequate strength and rigidity to maintain alignment of mounted components without depending on concrete foundation. Mounting frame shall be free from sharp edges and corners and shall have lifting attachments arranged for lifting with slings without damaging components. Provide a rigging diagram permanently attached to the mounting frame to indicate the capacity of each lifting attachment and the generator-set center of gravity.
- F. Maximum Dimensions: As indicated on drawings.

2.3 ENGINE

- A. Type: Water-cooled in-line or V-type, four-stroke cycle spark-ignition internal combustion engine.
- B. Rating: Sufficient to operate at 100 percent load for two hours at specified elevation and ambient limits.
- C. Fuel: Appropriate for use of No. 2 fuel oil.
- D. Engine Speed: 1800 RPM.
- E. Governor: Isochronous type with speed sensing.
- F. Safety Devices: Engine shutdown on high water temperature, low oil pressure, overspeed, and engine overcrank. Limits as selected by manufacturer.
- G. Frequency Response:
 - 1. Steady State Operational Bandwidth: 0.5 percent of rated frequency from no load to full load.
 - 2. Transient Response: Less than 5 percent for a 50 percent step-load increase or decrease. Frequency shall recover and remain within the steady state operating band within 5 seconds.
- H. Fuel System: Engine mounted diesel fuel pump and relief-bypass valve. Fuel shutoff solenoid valve, and flexible fuel connectors.

- I. Fuel Supply System: Comply with UL 142 fuel oil tank.
1. Base-Mounted Fuel Tank: UL 2080 listed fuel tank with 8 hour rated (NFPA 110 minimum run time by class) capacity. Integral rupture basin with leak detection. Provide fueling port with an overfill prevention type receptacle and lockable cap for exterior units. The tank shall include structural steel supports for top mounted engine generator set. Furnish complete with flexible fuel line connectors remote lockable cover, and analog level gauge. Furnish complete with float switches to indicate low 5% 25% 50% and 75% fuel level. The footprint of the base-mounted fuel tank shall not exceed the footprint of the generator frame for interior applications or the footprint of the enclosure for exterior installations.
 2. Fuel Cooler: Provide unit-mounted fuel cooler with all required hoses, fittings and mounting hardware. Generators without a unit-mounted radiator shall have an integral fan powered by a 120V circuit.
- J. Lubrication System: Engine or skid mounted filter and strainer, thermostatic control valve capable of full flow and designed to be fail safe, and crankcase drain arranged for gravity drainage with siphon or pump.
- K. Engine Jacket Heater: Thermal circulation type water heater with integral thermostatic control, sized to maintain engine jacket water at 90°F, and suitable for operation on 120 volts AC. The minimum wattage of the heater shall be watts or as recommended by the manufacturer.
- L. Cooling System: Closed loop, liquid cooled, with radiator factory mounted on engine-generator set mounting frame and integral engine-driven coolant pump.
1. Fan and Core: Nonferrous-metal construction sized to contain expansion of total system. Blower type fan, sized to maintain safe engine temperature in ambient temperature of 110°F. Radiator Airflow Restriction: 0.5 inches of water, maximum.
 2. Coolant: Solution of 50 percent ethylene-glycol-based antifreeze and 50 percent water, with anti-corrosive additives.
 3. Provide expansion tank with gage glass and petcock, and self-contained, thermostatic-control temperature control valve.
- M. Engine Starting: DC starting system with positive engagement, number and voltage of starter motors in accordance with manufacturer's instructions. Include remote starting control circuit, with MANUAL-OFF-REMOTE selector switch on engine-generator control panel. Provide the following accessories:
1. Battery: Voltage to match starter with capacity for three cranking cycles without recharge. Provide with battery cables and acid resistant battery tray.
 2. Battery-Charging Alternator: Factory mounted on engine with solid state voltage regulation.
 3. Remote Start Circuit Monitoring: Provide continuous monitoring of the generator start circuits. A failure shall initiate visual and audible alarms at the generator, remote annunciators, and start the generator.
 4. **[BC-#]:** Battery Charger: Current limiting type designed to float at 2.17 volts per cell and equalize at 2.33 volts per cell. Include overload protection, full wave rectifier, DC voltmeter and ammeter, and 120 volts AC fused input. Provide wall-mounted enclosure to meet ANSI/NEMA 250, Type 1 requirements.
 5. Provide two battery strings, two DC power supply/chargers with monitoring, and a best battery selector system. Each shall be sized to provide total starting capacity.

- 6. DC Power Supply/Charger: Utility grade current limiting type with battery temperature compensation designed to float at 2.17 volts per cell and equalize at 2.33 volts per cell. Include overload protection, full wave filtered rectifier, digital DC voltmeter and ammeter, and 120 volts AC fused input. Provide wall-mounted enclosure to meet ANSI/NEMA 250, Type 1 requirements
- 7. Best battery selector system for dual battery single load configuration. Solid-state design must isolate battery strings from each other.
- N. Exhaust System: Critical type silencer (85 dBA max at 10 feet) side inlet with muffler companion flanges and flexible stainless steel exhaust fitting, suitable for horizontal orientation, sized in accordance with engine manufacturer's instructions. Silencer shall include a threaded opening for connection of 3/4" drain line. Opening shall be flush on inside of silencer.
- O. The packaged engine generator shall comply with the current Environmental Protection Agency EPA and SCAQMD Emissions standards.
- P. Engine Accessories: Fuel filter, lube oil filter, intake air filter, lube oil cooler, fuel transfer pump, fuel priming pump, gear-driven water pump. Include fuel pressure gauge, water temperature gauge, and lube oil pressure gauge on engine-generator control panel.
- Q. Mounting: Provide unit with suitable spring-type vibration isolators.

2.4 GENERATOR

- A. Generator: ANSI/NEMA MG 1; three phase, re-connectible brushless synchronous generator with brushless exciter and PMG alternator excitation.
- B. Rating: As indicated on the drawings, at 0.8 power factor, 60 Hertz at RPM to match engine rating.
- C. Insulation: ANSI/NEMA MG 1, Class H.
- D. Temperature Rise: 105°C continuous.
- E. Enclosure: ANSI/NEMA MG 1; open drip-proof.
- F. Voltage Regulation:
 - 1. The maximum instantaneous voltage dip (IVD) shall be 30 percent for building loads.
 - 2. Include solid-state type voltage regulator, separate from exciter to match engine and generator characteristics, with voltage regulation ± 1 percent from no load to full load. Include manual controls to adjust voltage drop ± 5 percent voltage level, and voltage gain.
- G. Subtransient Reactance (X'd): Maximum 15 percent.
- H. Windings: Two-thirds pitch stator winding and fully linked amortisseur winding.
- I. Strip Heater: Thermostatically controlled unit arranged to maintain stator windings above dew point.

2.5 CONTROLS AND INDICATION

- A. Operating and safety indications, protective devices, basic system controls, and engine gauges shall be grouped in a common control and monitoring panel mounted on the generator set. Mounting method shall isolate the control panel from generator-set vibration.

- B. Ground Fault: Provide ground fault sensing at the generator. The sensor shall be located ahead of the generator service disconnect. Provide a ground fault indication on the engine-generator control panel. Provide an instruction nameplate at the control panel.
1. Instruction nameplate: Provide operational instructions for a ground fault indication as approved by the local Authority Having Jurisdiction.
- C. **[GCP-#]:** Engine-Generator Control Panel: ANSI/NEMA 250, Type 1 generator mounted control panel enclosure with engine and generator controls and indicators. Include provision for padlock and the following equipment and features:
1. Alarm indication as required by NFPA 110 for a Level 2 system.
 2. AC frequency meter.
 3. AC output voltmeter with phase selector switch.
 4. AC output ammeter with phase selector switch.
 5. Output voltage adjustment.
 6. DC voltmeter (alternator battery charging).
 7. Engine start/stop selector switch.
 8. Engine running time meter.
 9. Oil pressure gauge.
 10. Engine coolant temperature gauge.
 11. Shut down devices for overspeed, coolant high-temperature, coolant low-level, and oil low-pressure.
 12. Fuel derangement alarm.
 13. Generator overload.
 14. Auxiliary Relay: 3PDT, operates when engine runs, with contact terminals prewired to terminal strip.
 15. Remote Alarm Contacts: Pre-wire SPST contacts to terminal strip for remote alarm functions required by ANSI/NFPA 99.
 16. Ground fault indication.
 17. Generator control and start signal failure.
 18. 80% load alarm.
 - 19.
 20. Key switch, three-position selection switch.
- D. **[GAP-#]:** Remote Engine Annunciator Panel: ANSI/NFPA 99 and NFPA 110 for a Level 2 system. Include the listed pre-alarm and alarm points, audible alarm, alarm silencing means, repetitive alarm circuitry, and lamp test switch in a flush mounted panel with custom color painted finish. Provide all interconnecting wiring in conduit per manufacturer's requirements by the Electrical Contractor. The remotely reported alarms shall include the following.
1. Overcrank
 2. Low water (engine) temperature
 3. High engine temperature pre-alarm
 4. High engine temperature
 5. Low lube oil pressure pre-alarm
 6. Low lube oil pressure
 7. Overspeed
 8. Low fuel main tank
 9. Low coolant level
 10. Not in auto
 11. Emergency Power Supply (EPS) supplying load
 12. High battery voltage
 13. Low battery voltage
 14. Battery charger failure (includes AC failure)
 15. Generator running
 16. Normal utility power
 17. Emergency stop
 18. Rupture basin alarm
 19. Emergency Power Off Switch activated (EPO)
 20. Alarm for power supply or UPS serving motorized breakers
 21. Generator control and start signal failure.

22. 80% load alarm.

E. Building Automation System Integration:

1. Provide a terminal block to allow the Facility Monitoring and Control System (FMCS) to report generator alarms. Provide individual terminal points for each of the annunciator alarms and pre-alarms. Provide an additional terminal point to combine all generator alarms under a single terminal point. Provide a permanent label for each terminal point. Each terminal will provide a binary output for the FMCS to read. Refer to Specification Section 23 09 00 for alarms reported by the FMCS.

2.6 ACCESSORIES

- A. Generator Circuit Breaker: Molded or insulated case, service-rated electronic trip type; 100% rated breaker complying with NEMA AB1 and UL 489. The disconnect shall simultaneously open all associated ungrounded conductors and be lockable in the open position.
1. Tripping Characteristic: Designed specifically for generator protection.
 2. Trip Rating: Matched to generator rating.
 3. Shunt Trip: Connected to trip breaker when generator is shut down by other protective devices.
 4. Mounting: Provide freestanding enclosure or mount integrally with control and monitoring panel.
 5. The disconnecting means shall also shut down the prime mover, disable all start control circuits, and be configured with a mechanical reset.
 6. Arc Energy Reduction: Provide an arc energy reduction system to reduce the clearing time of an arc flash event. The arc energy system shall be provided for overcurrent protection devices rated 1,200 amps or larger.
- B. **[EPO]:** Remote Manual Stop Station (Emergency Power Off EPO): Provide a remote manual stop station with weather proof stainless steel or die cast housing, red mushroom button - push to stop operation, breakable cover/lens to access mushroom button, 120-volt rated. The manufacturer shall provide automatic monitoring of the EPO switch. Placing the EPO switch in the "Generator Powered OFF" status shall initiate a visual and audible alarm at each generator annunciator panel.
- C. Remote Fuel Fill Station: Provide a remote fuel fill station including a fill port within a surface-mounted, lockable, NEMA 3R stainless steel construction with gasketed hinged door and lockable handle. The fill port shall have a minimum overflow holding capacity of five (5) gallons. The fill port inside the cabinet shall be field coordinated. Provide dust cover for fill connection. Include local light and horn alarm with test switch and silence feature when tank level is above 95 percent full. Provide additional float switch in tank for level indication. Include the following accessories:
1. Solenoid valve to prevent additional fuel delivery to the tank when full; 120-volt power provided by Contractor.
 2. Lockable drain valve for overflow.
 3. Local analog gauge of main tank fuel level.
 4. Local digital gauge of main tank fuel level.
- D. Provide primary fuel filters in addition to secondary fuel filters.
- E. Provide dual redundant engine starters. The redundant engine starters shall be configured to start the engine when the primary engine starter fails.

2.7 OUTDOOR GENERATOR-SET ENCLOSURE SKIN-TIGHT

A. Prefabricated or pre-engineered skintight enclosure with the following features:

1. Construction: Reinforced galvanized steel, metal clad, integral structural steel framed housing anchored to a concrete foundation. Panelized aluminum housing with integral structural framing anchored to a concrete foundation. Construction shall allow access to control panels and service points. The panels shall enclose all components, including intake/exhaust louvers and sound attenuators. Extend the enclosure base frame as required for panels.
2. The generator control panel shall be located no greater than 5'-0" above finished grade for ease of access.
3. Structural Design and Anchorage: Wind resistant up to 100 mph.
4. Louvers: Equipped with bird screen and filter arranged to permit air circulation when engine is not running while excluding exterior dust, birds, and rodents. Motor operators shall be spring open, power close operating at 24 volts DC. The louvers shall be connected to the generator starting batteries through appropriate control relays. Louvers shall not extend outside main generator enclosure.
5. Hinged Doors: Provide a minimum of four doors with padlocking provisions. Single doors shall be 36" wide and 84" high. Double doors shall be 60" wide and 84" high. As standard, doors shall include rain-rail moldings above all door openings, recessed, keyed mortise locks, panic bar door hardware and full weather-stripping. Doors shall be removable.
6. Thermal Insulation: Manufacturer's standard materials and thickness selected in coordination with space heater to maintain winter interior temperature within operating limits as required by engine-generator-set components.
7. Fuel Tank Vent: Provide vent piping from the fuel tank to the exterior of the enclosure.
8. Fuel Fill: Provide fill access on the exterior of the enclosure at an elevation not to exceed 5'-0" above finished grade.
9. The exhaust system silencer shall be installed within the enclosure housing.
10. Acoustical Treatment: Provide acoustical treatment of the generator enclosure including wall panels, intake and exhaust air paths, ventilation openings, and tailpipe exhaust. Maximum sound level horizontally from the generator set shall be 85 dBA at 10 feet in a hemispherical free field in the configuration shown on the drawings. Sound attenuators shall be concealed within the enclosure panels. Panels shall extend from the enclosure base frame to the height of the generator section.

2.8 SITE COORDINATION

- ### A. Generator to property line distance: As indicated on drawings.

2.9 PARTICULATE FILTER

- ### A. Provide particulate filter to match generator sizing in compliance with SCAQMD requirements.
- ### B. Locate filter integral to the generator system housing.

3. PART EXECUTION

3.1 EXAMINATION

- ### A. Verify that surfaces are ready to receive work and field dimensions are as shown on the drawings.

- B. Verify that required utilities are available in proper location and ready for use.
- C. Beginning of installation means installer accepts existing conditions.

3.2 INSTALLATION

- A. Install in accordance with manufacturer's instructions.
- B. Install remote manual stop station in location shown on plans. Provide 120 Volt power and wiring in conduit as required. Coordinate installation with the manufacturer approved shop drawings and wiring diagrams. The remote manual stop station shall shunt trip the generator mounted circuit breaker and signal the engine prime mover to stop.
- C. The A-B-C phase rotation of the generator source shall match the A-B-C phase rotation of the utility source. The Contractor shall verify the generator and utility phase rotation match to prevent three phase motors and similar loads from operating backwards while being served by the generator.

3.3 FIELD QUALITY CONTROL

- A. Field inspection and testing will be performed under provisions of Section 26 05 00 and in compliance with NFPA 110 requirements.
- B. Provide portable test bank for full load test, if required. Simulate power failure including operation of transfer switch, automatic starting cycle, and automatic shutdown, and return to normal.
- C. Fill fuel tank prior to start of test.
- D. The on-site installation test shall be conducted as follows:
 - 1. With the prime mover in a "cold start" condition and the emergency load at standard operating level, a primary power failure shall be initiated by opening all switches or breakers supplying the primary power to the building or facility.
 - 2. The test load shall be that load that is served by the Emergency Power Supply System (EPSS).
 - 3. The time delay on start shall be observed and recorded.
 - 4. The cranking time until the prime mover starts and runs shall be observed and recorded.
 - 5. The time taken to reach operating speed shall be observed and recorded.
 - 6. The voltage and frequency overshoot shall be recorded.
 - 7. The time delay on transfer to emergency power for each switch shall be recorded. Life safety and critical branch transfer switches must transfer within 10 seconds.
 - 8. The time taken to achieve a steady-state condition with all switches transferred to the emergency position shall be observed and recorded.
 - 9. The voltage, frequency, and amperes shall be recorded.
 - 10. The prime mover oil pressure and water temperature shall be recorded, where applicable.
 - 11. The battery charge rate shall be recorded at 5-minute intervals for the first 15 minutes and at 15-minute intervals thereafter.
 - 12. When primary power is returned to the building or facility, the time delay on retransfer to primary for each switch with a minimum setting of 5 minutes shall be recorded.

13. The time delay on the prime mover cool down period and shutdown shall be recorded.
 14. Allow prime mover to cool for 5 minutes.
 15. A load shall be applied for 4 hours total. The building load shall be permitted to serve as part or all of the load, supplemented by a load bank of sufficient size to provide a load equal to 100 percent of the nameplate rating of the Emergency Power Supply (EPS), less applicable derating factors for site conditions. Observe and record load changes and the resultant effect on voltage and frequency.
 16. The full load test shall be initiated immediately after the cooling time has expired by any method that starts the prime mover and, immediately upon reaching rated rpm, picks up 100 percent of the nameplate kW rating on one step, less applicable derating factors for site conditions.
 17. During test, record the following at 5-minute intervals for the first 15 minutes and every 15 minutes for the rest of the test:
 - a. Kilowatts
 - b. Amperes
 - c. Voltage
 - d. Frequency
 - e. Coolant temperature
 - f. Enclosure temperature (interior)
 - g. Oil pressure
 - h. Engine exhaust temperature
 - i. Engine inlet temperature
 - j. Oil Temperature
 - k. Battery charge rate
 18. Upon completion of the test and after a cool down period, the crank/rest cycle shall be tested.
 - a. Any method recommended by the manufacturer for the cycle crank test shall be utilized to prevent the prime mover from running.
 - b. The control switch shall be set at "run" to cause the prime mover to crank.
 - c. The complete crank/rest cycle shall be observed and recorded.
 19. Test alarm and shutdown circuits by simulating conditions.
- E. Contractor shall fill fuel tanks upon completion of test.
- F. Testing documentation shall be submitted to the Architect/Engineer for review and approval.
- G. Generator testing worksheets are included with this specification section.

3.4 MANUFACTURER'S FIELD SERVICES

- A. Prepare, start, test, and adjust systems under provisions of Section 26 05 00.

3.5 ADJUSTING

- A. Adjust generator output voltage and engine speed.

3.6 CLEANING

- A. Clean work under provisions of Section 26 05 00.
- B. Clean engine and generator surfaces. Replace oil and fuel filters.

3.7 DEMONSTRATION

- A. Provide systems demonstration. Coordinate the demonstration schedule with the Owner and Architect/Engineer.
- B. Describe loads connected to emergency and standby systems and restrictions for future load additions.
- C. Simulate power outage by interrupting normal source and demonstrate that system operates to provide emergency and standby power.

END OF SECTION

DATE: _____
 CUSTOMER: _____
 ENGINE MODEL: _____
 GENERATOR MODEL: _____
 UNIT RATING: _____

W.O.# _____
 S/N: _____
 S/N: _____
 PKG _____

BATTERY VOLT: 24
 VOLTAGE: 480
 FUEL TYPE: Diesel
 TESTED BY: _____

kW: 1250
 KVA: 1563
 PHASE: 3
 HERTZ: 60
 RPM: 1800

ELAPSED TIME	DURATION	1	2	3	1	2	3		TARGET			HOUR		OIL	FUEL	AMBIENT	ENGINE	EXHAUST		ENGINE		COOLANT		COOLANT	
		VOLTS	VOLTS	VOLTS	AMPS	AMPS	AMPS	KW	KW	HZ	RPM	METER	P.F.	PRESS.	PRESS.	AIR TEMP.	WATER TEMP.	TEMP		OIL TEMP.	IN.HG	AT HEAT EXCH. OR RADIATOR		AT THE ENGINE	
0:10	0:10								313																
0:20	0:10								625																
0:40	0:20								1,250																
1:00	0:20								1,250																
1:20	0:20								1,250																
1:40	0:20								1,250																
2:00	0:20								1,250																
2:20	0:20								1,250																
2:40	0:20								1,250																
3:00	0:20								1,250																
3:20	0:20								1,250																
3:40	0:20								1,250																
4:00	0:20								1,250																
4:10	0:10								1,375																
4:20	0:10								625																
4:25	0:05								-																

Load Profile Time Load %
 10 Min 25%
 10 Min 50%
 4 Hours 100%
 10 Min 110%
 10 Min 50%
 5 Min 0%

SECTION 26 36 00

TRANSFER SWITCH

1. PART GENERAL

1.1 SECTION INCLUDES

- A. Automatic transfer switch **[ATS-#]**
- B. Remote annunciator for ATS **[RA-ATS-#]**

1.2 RELATED SECTIONS AND WORK

- A. Refer to the Transfer Switch Schedule for rating and configuration.

1.3 QUALITY ASSURANCE

- A. Manufacturer: Company specializing in automatic transfer equipment with three (3) years documented experience.

1.4 REFERENCES

- A. NEMA ICS 1 - General Standards for Industrial Control and Systems
- B. NEMA ICS 2 - Standards for Industrial Control Devices, Controllers, and Assemblies
- C. NEMA ICS 2-447 - AC Automatic Transfer Switches
- D. NEMA ICS 6 - Enclosures for Industrial Controls and Systems
- E. UL 1008 - Standard for Automatic Transfer Switches

1.5 SUBMITTALS

- A. Submit shop drawings and product data under provisions of Section 26 05 00.
- B. Submit product data for transfer switches showing overall dimensions, electrical connections, electrical ratings, and environmental requirements.
- C. Submit manufacturer's installation instructions under provisions of Section 26 05 00.

1.6 OPERATION AND MAINTENANCE DATA

- A. Submit operation and maintenance data under provisions of Section 26 05 00.
- B. Include instructions for operating equipment.
- C. Include instructions for operating equipment under emergency conditions when engine generator is running.
- D. Identify operating limits which may result in hazardous or unsafe conditions.
- E. Document ratings of equipment and each major component.
- F. Include routine preventive maintenance and lubrication schedule.
- G. List special tools, maintenance materials, and replacement parts.

1.7 REGULATORY REQUIREMENTS

- A. Conform to applicable code for emergency and standby electrical systems.

2. PART PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

- A. As scheduled on the drawings.

2.2 AUTOMATIC TRANSFER SWITCH

- A. Description: NEMA ICS 2; automatic transfer switch.
- B. Configuration: Electrically-operated, mechanically-held transfer switch.
- C. Control panel shall be micro-processor based.

2.3 SERVICE CONDITIONS

- A. Service Conditions: NEMA ICS 1.

2.4 RATINGS

- A. Refer to the one-line diagrams for the available interrupting capacity (AIC) of the transfer switch. The transfer switch shall be series rated with the equipment feeding the transfer switch. The series rating shall be the larger of the two AIC values when the AIC rating of the equipment feeding the normal and emergency sides of the transfer switch is not equal.
- B. Series rating with upstream devices shall be allowed per UL-1008.

2.5 AUTOMATIC SEQUENCE OF OPERATION

- A. Initiate Time Delay to Start Alternate Source Engine Generator: Upon initiation by normal source monitor.
- B. Time Delay to Start Alternate Source Engine Generator: 0 to 10 seconds, adjustable.
- C. Initiate Transfer Load to Alternate Source: Upon initiation by normal source monitor and permission by alternate source monitor.
- D. Time Delay Before Transfer to Alternate Power Source: 0 to 30 seconds, adjustable.
- E. Initiate Retransfer Load to Normal Source: Upon permission by normal source monitor.
- F. Time Delay Before Transfer to Normal Power: 0 to 30 minutes, adjustable; bypass time delay in event of alternate source failure.
- G. Time Delay Before Engine Shut Down: 0 to 30 minutes, adjustable, of unloaded operation.

2.6 ENCLOSURE

- A. Enclosure: NEMA ICS 6; Type 1.
- B. Maximum Dimensions: As indicated on drawings.

2.7 ACCESSORIES

- A. Load Shed:
 - 1. The controller shall be capable of being programmed to automatically shed the connected load from the generator in the event of a user configurable under- frequency, under-voltage or overload condition. Under-frequency shedding shall occur if generator is less than 58Hz for greater than 3 seconds or less than 50 Hz for greater than 0.5 seconds.

2. Switch shall be configurable to pick up an output status relay upon activation of the auto load shed feature. Output shall be usable to trip/isolate downstream loads in the event of an overload.
 3. Reset of the auto load shed function shall be via operator reset on display, remote reset contact input, or via network signal.
- B. Indicating Lights: Mount in cover of enclosure to indicate NORMAL SOURCE AVAILABLE, ALTERNATE SOURCE AVAILABLE, SWITCH POSITION.
 - C. Test Switch: Key operated or password protected switch. Mount in cover of enclosure to simulate failure of normal source.
 - D. Engine Start Signal: Rated 10 amps at 30VDC shall be provided to start the engine generator in the event of a normal source outage.
 - E. Remote Start Circuit Monitoring: Provide continuous monitoring of the generator start circuits. A failure shall initiate visual and audible alarms at the generator, remote annunciators, and start the generator.
 - F. Return to Normal Switch: Mount in cover of enclosure to initiate manual transfer from alternate to normal source.
 - G. Transfer Switch Auxiliary Contacts: 2 normally open; 2 normally closed indicating switch to normal source or emergency source.
 - H. Normal Source Monitor: Monitor each line of normal source voltage and frequency; initiate transfer when voltage drops below 85 percent or frequency varies more than 3 Hertz from rated nominal value, values shall be field adjustable.
 - I. Alternate Source Monitor: Monitor each line of alternate source voltage and frequency; inhibit transfer when voltage is below 85 percent or frequency varies more than 3 percent Hertz from rated nominal voltage, values shall be field adjustable.
 - J. Engine Exerciser: Start engine every 14 days. Run for 30 minutes before shutting down. Each event shall be configurable for Test with Load or Test Without Load. Bypass exerciser control if normal source fails during exercising period.
 - K. In-Phase Monitor: Inhibit transfer until source and load are within 30 electrical degrees.
 - L. Provide 2 N.O. and 2 N.C. isolated contacts to indicate:
 1. Normal source available.
 2. Emergency source available.
 3. Exercise mode in operation.
 - M. Serial Communication Port: Two twisted pairs of shielded communication cable in conduit shall daisy chain all transfer switches with a remote annunciator.
 - N. **[RA-ATS-#]** Remote Annunciator: A remote annunciator shall be provided that shall monitor and control the following functions for each transfer switch:
 1. Load Connect to Emergency/Normal Indication
 2. Source Available: Emergency/Normal Indication
 3. Time Delay Indication and Key Locked Bypass Switch
 4. Transfer Test Indication and Key Locked Switch
 5. Remote transfer loads between normal and emergency sources with Key Locked Switch
 6. Remote generator start with Key Locked Switch
 7. Remote generator stop with Key Locked Switch

Annunciators shall be located where shown on the drawings, as directed by the Owner. Extend conduit and wire as required by the manufacturer.

- O. An adjustable emergency to normal pre-signal signal to elevator controller.
- P. Metering Capabilities: The following metered readings shall be available at the local display.
 - 1. Current, per phase RMS and neutral
 - 2. Current unbalance %
 - 3. Voltage, phase-to-phase and phase-to-neutral
 - 4. Voltage unbalance %
 - 5. Real power (KW), per phase and 3-phase total
 - 6. Apparent power (KVA), per phase and 3-phase total
 - 7. Reactive power (KVAR), per phase and 3-phase total
 - 8. Power factor, 3-phase total & per phase
 - 9. Frequency
 - 10. Accumulated energy, (KWH, KVAH, and KVARH)
 - 11. Demand, (KWH, KVA)

3. PART EXECUTION

3.1 EXAMINATION

- A. Verify that surfaces are ready to receive work.
- B. Verify field measurements are as instructed by the manufacturer.
- C. Verify that required utilities are available, in proper location, and ready for use.
- D. Beginning of installation means acceptance of existing conditions.

3.2 INSTALLATION

- A. Install in accordance with manufacturer's instructions.
- B. Provide wiring to elevator controller for emergency source mode and emergency to normal pre-signal.

END OF SECTION

SECTION 26 43 00

SURGE PROTECTION DEVICES

1. PART GENERAL

1.1 SECTION INCLUDES

- A. This section describes materials and installation requirements for factory and field wired low voltage surge protection devices (SPD) for the protection of all AC electrical circuits. SPD equipment to be installed at designated service entrance equipment, distribution panels and electronic equipment.

1.2 QUALITY ASSURANCE

- A. The specified unit shall be designed, manufactured, tested and installed in compliance with the above references. The unit shall be "Listed by Underwriters Laboratories" to UL 1449.
- B. Each unit shall be designed and manufactured by a qualified manufacturer of power conditioning equipment. The qualified manufacturer must have been engaged in the design and manufacture of such products for a minimum of five years.

1.3 REFERENCES

- A. ANSI/IEEE C62.33 – IEEE Guide on Testing of MOV components
- B. ANSI/IEEE C62.35 – IEEE Guide on Testing of SAD components
- C. ANSI/IEEE C62.41 - IEEE Recommended Practice on Surge Voltage in Low Voltage AC Power Circuits
- D. ANSI/IEEE C62.45 - IEEE Guide on Surge Testing for Equipment Connected to Low Voltage AC Power Circuits
- E. ANSI/UL 1449 Latest Edition - UL Standard for Safety for Surge Protective Devices
- F. CBEMA – Computer Business Equipment Manufacturers Association
- G. IEC 664 – International Engineering Consortium, Standard for Clamping Voltage
- H. California Electrical Code - Surge Protection Devices
- I. NFPA 70 - National Electrical Code
- J. UL 67 – Listed for Internal Panelboard Transient Voltage Surge Suppressors
- K. UL 96A – Devices listed as approved for secondary surge arrestors (VZCA)
- L. UL 248-1 - Fusing
- M. UL 1283 – Electromagnetic Interference Filters, Fifth Edition

1.4 SUBMITTALS

- A. Shop Drawings: Should include device dimensions, mounting requirements including wire size and over-current protection device rating, nameplate nomenclature, electrical ratings, short circuit current rating, and test results as indicated below under "Testing, Warranty and Life Expectancy" as provided by an independent test lab or a UL certified test lab for the category(ies) of suppression device(s) specified using the appropriate IEEE test wave. Product data sheets with installation instructions for each size and type of device are required. Shop drawings submitted without the testing data as required by section this section will be rejected.
- B. Fuse information: Provide fuse information if required for operation. Include size, manufacturer, time-current chart responses to UL 1449 testing requirements, maximum surge protection capability per mode and phase as limited by the fuse, and verification of repetitive surge protection device operation without system degeneration greater than 10%.

1.5 SPARE PARTS

- A. Surge Protection Modules: Furnish 1 replacement module for each type installed.
- B. Fuses: Furnish to the Owner 3 spare fuses of each type and rating installed.

1.6 TESTING, WARRANTY AND LIFE EXPECTANCY

- A. Manufacturer must provide independent testing on repetitive capability and maximum surge current rating of service entrance suppressor units. This shall be performed at a nationally recognized lab not affiliated with the manufacturer.
1. Single pulse surge current capacity: Single pulse surge current tested in a mode at rated surge currents.
 2. Single pulse surge current capacity test: An initial UL 1449 defined 1.2 x 50µs, 6000V open circuit voltage waveform and an 8 x 20µs, 500A and 3kA short circuit current waveform shall be applied to benchmark the unit's suppression voltage (VPR).
 3. A single 8 x 20µs waveform pulse of maximum rated surge current per mode shall then be applied. To complete the test, another UL 1449 surge shall be applied to verify the unit's survival. Survival is achieved if the suppression voltage measured from the two UL1449 surges does not vary by more than 10%.
- B. Minimum Repetitive Surge Current Capacity:
1. Service entrance suppressor units should be tested repetitively at an independent lab to verify repetitive capacity.
 2. Minimum Repetitive Surge Current Capacity Test:
 - a. An initial UL 1449 surge defined as 1.2 x 50µs, 6000V open circuit voltage waveform and an 8 x 20µs, 500A and 3kA short circuit current waveform shall be applied to benchmark the unit's suppression voltage.
 - b. A repetitive number of ANSI/IEEE C62.41.2-2002 (Category C3) surges, defined as a 1.2 x 50µs 10kV or 20kV open circuit voltage waveform and an 8 x 20µs 10,000A short circuit current waveform, shall then be applied at one-minute intervals.
 - c. To complete the test, another UL 1449 surge shall be applied to verify the unit's survival.
 3. Survival is achieved if the suppression voltage (VPR) does not vary by more than 10%.
 4. Proof of such testing shall be the test log generated by the surge generator.
- C. Provide UL 1449 classification white sheet pages indicating the VPR (voltage protection rating) for each SPD unit submitted for this product using the 6kV/3kA combination wave surge.
- D. Warranty: Ten (10) years. Includes workmanship, installation and programming.

2. PART PRODUCTS

2.1 DESCRIPTION

- A. General: The unit shall provide transient voltage suppression, surge current diversion and high-frequency noise attenuation, when connected in parallel to the facilities distribution system. The unit MCOV shall not be less than 115% of the nominal system voltage. Operating frequency shall be for a 60 Hz system. The unit shall provide protection in all normal modes for "wye" and "delta" systems. The short circuit current rating shall be the larger of the listed value on the drawings or as required by the equipment protected.

2.2 RATINGS

A. **[SPD-#]:** Service Entrance Suppressors:

1. For 277/480-volt, 3 phase, 4 wire, type 2, category C3 unit.
 - a. Surge current capacity: 100,000/200,000 amps per protection mode/phase
 - b. Nominal Discharge Current: 20 kA.
 - c. Mounting: Refer to the drawings.
 - d. Voltage Protection Rating: Refer to requirements below.
 - e. Components: Minimum component size of 20mm thermally protected metal oxide varistors (MOV).
 - f. Disconnect: Surge-rated disconnect with 200,000 SCCR.
2. Approved Manufacturers:
 - a. Square D Surgelogic EMA Series
 - b. Siemens TPS3 Series
 - c. Eaton SPD Series
 - d. Current Technology Current Guard Plus
 - e. ASCO Power Technologies 400 Series
 - f. LEA International LSS Series

B. **[SPD-#]:** Secondary Distribution Suppressors:

1. For 277/480-volt, 3 phase, 4 wire, type 2, category B3/C1 unit.
 - a. Surge current capacity: 100,000/200,000 amps per protection mode/phase
 - b. Nominal Discharge Current (I_N): 20 kA.
 - c. Mounting: Refer to the drawings.
 - d. Voltage Protection Rating: Refer to requirements below.
 - e. Components: Minimum component size of 20mm metal thermally protected oxide varistors (MOV).
2. Approved Manufacturers:
 - a. Square D Surgelogic EMA Series
 - b. Siemens TPS3 Series
 - c. Eaton SPD Series
 - d. Current Technology Current Guard Plus
 - e. ASCO Power Technologies 400 Series
 - f. LEA International CFS Series

C. **[SPD-#]:** Critical Load Protections – Fixed Equipment – DIN Rail Mount:

1. For 120/208-volt, 3 phase, type 2 unit. Refer to schedule or equipment requirements for specific equipment configuration required.

2. For plug-in modules to mount on DIN rail in control panels, motor control centers, etc.:
 - a. Surge Current Capacity: 25,000/50,000 amps per protection mode/phase
 - b. Nominal Discharge Current (I_N): 20 kA
 - c. Components: Metal oxide varistors (MOV)
 3. Approved Manufacturers:
 - a. General Electric TD Series
 - b. Bussman BSP Series
 - c. ASCO Power Technologies 318 Series
 - d. Mersen Surge Trap Series
 - e. Or approved equal
- D. Receptacles:
1. For 120-volt, 1 phase, 3 wire, type 3, category A3 unit.
 - a. Surge current capacity (I_N): 12,000 amps per protection mode.
 - b. Components: 20mm MOV
 - c. Maximum Continuous Operating Voltage: 150 Volts
 2. Refer to Specification Section 26 27 26 for additional receptacle construction information.
- E. Voltage Protection Rating:
1. Protection modes and UL 1449 voltage protection rating for surge suppression units per each mode (L-N, L-L, L-G, and N-G as appropriate).
 - a. 277/480 Volt, 3 phase, 4 wire. 1200 Volt L-N, L-G, N-G and 1800 Volt L-L
 - b. 120/208 Volt, 3 phase, 4 wire. 700 Volt L-N, N-G, 800 Volt L-G and 1200 Volt L-L
- F. EMI/RFI Noise Rejection or Filtering:
1. Each unit shall include a UL1283 first order, high-frequency filter for noise filtering between 10 KHz and 100 MHz.
- G. Indication:
1. Each unit shall include solid-state indicators with externally mounted LED visual status indicators that indicate on-line status of each protection mode of the unit.
 2. Each unit shall include an audible alarm with silencing switch to indicate when protection has failed.
 3. Provide each secondary distribution and critical load type unit(s) with a transient counter.
 4. Each unit shall contain form "C" contacts for remote indication of an alarm status.
- H. Fuses:
1. Use fuses recommended by the manufacturer to satisfy repetitive UL 1449 operation of the surge suppression unit.
 2. Fuses shall be rated 200, 000 AIC minimum interrupting capacity.

3. PART EXECUTION

3.1 INSPECTION

- A. Examine equipment for size and type of surge protection device to be used to ensure physical compatibility.
- B. Inspect surge protection device for any signs of physical damage due to shipping or handling before installing surge protection device.

3.2 INSTALLATION

A. Mounting Location:

- 1. The unit shall be installed as close as practical to the panel secondary lugs in accordance with applicable national/Local Electrical Codes and the manufacturer's recommended installation instructions. Connect the unit to the or switchboard or panel using a conduit nipple. Flush mount the unit in the front of the switchboard. Mount unit directly across from the breaker or disconnect serving it.
- 2. Integral surge protection devices mount between the main and branch circuit breakers.
- 3. If internal surge protection device is specified, device shall be installed in a barrier compartment isolated from other components.

B. Connections:

- 1. Conductors from the protected bus to the unit shall not be any longer than necessary avoiding unnecessary bends. The conductor leads shall be twisted together and as short as possible. Connection shall be with mechanical lugs for each phase, neutral, and ground if applicable. Contractor shall provide wire and circuit breakers sized per the approved manufacturer's requirements. Maximum lead length from protected bus to surge protection device shall be per manufacturer's requirements, but no greater than 5'-0".
- 2. The surge protection unit shall be isolatable from the electrical distribution system via 3 pole circuit breaker mounted in the switchboard/panelboard or be equipped with a factory supplied integral fused switch or circuit breaker. Single phase 120-volt units shall be hardwired without a disconnecting means.
- 3. Neutral and ground shall not be bonded together at secondary panelboard locations.

C. Additional Locations: Critical Load Protection – Fixed Equipment (120 Vac):

- 1. Install an A3 plug-in surge protection device between each of the following equipment items and its power supply conductors.
 - a. Fire alarm master panel
 - b. Phone switch
 - c. Intercom master
 - d. Building management system master
 - e. Security system master
 - f. Telephone switch
 - g. TV head
 - h. Elevator control panel

D. General:

- 1. Check unit for proper operation of protection and indication under start-up.
- 2. Check unit to ensure all MOVs for each mode of protection are operational. Verify integral fuse links are operational and have not melted.

3. Surge suppression devices shall not be installed ahead of the main service disconnect(s).
4. Install fuses in all fuse holders and fused disconnects internal to the surge protection unit. Use fuses recommended by the manufacturer to satisfy repetitive UL 1449 operation of the surge suppression unit. External fusing of the surge protection device is not allowed.
5. Coordinate location of surge protection device to allow adequate clearances for maintenance.
6. Manufacturer service phone number shall be posted on the front of the surge protection device.

END OF SECTION

SECTION 26 51 00

LIGHTING

1. PART GENERAL

1.1 SECTION INCLUDES

- A. Interior luminaires and accessories
- B. Exterior luminaires and accessories
- C. Lamps
- D. Poles

1.2 REFERENCES

- A. ANSI C78.377 - Specifications for the Chromaticity of Solid State Lighting Products
- B. ANSI C82.16 - Light-Emitting Diode Drivers - Method of Measurement
- C. ANSI C82.77 - Standard for Harmonic Emission Limits and Related Power Quality Requirements for Lighting Equipment
- D. IEEE C2 - National Electrical Safety Code
- E. NEMA SSL1 - Electronic Drivers for LED Devices, Arrays or System
- F. UL 8750 - Light Emitting Diode (LED) Equipment for use in Lighting Products
- G. LM-79 - Approved Method: Electrical and Photometric Measurements of Solid-State Lighting Products
- H. LM-80 - Measuring Luminous Flux and Color Maintenance of LED
- I. Project site classification as defined in IESNA RP-33

1.3 SUBMITTALS

- A. Submit product data under provisions of Section 26 05 00.
- B. Basic Requirements of Submittal:
 - 1. Submit product data sheets for luminaires, lamps, ballasts, drivers and poles. Include complete product model number with all options as specified. Submittal shall be arranged with luminaires listed in ascending order, and with each luminaire's associated lamp, ballast, driver, or pole information following luminaire's product data. Failure to organize submittal in this manner will result in the submittal being rejected.
 - 2. Submit lens product data, dimensions and weights if not included in product data sheet submittal.
 - 3. Include outline drawings, support points, weights, and accessory information for each luminaire.
 - 4. Submit manufacturer origin of LED chipset and driver.
- C. LED Lighting - Performance Testing Submittal (when requested by Architect/Engineer):
 - 1. IESNA LM-79: Include photometric report for the latest generation system being furnished. Provide name of independent testing laboratory, report number, date of test, luminaire series/model number, input wattage, and light source specifications.
 - 2. IESNA LM-80: Measuring Lumen Maintenance of LED Light Sources

- D. LED Lighting - Control Compatibility Submittal:
 - 1. Submit lighting control capability data for each LED luminaire. The submittal shall clearly identify device data proposed by the Contractor and approved by the luminaire manufacturer for dimming, switching, addressable, wireless, and similar control characteristics.
- E. Submit utility rebate forms where offered at project location. Submit completed rebate forms within 30 days of Substantial Completion.
- F. LED Lighting Requirements:
 - 1. Light Pollution Reduction:
 - a. Exterior luminaires: Submit manufacturer backlight uplight glare (BUG) rating including data showing percentage of light lumens emitted at or above 90° from nadir for each luminaire type.
 - 2. Toxic Material Reduction:
 - a. Submit manufacturer published data for each lamp type being furnished, indicating mercury content in milligrams per lamp.

1.4 EXTRA STOCK

- A. Provide extra stock under provisions of Section 26 05 00.
- B. LED Light Engines or Modules: 5 percent of quantity installed, minimum one (1) of each size and type of field replaceable light engine or module. Provide field replacement installation instructions.
- C. Lenses: Three (3) percent of quantity installed, minimum one (1) of each size and type.
- D. LED Drivers: 5 percent of quantity installed, minimum one (1) of each size and type.
- E. Exit Signs: Provide 5 additional exit sign luminaires complete with labor, conduit, and wire. Additional exit luminaires shall be located per the Architect/Engineer or provided as attic stock when a location is not defined prior to Owner occupancy. When multiple exit signs are scheduled, the quantity listed above shall represent each type listed.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Deliver products to site. Store and protect under provisions of Section 26 05 00.
- B. Protect luminaire finishes, lenses, and trims from damage during storage and installation. Do not remove protective films until construction cleanup within each area is complete.
- C. Handle site lighting poles carefully to prevent breakage and damage to finish.

1.6 MOCKUP

- A. Provide and install luminaires with power and control connections in mockup rooms as identified in Division 1. Approved luminaires in mockup may be reused as part of complete work if in original condition.

1.7 WARRANTY

- A. The warranty period begins at the date of Substantial Completion.

- B. Drivers:
 - 1. LED Drivers: Five (5) years
- C. LED Systems:
 - 1. Light Emitting Diode (LED) Light Engines: Five (5) years
- D. Emergency Battery Pack:
 - 1. Emergency battery pack shall have a five-year warranty from date of Substantial Completion.

2. PART PRODUCTS

2.1 INTERIOR LUMINAIRES AND ACCESSORIES - GENERAL

- A. Lensed Troffers: Provide hinged frames with latches and 0.125-inch thick virgin acrylic lenses. Prismatic lenses shall have depth of no less than 0.080", KSH12 or equal. Other lenses as scheduled.
- B. Recessed Luminaires: Confirm ceiling and wall type and furnish trim and accessories necessary to permit proper installation in each system. Where fire-rated ceiling or wall assemblies are specified, furnish and install listed enclosures around luminaires that maintain the system rating.
- C. Luminaires: Louvers shall be anodized low iridescent specular aluminum with mitered corners and interlocking construction. Provide ballast covers to separate inboard/outboard lamps when multi-level switching is indicated, so light does not spill into unlit cells.
- D. Suspended Luminaires: Coordinate power feed and suspension canopies with ceiling type and architectural RCP for proper fit and location. Ensure finished installations are plumb and level at elevations specified. Verify suspension length prior to submittal.
- E. Exit Signs: Stencil face, 6-inch high letters, directional arrows as indicated, universal mounting type as indicated on the drawings.
- F. Self-Powered Exit Signs: Stencil face, 6-inch high letters, directional arrows as indicated, universal mounting type as indicated on the drawings. One-piece, self-contained unit with sealed, maintenance-free nickel cadmium battery, automatic charger and electronic circuitry. Relay automatically energizes lamp from battery when circuit voltage drops to 80 percent of nominal voltage or below. When normal voltage is restored, relay disconnects lamps from battery, and battery is automatically recharged and floated on charger.
- G. Self-Powered Emergency Lighting Units: One-piece, self-contained unit with sealed, maintenance-free nickel cadmium battery, automatic charger and electronic circuitry. Relay automatically energizes lamp from battery when circuit voltage drops to 80 percent of nominal voltage or below. When normal voltage is restored, relay disconnects lamps from battery, and battery is automatically recharged and floated on charger.
- H. Painted reflector surfaces shall have a minimum reflectance of 90%.
- I. All painted components shall be painted after fabrication. Color to be per available colors by manufacturer. Verify color with architect.

2.2 EXTERIOR LUMINAIRES AND ACCESSORIES - GENERAL

- A. Listed for wet or damp location as scheduled.
- B. Provide low temperature ballasts or LED drivers, with reliable starting to -20°F.

- C. In-grade luminaires shall have lamp/optic separation to prevent surface temperature from exceeding 115°F. Compartment separation of wire entry and control gear/lamp chamber.
- D. Exterior LED luminaires shall contain separate, easily accessible and replaceable Category C surge protection device.

2.3 SUBMERGED LUMINAIRES – GENERAL

- A. Pool luminaires shall be listed for the specific submersible location (e.g., swimming pool) to meet depth specified. Manufacturer to test all luminaire enclosures to minimum 10 psi (0.70kg/cm²) internal pressure while totally submerged in water. No visible air bubbles allowed. Manufacturer to verify luminaire functionality at specified operating depth.

2.4 LIGHT EMITTING DIODE (LED) LUMINAIRE SYSTEMS

- A. Light emitting diodes used in interior applications shall have a minimum color rendering index (CRI) of 80. The R9 color rendering value shall be a minimum of 50. Light emitting diodes used in exterior applications shall have a minimum color rendering index (CRI) of 70. Color temperature of the luminaires shall be as noted on the luminaire schedule. Provide light source color consistency by utilizing a binning tolerance within a maximum 3-step MacAdam ellipse unless noted otherwise.
- B. LED chip arrays specified as color changing shall have chip colors as noted on the luminaire schedule.
- C. Rated life shall be minimum of 50,000 hours at L70.
- D. LED chips shall be wired so that failure of one chip does not prohibit operation of the remainder of the chip array.
- E. Dynamic Tunable LED (DLED): Variable correlated color temperature LED systems shall offer a range of temperature control from 2700K through 6000K. Color rendering index shall be a minimum of 80. Dimming control from 100% to 1%. Shall offer compatibility with any LED dimming driver/controller including 0-10V, DALI, DMX, etc.
- F. Warm Dim LED (WLED): Variable warm dimming LED systems shall offer a range of temperature control from 2700K through 1800K. Color rendering index shall be a minimum of 80. Dimming control from 100% to 1%. Shall offer compatibility with any LED dimming driver/controller including 0-10V, DALI, DMX, etc.
- G. Luminaire minimum lumens is defined as the absolute lumens per the manufacturers LM-79-08 test report.
- H. LED luminaires shall be designed for ease of component replacement including modular replaceable boards or Zhaga sockets. Luminaires that are factory sealed and do not have field replaceable parts shall provide a 10-year warranty.
- I. LED light engine shall have a maximum LLD of 0.85 at 50,000 hours at 25°C ambient.
- J. LED Driver:
 - 1. Solid state driver with integral heat sink. Driver shall have over-heat, short-circuit and overload protection, power factor 0.90 or above and maximum total harmonic distortion of 10%. Driver shall have a voltage fluctuation tolerance of +/- 10%.
 - 2. Drivers shall have dimming capabilities as outlined in the luminaire schedule for each luminaire type. Dimming shall control light output in a continuous curve from 100% to 10% unless noted otherwise.
 - 3. Driver shall have a minimum of 50,000 hours rated life.

4. Driver shall be tested to ANSI C82-16 for input current inrush, total harmonic distortion (THD), and power factor. Driver start time shall be less than 0.5 seconds to 98% of initial light output. Flicker should be less than 30% throughout the operating range.
5. Driver shall be field replaceable without removal of the luminaire.

2.5 EMERGENCY BATTERY INVERTER

- A. One-piece, self-contained unit with high-temperature, maintenance-free nickel cadmium battery, charger, and electronic circuitry.
- B. Charging indicator light to monitor charger and battery. Test switch and installation hardware.
- C. UL listed for installation inside or on top of luminaire.
- D. Minimum lumen output as indicated on luminaire schedule.

2.6 ACCEPTABLE MANUFACTURERS - POLES

- A. Manufacturer of Luminaire
- B. Valmont Poles
- C. U. S. Pole Company
- D. KW Industries

2.7 LIGHTING POLES

- A. Metal Poles: Round straight steel lighting pole with embedded anchor transformer base.
 1. Painted poles shall have electrostatic applied polyester powder coated paint finish thermally cured with UV protection. Interior of pole shall be coated with same coating for a minimum of 12" from base plate.
 2. Galvanized steel hot dipped finish to standard AASHTO M 111.
- B. Wind Load: 100 MPH velocity, with 1.3 gust factor with luminaires and brackets mounted.
- C. Hand Hole: 2 x 4 inches with removable weatherproof cover installed at manufacturer's standard location. Provide matching gasketed cover plate.
- D. Pole Top: Provide mast arm(s) in array as indicated.
- E. Anchor Bolts: As recommended by pole manufacturer. Provide template, flat washers, lock washers, and hex nuts for each pole. Grout between anchor plate and concrete base with non-shrink grout after pole is plumbed.
- F. Vibration Damper: Canister or snake type second mode vibration damper internal to the metal pole as recommended by pole manufacturer. Provide additional pole top damper for first mode vibration on single-head metal poles where recommended by manufacturer.

3. PART EXECUTION

3.1 INSTALLATION

- A. Securely fasten luminaires to the listed and labeled ceiling framing member by mechanical means such as bolts, screws, rivets or listed clips identified for use with the type of ceiling framing members. If ceiling framing is not listed for luminaire size or weight, support luminaires independent of ceiling grid with a minimum of two (2) #12 gauge wires located on diagonal corners.

- B. Install recessed flanged luminaires to permit removal from below. Use manufacturer-supplied plaster frames and swing gate supports. Support luminaires independent of ceiling with a minimum of two (2) #12 gauge wires located on diagonal corners.
- C. Support surface-mounted luminaires directly from building structure. Install luminaires larger than eight square feet (8 ft²) or weighing more than 30 pounds independent of ceiling framing. Do not fasten supports to piping, ductwork, mechanical equipment, or conduit, unless otherwise noted.
- D. Support suspended or pendant mounted luminaires independent of ceiling grid with a minimum of two #12 gauge wires. Suspension assembly and anchors shall be capable of supporting 300 pounds dead load at each suspension point.
- E. Provide seismic bracing of luminaires per IBC Chapter 16. Design pendant luminaires on a component seismic coefficient (Cc) of 0.67. Design vertical supports with a factor of safety of 4.0. Contractor shall verify the Seismic Hazard Exposure Group and Performance Criteria Factor.
- F. Fire-rated Ceilings: Support luminaires independent of ceiling system with a minimum of two (2) #12 gauge wires.
- G. Adjust aimable luminaires to obtain lighting levels on objects and areas as directed to obtain desired lighting levels.
- H. Recessed luminaires and other optical accessories shall remain in protective wraps or films until construction in area is complete and area has been cleaned.
- I. Industrial Pendant Luminaires: Use hangers rated 500 pounds minimum or provide safety chain between ballast and structure. Provide safety chain between reflector and ballast.
- J. Luminaire Pole Bases: Sized and constructed as indicated on the drawings. Project anchor bolts 2 inches minimum above base. Install poles plumb with double nuts for adjustment. Grout around pole anchor base.
- K. Use belt slings or non-chafing ropes to raise and set pre-finished luminaire poles.

3.2 CONSTRUCTION USE OF PROJECT LUMINAIRES

- A. The Contractor shall provide temporary construction lighting per the requirements of Division 1.
- B. The project luminaires shown on the construction documents shall not be used for temporary construction purposes without providing a plan for Owner approval that addresses energy and luminaire operating hours.

3.3 RELAMPING

- A. Replace failed lamps at completion of work. Replacement of LED diodes burnouts after the warranty period starts shall be the responsibility of the final user.

3.4 ADJUSTING AND CLEANING

- A. Align luminaires and clean lenses and diffusers at completion of work. Clean paint splatters, dirt, and debris from installed luminaires.
- B. Touch up luminaire and pole finish at completion of work.

3.5 LUMINAIRE SCHEDULE

- A. As shown on the drawings.

END OF SECTION

SECTION 26 55 61

THEATRICAL LIGHTING

PART 1 -GENERAL

1.1 SUMMARY

- A. This specification section includes the engineering, fabrication, furnishing, delivery, and installation of new theatrical stage lighting equipment as specified in the 'Products' specifications and as indicated on the related stage lighting drawing documents for the auditorium stage.
- B. Contract Documents and General Requirements apply to the work of this Section.
- C. All bidders shall fully inform themselves of the conditions under which the work is to be performed. No additional compensation shall be allowed for any labor or item the bidder could have been fully informed of prior to the bid date.
- D. While the components, quantities, and arrangements described herein and shown on the drawings indicate specific details for the realization of the stage systems, bidders may propose alternate details and components that will fulfill the functional parameters of the envisioned system. In such event, bidders shall submit a complete set of specifications and drawings, not less detailed than these and following the same general outline, together with a detailed statement indicating paragraph by paragraph wherein the equipment to be offered deviates from specifications included in this bid request. Where alternate proposals are offered they shall be submitted with the amount to be added or deducted from the base bid which is required from all bidders.

1.2 SCOPE OF WORK

- A. Work under this section consists of the installation of all materials and equipment necessary for the proper operation of all stage lighting equipment. Installation contractor shall furnish qualified personnel to test and adjust the equipment after installation until specified performance is attained.
- B. Preparation and submission of complete engineered shop drawings for approval by the Architect and Theatre Systems Consultant.
- C. Verification of conditions and dimensions at the job site.
- D. The adjustment and testing of the completed installation by the Contractor's personnel, subject to Architect and Theatre Systems Consultant's approval.
- E. Submission of required record documents.
- F. Coordination with other affected work, trades, and inspections.
- G. Installation work includes, but is not limited to the following:
 - 1. New stage lighting dimmer racks.
 - 2. New stage lighting data distribution and lighting control processor racks.
 - 3. New lighting control receptacle stations and low voltage control wiring.
 - 4. New house lighting control stations and low voltage control wiring.
 - 5. New stage manager's control panel and low voltage control wiring.
 - 6. New worklight control stations and low voltage control wiring.

7. New lighting control DMX512 protocol wiring, low voltage house light, worklight, and rehearsal light wiring, Ethernet data wiring, and any additional new control wiring per the systems manufacturer's final shop drawings.
 8. New circuitry distribution connector strips, plug boxes and wall boxes.
 9. New stage lighting spotlight fixtures and followspots.
 10. New stage lighting control console, remote focus unit, video monitors, and Ethernet nodes.
 11. New power service, circuit protection, system conduit, raceways, junction boxes, pull boxes and related wiring as specified on the electrical drawings.
 12. Installation and connection of system line voltage equipment and components.
 13. The contractor shall furnish and install all low voltage stage lighting control wiring. The contractor shall coordinate with the stage lighting equipment manufacturer regarding the responsibility for termination of stage lighting control low voltage wiring.
 14. Initial hanging and plugging of new portable stage lighting fixtures per the Theatre Systems Consultant's directive.
 15. All scaffolding, hoisting equipment, ladders, man-lift devices, tools, etcetera necessary to perform the work.
- H. The above scope of work is intended as a reference guide only and is not intended to define the limits of the work necessary for a complete installation. All labor, materials, and equipment necessary for the proper operation of all systems must be provided.

1.3 RELATED SECTIONS

- A. Theatrical Stage Rigging and Drapery Equipment
- B. Basic Electrical Requirements
- C. Basic Electrical Materials

1.4 SYSTEMS INTEGRATOR

- A. The Contractor shall utilize a System Integrator to coordinate and assist in the installation of all aspects of the theatrical lighting system as specified in this section. This shall include but not be limited to all dimming and control equipment as well as integration with the architectural lighting fixtures connected to the dimming and control system. The following companies have prior approval as System Integrator:
 1. BCT Entertainment
2780 East Regal Park Dr.
Anaheim, CA. 92806
(714) 237-9270

Polaris Lighting
624 Irving Ave.
Glendale, CA. 91201
(818) 265-0330
 3. Barbizon Lighting
8269 East 23rd Avenue, Suite 111
Denver, Co. 80238
(303) 394-9875

4. Kinetic Lighting
722 Thompson Ave
Glendale, CA. 91201
(310) 837-3204
5. LVH Entertainment
3685 Medford Street
Los Angeles, CA. 90063
(805) 278-4584

1.5 RESPONSIBILITY

- A. Organize and program the Work of the Section to harmonize with the work which will be performed by other contractors during the Project so that work will proceed as expeditiously as possible.
- B. The engineering, fabrication, installation, and coordination of systems and associated components specified in this Section are the Contractor's responsibility.
- C. Comply with all applicable code requirements and the requirements of federal, state, and local authorities having jurisdiction over the design, fabrication, installation, and operation of the systems and associated components specified in this section.
- D. Take full responsibility for the proper placing and fitting of equipment and materials furnished under this Section into the structure.
- E. Design components and install equipment to fit into the structure as built.
- F. Specifications only establish criteria and do not attempt to dictate specific details and methods that may be necessary for proper installation; drawings related to the Work of this Section may therefore be diagrammatic.
- G. Become familiar with the building construction and finishes, access and space available for equipment, and obvious interferences requiring special attention.
- H. Check and verify pertinent dimensions, sizes, loads, and the appropriateness of structure supporting the proposed Work of this Section, both on the Drawings and in the field before proceeding with any work.
- I. Provide additional structural and support members and guards as necessary for proper installation and operation of the Work of this Section.
- J. All stage lighting equipment and hardware must be of new and recent manufacture.
- K. All components utilized in the stage lighting equipment shall be specifically recommended by their manufacturer or trade organization for stage lighting applications. They shall be installed and used in accordance with the manufacturer's specification.
- L. Provide equipment, devices, machinery, and systems based upon the following:
 1. Safety to personnel during operation, use, and maintenance.
 2. Adequate strength.
 3. Reliability, with consideration for special or unusual requirements of the unit or installation.
 4. Ease of maintenance.
 5. Coordination with associated and adjacent systems provided under other Sections.

1.6 CODES, LABELS, AND STANDARDS

- A. All stage lighting equipment and installation methods must conform to current State rules and all local codes and ordinances.
- B. All components shall be listed by Underwriters Laboratories (UL).
- C. A manufacturer's label shall be conspicuously and permanently attached to each piece of stage lighting equipment.
- D. Those parts of the stage lighting equipment that require maintenance shall be safely and easily accessible and serviceable.
- E. Conform to the applicable requirements of the current editions of the following reference codes or standards:
 - 1. National Electrical Code (NEC).
 - 2. United States Institute for Theatre Technology (USITT).
 - 3. Entertainment Services & Technology Association (ESTA).
 - 4. American National Standards Institute (ANSI).
- F. Where in these Specifications one certain kind, type, or brand of manufacturer or material is named, it shall be regarded as the required minimum standard of quality. Substitutions lowering performance, quality, method of assembly or installation, or in general, not in keeping with Drawings and Specifications will not be permitted. Only written approval of the Architect and Theatre Systems Consultant will permit substitution for materials specified. Where both catalog number and description are indicated, requirements of description shall take precedence and prevail.

1.7 QUALIFICATIONS

- A. Provide the Work of this Section under a single contractor with a contractor widely experienced in providing and installing theatrical stage lighting equipment and related electrical hardware of the quality and complexity specified in this Section.
- B. Maintain a competent Supervisor, acceptable to the School and the Architect, during the entire installation. Change of Supervisor during the Project is not acceptable without prior written approval from the School and the Architect.
- C. Employ only experienced electricians and stage lighting technicians on the Project.
- D. Employ only certified welders, if welding is required.

1.8 BIDS MUST INCLUDE

- A. All equipment, labor, and services indicated in these specifications and in the related stage lighting drawing documents, including all necessary hardware, fittings, and components necessary for a full and complete system.
- B. A schedule and time estimate for preparation, fabrication, equipment delivery, and installation.
- C. A list of manufacturer's names, model and type numbers, and catalog data sheets covering all items included in the 'PRODUCTS' section of this document.

1.9 SUBMITTALS

- A. Make submittals to the Architect per requirements in Division 1 for transmittal to their consultants.

- B. Identify variations from Contract Documents and product or system limitations which may be detrimental to successful performance of the completed Work.
- C. Distribute copies of reviewed submittals to concerned parties. Instruct parties to promptly report any inability to comply with provisions. All submittals shall be submitted in a timely manner in order to allow adequate time for review and resubmittal if necessary.
- D. Submit and identify each shop drawing using both descriptive title and numeric or alphanumeric drawing number. Do not change drawing title or number after first submittal.
- E. The review of shop drawings, brochures, and samples is general only and does not relieve Manufacturer or Contractor of responsibility for errors, equipment design responsibility, deviations from Drawings and Specifications, or conflict with other work which may result from such deviations.
- F. The review of a separate item does not indicate review of the complete assembly in which it functions.
- G. No work shall begin on fabrication of equipment until drawings are approved and returned to contractor. No material shall be shipped to job site until formally approved in writing.

1.10 PERMITS AND INSPECTIONS

- A. Obtain and pay for required permits and inspections of Work of the Section.
- B. Furnish material and Work under this Section that meets or exceeds applicable legal and code requirements.
- C. Perform tests required by the Architect, School Representative, and authorities having jurisdiction.

1.11 SAFEGUARDS AND PROTECTION

- A. Provide suitable barriers and warning signs associated with or adjacent to stage lighting installation wherever necessary for the protection or safety of workers on the Project, School's personnel, and others during construction. Maintain barriers and warning signs during installation of the Work of this Section.
- B. Provide guards and guides at structural edges and corners and surrounding equipment as necessary to prevent fouling or tearing of adjacent theatrical equipment or contact with personnel.
- C. Protect materials and equipment from dirt and damage. Cover materials until just before the completion of the Project to prevent the adhesion of foreign matter or unintended paint.
- D. Replace damaged or defective work or material prior to final payment request.
- E. Take full responsibility for loss or injury to persons or property resulting from neglect of the above precautions.

1.12 DELIVERY AND STORAGE OF MATERIALS

- A. Contractor is responsible for the scheduling and timely delivery and placement of items furnished under this Section.
- B. Clearly identify on each container the contents stored within.

1.13 RECORD DRAWINGS AND MANUALS

- A. Within thirty days of final installation approval, provide to the Architect (6) copies of an 'Operating and Servicing Manual' for the Stage Lighting System. Provide (1) copy of the manual to the Theatre Systems Consultant. Each manual shall be bound in a hard cover binder and contain the following information:
 - 1. Final as-built shop drawings including updated equipment locations and conduit runs.

2. Catalog data.
 3. Operating and maintenance data.
 4. Parts lists and source for parts and service.
 5. Guarantees and warranties.
 6. Test reports.
- B. Each complete manual shall include all instructions necessary for proper operation and servicing of the systems. The instructions must be written in a manner that easily describes the necessary day-to-day operating procedures.

1.14 SPARE PARTS

1. Provide spares, spare parts, and special tools for all stage lighting equipment if necessary for proper operation and maintenance of equipment.

1.15 COMPLETION

- A. Provide all labor, engineering, design, testing, supervision, material and equipment required even though not specifically mentioned herein, so that when work is completed, an operable system will be turned over to the School. Any errors, omissions, or ambiguities are not to condition this requirement but shall be brought to the attention of the Owner in their possible effect on intent of this Specification.
- B. Before operating any equipment for demonstration or test comply with manufacturer's preparation instructions.
- C. Once equipment has been installed a factory authorized field service technician shall check and test equipment and make adjustments as necessary.
- D. After checkout and adjustment, the stage lighting system shall be operated for approval of the School, Architect, and Theatre Systems Consultant.
- E. If due to installation-caused matters the Architect or Theatre Systems Consultant are required to perform any follow-up checkout or inspection visits after the approved completion of the project, the Contractor shall compensate the Architect or Consultant at their standard hourly rates for all time expended.

1.16 WARRANTY

- A. Guarantee all materials, equipment, and work against defects of any kind for a period of one year from written acceptance of the work.
- B. Parts Warranty: Obtain guarantees and/or warranties for factory assembled equipment and include with 'Operations and Maintenance Data'.
- C. Replacement: In the event of failure of any work, equipment, or device during the life of the guarantee, at no cost to the School, repair or replace the defective work and remove, replace, or restore any parts of the structure or building which may be damaged as the direct result of the defective work or in the course of making the replacement of defective work or materials. Any work, equipment, or device replaced due to failure shall be guaranteed for a period of one year from date of replacement.
- D. Make a minimum of two inspections with operations personnel, within the warranty period, at no expense to the School, to ensure all systems to be in satisfactory operating condition. Submit a written report signed by operating personnel witnessing inspection to the School indicating inspection results with copies to the Architect and Theatre Systems Consultant.

- E. The Contractor shall provide field service maintenance, at no cost to the School, within 24 hours of notification of system malfunction. This service response shall be in effect for a period of 12 months after the School's acceptance of the system.

1.17 INSURANCE

- A. Provide full insurance against loss or damage during equipment shipment, storage, installation, and testing.

PART 2 - PRODUCTS

2.1 DIMMING SYSTEM

A. DIMMER RACKS

1. The dimmer racks shall be designed specifically for entertainment lighting, and shall consist of 6, 12, 24, or 48 dimmer module spaces. Dimmer rack shall be UL listed.
2. Rack set-up and preset data shall, as standard, be fully user programmable on a per rack or system wide basis.
3. Dimmer rack shall be a modular, freestanding cabinet. Cabinet shall be a welded, heavy gauge steel framework and be fully enclosed with removable panels and include a hinged, locking door over dimmer section. The dimmer rack shall allow for adjacent or back-to-back mounting of multiple racks. The rack shall be constructed to permit insertion and removal of dimmers and control modules without the use of tools. Finish shall be baked enamel over a primed surface.
4. Dimmer racks shall operate at 120/208VAC 3 phase, 4 wire + ground 60 Hz at a maximum of 800A per phase. Bussing across adjacent multiple racks shall be possible.
5. Load phase, neutral, and ground terminals shall, as standard accept up to a #6-gauge wire. An optional terminal adapter accepting up to #2-gauge wire shall be provided to minimize load voltage losses. Dimmer racks shall be braced for 50,000 amps. Provisions shall be made for optional amp trap devices to provide higher fault current protection, if required.
6. Dimmer rack shall be designed for up to 48 dual plug-in modules. Each module shall contain two 2.4KW dimmers, non-dims, constant voltage breakers or one dual-sized special purpose fluorescent dimmer, comprising a total of up to 96 dimmers per cabinet. Provide additional special purpose modules as defined herein. Provide dimmer modules as indicated on Drawings.
7. Dimmer modules shall rest on mounting trays with guide rails to align dimmer during insertion. Cabinet shall be shipped without dimmers or mounting trays installed for ease of installation.
8. All dimmer input power and control wiring shall be factory wired with terminated load wires to terminals adjacent to each dimmer receptacle. A neutral buss shall also be furnished in cabinet.
9. Ventilation shall be provided using multiple low-noise fans. The fans shall maintain the temperature of all components at proper operating levels with dimmers at any load. Air shall flow over the surfaces of the heat generating components using a combination of convection and fan assisted airflow. Each rack shall be outfitted with a lockable door that does not impede airflow in any manner. Fans shall operate only when the lighting control console is activated.
10. Load terminations shall be clearly marked with the rack circuit number. Signal terminations shall be by plug-in screw terminals to facilitate contracting and servicing and shall be clearly labeled.
11. Provide a label for each dimmer rack with rack ID# and circuit # range contained within rack. Label to be attached near top of rack with mechanical fasteners, adhesive only fastening is not acceptable.
12. Provide spare modules as noted in schedule of quantities on project drawings.

B. DIMMER RACK CONTROL ELECTRONICS

1. The main dimmer control electronics shall be housed in one processor plug-in module. The dimmer control electronics shall have a direct Ethernet connection and shall accept (2) DMX512 protocol inputs.
2. All rack setup and preset data shall be stored in a non-volatile manner and may be transferred to a replacement control processor module without losing data.
3. The dimmer system shall support the following range of peripherals:
 - a. Remote backup preset panels.
 - b. Remote handheld programmers.
 - c. Remote panels for architectural style channel and preset control of separate and independent zones of lighting.
4. Dimmer rack control electronics shall have the provision to select any circuit in the rack for activation by a Panic function. Panic function shall be activated by a remote contact closure.
5. Dimmer rack control electronics shall contain provisions for mapping DMX512 addresses from any of the three control inputs to circuits in that rack. Control electronics shall also support setting of minimum and maximum output levels, dimmer curves, non-dim operation, and direct dimmer level setting.

C. DIMMER MODULES

1. The dimmer modules shall be fully plug-in and factory wired. Dimmer modules shall be of rugged and heavy-duty construction. Power and signal pins shall be recessed in a self-aligning housing to avoid handling, storage, and insertion damage. A contoured handle shall be provided for ease of insertion and withdrawal. All chassis parts, except heat sinks and handle, shall be properly treated, primed and finished in fine texture, scratch resistant, gray powder coat paint. Each module shall be labeled with the manufacturer's name, catalog number and rating. Dimmer modules shall be UL recognized devices.
2. Dimmer modules shall be keyed so that dimmer modules of greater capacity shall not be interchangeable.
3. Each dimmer module shall contain one or two single pole circuit breakers, associated solid state switching modules, filters, power, and control components.
4. Dimmer electronics shall be completely solid state. They shall utilize two silicon-controlled rectifiers in a back-to-back electrical configuration. The full load of the circuit is to be carried and controlled by the silicon-controlled rectifiers.
5. Each dimmer shall be protected by a fully magnetic circuit breaker of the appropriate current rating and 10,000 AIC surge rating mounted on the face plate of the dimmer module so that the trip current is not affected by ambient or rack temperature. The circuit breaker shall be rated for tungsten loads having an inrush rating of no less than 20 times normal current and shall disconnect the power to the dimmer module before damage can be done to the dimmer power components. The circuit breakers shall be rated for 100 percent switching duty applications and shall be a UL recognized device.
6. SSR devices shall be encapsulated, epoxy filled high impact plastic cases with optically isolated firing circuits, control circuitry, and two silicon-controlled rectifiers (SCRs). There shall be a minimum of 2,500 volts RMS of isolation between the AC line and the control lines of the SSR.
7. The SSR shall be in an industry standard format that is easily field replaceable without removing any other electrical or electronic devices.

8. Each dimmer module shall have an integral inductive filter, minimum **500** micro-second rise time, to reduce the rate of current rise time resulting from the SSR switching on. The filter shall limit objectionable harmonics, reduce lamp filament sing and limit the radio frequency interference online and load conductors.
9. Special Purpose Modules
 - a. Standard factory modules shall be available to provide dedicated non-dim circuits utilizing mechanical relays and not employing SSR devices. Each non-dim shall be provided with a primary circuit breaker of the appropriate rating. Non-dims shall be designed so they can be used for inductive loads.
 - b. Standard factory modules shall be available to provide hard fired output for use with neon, cold cathode, and fluorescent loads. Hard fired modules shall provide a current source independent of the load current for the SCR Gate Drive Signal. Hard fired dimmers shall function independent of load as a result and shall drive loads of 1 watt or less.
 - c. Standard factory modules shall be available to provide constant 120VAC voltage irrespective of control signal to dimmer racks.
 - d. Standard factory modules shall be available that are capable of functioning as a dimmer, relay, or constant voltage breaker on either half of a dual module. Either of the three functions can be mixed or matched on either half of the module. Dimmer or relay functions can be remotely configured from the stage lighting control console or from the dimmer rack processor. The constant voltage function shall be manually activated at the dimmer module without the need for configuration at the dimmer processor
 - 1) If Stage Lighting Manufacturer can provide a multi-function module capable of dimmer or relay functionality on either half of the module but without the constant voltage function provide an additional dual constant module for every 4th multi-function module specified, rounded up to next even number.
10. Dimmer modules incorporating IGBT technology (insulated gate bipolar transistors) instead of silicon-controlled rectifiers will be accepted based upon submittal of performance standards and equipment specifications to the Electrical Engineer and Theatre Systems Consultant for approval prior bid submittal.

D. RELAY RACKS

1. Relay racks shall be UL-listed enclosures containing 12, 24, or 48 pole breaker subpanels. Racks shall be constructed of 16-gauge galvanized steel and finished in a fine-textured scratch resistant paint.
2. Panel covers shall be available to support surface or flush mounting. Panel shall contain lockable door(s).
3. 1, 2, or 3-pole breakers or relays, up to 30A capacity, shall be supported in any combination within the panel.
4. A control interface shall be provided for panel setup and monitoring. Indicators shall be provided for power status, DMX status, network status, and rack errors. The panel shall support DMX512 and Ethernet network (sACN) control signals. The control interface shall support a USB memory stick interface for upload of configurations and software updates.
 - a. Control interface shall support recording and playback of user-configured presets.
 - b. Presets shall be able to be recalled via an astronomical time clock. Up to 50 events shall be supported.

- c. Individual relays shall be capable of being assigned a discrete control address on a circuit-by-circuit basis without the requirement for sequential addressing beginning from a rack start address.
- 5. The control electronics shall report the following information per branch circuit:
 - a. Breaker state (on/off and open/closed).
 - b. Current draw (amps)
 - c. Voltage.
 - d. Energy usage.
- 6. Branch circuit breakers shall feature a high inrush trip curve and shall not trip at full load. Relays shall utilize an integral mechanically held air-gap relay. All breakers shall feature integral current sensing.
- 7. A main breaker shall be an option to support the maximum feeder size for each size panel.
- 8. Basis of design: Electronic Theatre Controls Sensor IQ Series.

E. PORTABLE DIMMER DEVICES - 1 CHANNEL DIMMERS

- 1. Portable dimming modules shall be comprised of one 750-watt dimmers packaged in an enclosure suitable for mounting to the yoke of incandescent-lamped theatrical spotlights.
- 2. The dimming module enclosure shall include provisions for pipe mounting brackets as well as wall mounting brackets and shall contain handles for ease of carrying.
- 3. Each dimming module shall be powered by a 20A 120VAC one-phase electrical service.
- 4. The dimmers shall be compatible with the USITT DMX512/1990 control protocol and the dimming control input shall be optically isolated. Each dimmer module shall include 5-pin XLR DMX512 input and thru receptacles.
- 5. Each dimming module shall include a processor with local controls mounted on its enclosure. The functions available at the local controls shall include selection of the starting DMX address, setting dimmer levels.
- 6. Dimmer output voltage transition time shall be not less than 450 microseconds.
- 7. Dimming modules shall be convection cooled and shall operate without cooling fans or filters. Each dimming module shall produce little or no mechanical noise.
- 8. Dimmer modules shall be UL listed and labeled.
- 9. Provide each dimming module with the following accessories & options.
 - a. Dimmer outputs shall be via 20A grounded stage pin connectors on flexible cable.
 - b. 5-15P input connector on 12" long flexible cable attached to module.
 - c. (1) 15' portable DMX512 control extension cable with heavy-duty jacket and black Neutrik 5-pin XLR connectors with gold plated contacts (TMB ProPlex PC224P or equal). Provide DMX512 extension cable fabricated per criteria noted in the extension cable portion of this specification section.
 - d. Pipe mounting hardware kit suitable for attachment to a theatrical fixture yoke.

10. Provide quantity and type of dimming modules and accessories as indicated in the schedule of quantities on Project Drawings.
11. Acceptable products:
 - a. ETC #ES750.
 - b. Strand Lighting Light Pack dimmer

2.2 EMERGENCY LIGHTING & POWER DISTRIBUTION

A. EMERGENCY LIGHTING TRANSFER SYSTEMS

1. Provide (1) UL 1008 code rated emergency lighting transfer relay panel to switch dimmed and non-dimmed lighting circuits to emergency power in the event that the normal power supply to the stage lighting system fails. Features include:
 - a. The transfer panel shall provide dimmer pass-through for normal operation.
 - b. The panel shall be wall or floor-mounted, separate from the dimmer racks.
 - c. The transfer panel shall be configured to accept a single 120/208VAC 3-phase emergency power source or individual emergency branch circuits, type per project drawings. The source voltage settings shall be field adjustable for either single or three phase power.
 - d. The panel shall have a quantity of 20-amp circuits for transfer switches sufficient to supply emergency power to all applicable circuits as indicated on electrical drawings.
 - e. The panel shall have voltage sensing of normal supply lines and automatic retransfer of power on restoration of normal supply.
 - f. An integral test switch shall be provided to simulate normal power source failure for periodic verification of system operation. The test switch shall be accessible without opening the panel.
 - g. Provide a remote test keyswitch station suitable for mounting in a recessed backbox for remote testing of normal power source failure. Test station shall include momentary keyswitch with indicators lights for normal mode, emergency mode, and fire alarm modes.
2. Provide DMX Emergency Bypass Controller(s) to bypass the DMX control signal and drive all connected loads to full in a loss-of-power or emergency situation.
 - a. Bypass controller shall accept a contact closure input that will drive a single universe of DMX512 to full or to a preset level when activated. Bypass controller shall not process the DMX512 signal when in Normal input mode.
 - b. Bypass controller shall contain an LED indicator on exterior of unit signaling normal state or bypass state. Controller shall contain internally accessible DIP switches for configuration of DMX record mode, Contact Input Type, and Wait Time for Restore of incoming DMX.
3. Provide Emergency Bypass Detection Kit(s) for monitoring normal 3-phase power feed to dimming system and providing a maintained contact closure output upon loss of power to trigger other lighting bypass controller(s).
4. Provide surface mounted 30A 3-pole circuit breaker enclosures for connection of sense feed wiring between dimmer rack and transfer switch as well as between dimmer rack and bypass controller.

B. DIMMER-CIRCUIT DISTRIBUTION EQUIPMENT

1. Provide stage lighting circuitry connector strips and plug boxes as shown on the stage lighting drawing documents.
 - a. Each connector strip and plug box shall be provided with screw terminal strips for feed connections, mounting bracket devices, and basket weave strain-relief multi-cable connectors where necessary.
2. Provide all necessary mounting hardware for pipe or surface mounted strips and boxes as detailed on project drawings.
3. Backboxes for all plug boxes shall be provided by stage lighting manufacturer unless noted otherwise on project drawings.
4. Plug boxes and plug strips shall have two sets of knockouts on each of the sides.
 - a. Production dimmer and relay circuits shall utilize grounded stage pin connectors or 5-20R connectors as indicated on project drawings.
 - b. Non-dimmable rehearsal light circuits shall utilize L5-20 grounded twistlock connectors.
 - c. Dimmable running light circuits shall utilize grounded stage pin connectors.
 - d. Non-dimmable and non-switched 120VAC power shall be supplied to connector strips and plug boxes via pigtail or panel mount 5-20R receptacles.
5. Exterior finish shall be flat, black baked enamel. Custom colored finishes shall be required if indicated on project drawings.
6. Circuit identification numbers shall be securely affixed to face of plug boxes and to one or both sides of plug strips as indicated on project drawings. Numbers shall be engraved Lamacoid tags, white letters on black background and shall be secured via rivets or other mechanical fasteners. Adhesive-only fastening is not acceptable. All labels shall be attached at the factory where distribution devices are fabricated.

C. COMPANY SWITCH

1. Provide Theatrical Systems Company Switches as described herein and as shown on Theatre Systems Consultant's Drawings and Electrical Drawings.
2. Company Switch configuration shall be 120/208V, 3-phase, 5-wire, amperage as noted on Project Drawings. Lighting System Company Switches rated 200A or greater shall have double neutrals.
3. Enclosure shall be a NEMA 1 wall mounted enclosure fabricated with a 14 ga. steel and finished in a black epoxy paint. The Company Switch must satisfy requirements of NFPA 70 Article 384 and Article 520. The Company Switch shall be UL listed and labeled.
4. Provide a front door panel to protect circuit breaker controls. There shall be no access to live electrical conductors when the door is open.
5. 3-phase, 120/208VAC company switch assemblies shall be provided with connectors by Cam-Lok, Leviton or equal, compatible with industry standard Cam-Lok E1016 devices, six connectors including double neutrals.
6. Company switch shall also contain a connection chamber for connection with bare wire to copper bus bars. Load connection busbars shall contain (2) 3/8"-16 x 1" bolts and (1) dual rated solderless lug for cable connection. When open, the hinged door shall trigger a shunt-trip mechanism that will trip the breaker.

7. Main breaker shall be UL listed, 3-pole, 100% equipment rated, continuous duty circuit breaker with a minimum AIC rating of 65,000A. Enclosure shall be Hi-Pot tested at 1250VAC for a period of no less than 10 seconds.
8. All connections from Main Circuit Breaker to output panel shall be by copper bus. All bus sizes shall be based on a current density no greater than 1,000 amperes per square inch.
9. All internal noncurrent-carrying metal parts shall be grounded to the main chassis frame.
10. Enclosure shall contain a neon indication lamp to indicate voltage present on each phase leg and a neon lamp to indicate ground integrity.
11. Company switch shall be labeled, 'THEATRICAL LIGHTING SYSTEMS COMPANY SWITCH' along with amperage.
12. Acceptable Manufacturers:
 - a. Electronic Theatre Controls - Powersafe Pro
 - b. Stagecraft Industries - Series 600
 - c. Lex Products Corp.
 - d. Others contingent on approval by Theatre Systems Consultant.

2.3 STAGE LIGHTING CONTROL SYSTEM

A. STAGE LIGHTING CONTROL DATA NETWORK DEVICES

1. Provide Ethernet and DMX512 data network control and distribution devices as described herein. All devices connected to the ethernet data network shall be compatible with the lighting control console and any other lighting control devices connected to the ethernet network. All connected ethernet devices shall support 10BaseT and utilize Neutrik EtherCon RJ-45 connectors for data connections. All DMX512 and Ethernet network components shall be compatible with the following ANSI Standards:
 - a. ANSI E1.11 - Entertainment Technology USITT DMX512-A - Asynchronous Serial Digital Data Transmission Standard For Controlling Lighting Equipment and Accessories.
 - b. ANSI E1.20 - Entertainment Technology RDM - Remote Device Management Over DMX512 Networks
 - c. ANSI E1.31 - Entertainment Technology - Lightweight Streaming Protocol For Transport of DMX512 using ACN.
2. Provide all control wiring and control cables for a complete functioning system so that all control and dimming components, except portable lighting fixtures, can be interconnected and tested at the time of system commissioning.
3. Provide portable control cables as required to connect ceiling or gridiron junction boxes with operable stage lighting batten connector strips as indicated on project drawings.
 - a. Cables for Ethernet network signals shall be constructed from a heavy-duty cable constructed to ISO/IEC 11801 CAT5e standards. Cable shall be supplied with Neutrik Ethercon connectors at each end. Cable shall be TMB ProPlex PCCATEP or pre-approved equal.

- b. Cables for DMX512 signals shall be constructed from a heavy duty, double shielded low capacitance cable suitable for RS422/RS485 applications. Cables shall be supplied without connectors at each end if distribution devices have terminal strips for data connections, otherwise cables shall be supplied with Neutrik XLR 5-pin connectors with gold contacts. Cable shall be TMB ProPlex PC224P or pre-approved equal.

B. CONTROL EQUIPMENT RACKS (CER-1 & CER-2)

1. Provide floor or wall-mounted control equipment rack(s) for housing selected components described in this section and as noted in contract drawings.
2. Control equipment rack shall be a 16-gauge steel wall-mounted enclosure with provisions for a locking front door. The front door shall be solid or with a Plexiglas insert per drawings. Doors shall be easily removable in the field. Plexiglas doors shall be reversible to hinge on the left or right side in the field. The side and rear panels shall contain louvered vents. Provide 5 sets of keys to the owner. When multiple racks are indicated they shall be keyed alike.
 - a. CER-2 rack containing the SMP control station shall be Middle Atlantic SWR-series shallow wall rack with PFD-xx door.
3. The rack shall contain 2 pair (front and rear) of 11-gauge CRS mounting rails predrilled for #10-32 screws on standard EIA 19" spacing. Both sets of rails shall be adjustable from front to back. Provide screws sufficient to fasten all devices mounted in rack including blank cover plates and vent panels. Rear rails on CER-1 only.
4. All devices within rack shall be powered via UPS mounted in rack (CER-1 only). Provide additional power strips, as necessary, connected to UPS and designed to securely mount inside rear rails of rack.
5. Control equipment racks located in the stage areas or areas in or adjacent to the auditorium, seating area or control rooms shall only utilize a UPS power source if there are system control devices in the rack requiring 120VAC power. In this case the UPS shall be passively cooled with no fan noise or power shall come from a remote power source.
6. The rack shall be designed for single-phase 2-wire with ground operation at a maximum of 20 amps, 120 volts 60 Hz AC.
7. The rack shall be designed to allow for easy insertion and removal of all components, and for convenient access to all rear-mounted power and control connections.
8. The rack shall contain a minimum of 3 open rack spaces to accommodate future control devices. Provide solid blank panels for all empty spaces.
9. Provide labels on all devices in equipment rack if necessary to define function or clarify where control signals are fed from. Devices requiring labels include Ethernet nodes, DMX repeaters, and others as indicated on project drawings.
10. Items contained in the control equipment rack(s) shall include but are not limited to:
 - a. Ethernet switch(es).
 - b. CAT-5 cable management panel(s).
 - c. Ethernet patch panel(s).
 - d. Ethernet port label panel(s).
 - e. DMX512/Ethernet nodes as required.

- f. DMX512 Repeaters as required
- g. Sliding shelf & storage drawers.
- h. Stage Mangers Panel.
- i. A digital clock and timer panel.
- j. Adjustable panel mounted 12" LED gooseneck worklights with rotary dimmer knob (Littlite #RL-10-D-LED or equal).
- k. (1) UPS device.
- l. (Lot) blank or vent panels as required.
- m. Architectural Lighting Control System Processor (see below.)

C. CONTROL RECEPTACLE STATIONS AND JUNCTION BOXES (CRS)

1. Control receptacle stations shall contain locking data-grade connectors and be provided with appropriately sized surface-mounted electrical back boxes unless noted otherwise. The faceplates shall have engraved nomenclature filled with contracting paint color for all connections. Ethernet connectors shall be Neutrik EtherCon RJ-45. Provide control receptacle stations with receptacles as indicated on Theatre Systems Consultant's drawings.
2. All connectors shall utilize screw terminal or punchdown connections for termination of installed wiring, field soldering of connections is not acceptable.
3. Control data junction boxes at ceiling or gridiron level shall be placed adjacent to junction boxes for power circuits.
 - a. Junction boxes for Ethernet network signals shall utilize Neutrik Ethercon receptacles to connect portable cables between ceiling/gridiron and stage lighting batten connectors strips below.
 - b. Junction boxes for DMX512 signals shall contain data grade quality terminal strips. The junction boxes shall include integral cord connectors with strain-reliefs to resist lateral loading on the cables.
 - c. Gridiron control junction boxes with network ports shall include label with network port #. Provide port # labeling at each end of flexible data cabling between gridiron receptacles and connector strip receptacles. Provide port # at receptacles where flexible cable enters connector strips.
4. Provide labels with unique port ID numbers corresponding to patch panel for every Ethernet network receptacle in the system. On the same label with port # provide maximum extension cable length for use with portable extension cables based on a 330-foot maximum network segment length. Label shall be an engraved Lamacoid tag with white characters on a black background.
5. All Lamacoid labels for network port #'s and maximum cable lengths shall be screwed or riveted to receptacle face panels. Adhesive only fastening will not be acceptable. Pre-drill face panels at factory at time of fabrication for ease of label installation onsite once extension cable lengths have been determined.

D. ETHERNET SWITCH(ES)

1. Provide high-speed multiport Ethernet switch(es) suitable for use with the stage lighting control console and related ethernet nodes.
 - a. Ethernet switch(es) shall contain a minimum of 24 ports. All connectors shall be located on the front of the unit.
 - b. The switch shall have, located on the front panel, indicator status lights for each port as well as for general network and hub status.
 - c. Switch(es) shall be mounted in equipment rack 'CER-1'. Rack-mounting ears shall be provided.
 - d. Ethernet switch(es) shall provide Power-over-Ethernet, PoE, based on the IEEE 802.3af standard.
 - e. Provide a quantity of Ethernet switches as required, sufficient to support system design as indicated on contract drawings.

E. ETHERNET PATCH PANEL

1. Provide Ethernet patch panel(s) for terminating Category-5 ethernet wiring from field devices.
2. The patch panel(s) shall contain a quantity of ports sufficient to connect all field wiring devices. Minimum of 12 ports per patch panel. If all slots in patch panel are not required provide (5) spare, un-used RJ45 panel mount connectors for future expansion.
3. Patch panel(s) shall be mounted in equipment rack 'CER-1'.
4. Provide separate 1RU blank panel(s) for labeling patch panel ports. Label each port with a unique I.D. label indicating port # and location for all Ethernet jacks connected to field wiring devices.
5. Provide a sufficient quantity of CAT-5 patch cables to connect all field wiring devices to Ethernet switch(es) plus (5) spare cables.
6. Provide red patch cables for all devices that are to remain permanently connected for basic system functionality including dimmer, racks, architectural control processor, hard wired LCD stations, and installed Ethernet nodes.
7. Provide rack-mounted cable management panel(s) for dressing of patch cables between patch panel and Ethernet switch(es).

F. UNINTERRUPTIBLE POWER SUPPLY (UPS)

1. Provide (1) rack-mounted uninterruptible power supply (UPS) for use with the control data network devices located within the control equipment rack "CER-1". The UPS shall be sized to power all equipment installed in the rack with an allowance for future equipment but shall not be rated for less than 450 watts.

G. DMX512 REPEATERS (SURFACE MOUNTED)

1. Provide surface mounted DMX repeaters containing DIN rail mounted DMX512 repeaters and a DIN rail mounted power supply. DMX repeaters and power supply shall mount in a surface mount NEMA 1 enclosure with conduit knockouts.
2. DMX repeaters shall provide 2500V opto-isolation from input to output and 250V fault protection on all ports. Repeater shall use self-resetting data links and shall not contain fuses.

3. DMX repeater modules shall contain power, DMX present, and transmit indicators. All terminations shall be via terminal strips.
4. DMX repeaters shall be fully compatible with ANSI E1.20 RDM Remote Device Management protocol.

H. ETHERNET NODES

1. PORTABLE DMX512-TO-ETHERNET NODES

- a. Provide portable DMX512 Ethernet pipe-mount nodes for connection to the stage lighting control network. DMX512 Ethernet Nodes shall be provided with the following features:
 - 1) ANSI E1.11 (DMX512-A), E1.20 (RDM) and E1.31 (sACN) compatibility.
 - 2) LCD screen for displaying status and configuration information.
 - 3) (1) Neutrik EtherCon RJ-45 Ethernet receptacle.
 - 4) (2) DMX512 receptacles configured as Outputs or Inputs. Ports shall be fully configurable via software provided by the Manufacturer.
 - 5) Nodes shall be capable of PoE Power-over-Ethernet operation.
 - 6) Pipe Clamp, mounting hardware, and safety cable for attachment to lighting pipes or handle with mounting hardware for desktop or surface mount applications.
- b. Temporarily connect nodes at field locations to ensure functionality of node with system. Return portable nodes to owner after system checkout, acceptance, and training.
- c. Refer to schedule of quantities on project drawings for types and quantities of nodes.

2. RACK MOUNTED DMX512-TO-ETHERNET NODES

- a. Provide rack-mounted DMX512-to-Ethernet nodes for distribution of control signals to/from field devices as shown on Theatre Consultant's drawings. Rack-mounted DMX512-to-Ethernet Nodes shall be provided with the following features:
 - 1) ANSI E1.11 (DMX512-A), E1.20 (RDM) and E1.31 (sACN) compatibility.
 - 2) LCD screen for displaying status and configuration information.
 - 3) RJ-45 Ethernet receptacle on rear of unit or integral to circuit board.
 - 4) (2) DMX512 receptacles per node configured as outputs or inputs. Ports shall be fully configurable via software provided by the Manufacturer.
 - 5) Nodes shall be capable of PoE Power-over-Ethernet operation.

3. PANEL MOUNTED DMX512-TO-ETHERNET NODES

- a. Provide panel mounted one-port, DMX512-to-Ethernet nodes, user configurable as an input or output, as shown on Theatre Consultant's drawings.
- b. Node shall be capable of PoE operation, shall fit in a standard single gang deep backbox, and shall mount with standard Decora-style faceplates.
- c. Node shall utilize an XLR5 male or female connector and shall contain signal indicators for Network and DMX512 status.

- d. Node shall be compliant ANSI E1.11 (DMX512-A), E1.20 (RDM) and E1.31 (sACN).

4. PORTABLE VIDEO ETHERNET NODE

- a. Provide (1) portable table-top Video Ethernet Node for remote video connection to the main lighting control console. Remote video node shall be provided with the following:
 - 1) (1) UTP 10Base-T Ethernet port.
 - 2) Ports for connection of (2) Video Monitors. Video ports shall be configurable via software provided by the Manufacturer.
 - 3) Ports for connection of (1) Keyboard, and (1) mouse.
 - 4) LED indicator for display of power and network activity.
 - 5) (1) Full-size PC Keyboard and mouse.
 - 6) 21" LCD flat-panel display monitor(s).
- b. If the Stage Lighting Manufacturer's lighting console only supports a wireless video node in the form of a laptop computer, then the following accessories shall also be supplied:
 - 1) A quantity of Wireless access points and mounting hardware required to provide a strong signal to the computer at any location in the auditorium, backstage, and control room areas.
 - 2) (1) laptop computer with a minimum 15" display and included wireless card or built-in wireless capability.
 - 3) A lockable hard carrying case with space for computer, power supplies, cables, and accessories. Carrying case to include permanently attached label: 'VIDEO NODE.'
 - 4) The laptop computer video node shall support an external video display. (1) external 22" LCD monitor shall be provided in addition to the LCD integral to laptop computer.
 - 5) Any additional accessories or items required to provide a complete and operational remote video node shall also be supplied. All original manuals and software (on CD-ROM or DVD) supplied with computer shall also be provided.

I. STAGE LIGHTING CONTROL CONSOLES

- 1. Provide (1) stage lighting control console "CC-1". The control console shall support the following minimum requirements:
 - a. 2,048 DMX512 channels via XLR5 outputs. 12,288 DMX512 channels via lighting network (optional). Provide with 2,048 Control channels.
 - b. 1,000 cues, 1,000 groups, 1,000 Macros. 400 effects.
 - c. 1000 Palette presets for each of 4 moving light attribute groups
 - d. 1 master playback fader with support for additional virtual playback faders with fully independent cue lists. Tracking and cue-only operation.
 - e. 20 Submasters (minimum).
 - f. Connections for (2) external video touchscreen displays.

- g. 4 rotary encoders for control of automated lighting functions.
 - h. Attribute library support for automated lights.
 - i. Onboard editing function to allow user to add new fixtures to the attribute library.
 - j. Color picker function for color-changing lights.
 - k. Data storage via 40GB internal hard drive or via USB flash drive.
 - l. Automated lighting control support. Attribute library support for automated lights including an onboard editing function to allow user to add new fixtures to the attribute library.
 - m. Wireless Remote Focus Unit (WRFU) support via lighting network.
 - n. Offline editing software for creation and editing of control console show files.
 - o. Console face panel and processor shall be a single integrated unit.
 - p. Basis of Design Products
 - 1) Electronic Theatre Controls, Ion Xe20, 2048 output.
 - 2) Philips Strand Lighting, Neo, 2,000 Channel, with fader wing utilizing 20 submasters.
2. Provide (1) stage lighting control console "CC-101". The control console shall support the following minimum requirements:
 - a. 512 DMX512 channels via (2) XLR5 outputs. 80 channels / multi parameter devices.
 - b. 999 cue memories, 10 pages of 40 playbacks.
 - c. 40 channels / playback faders.
 - d. HDMI output for monitor or media playback.
 - e. Audio input and output connectors
 - f. 25GB of onboard storage for show files and media.
 - g. Basis of Design Product
 - 1) Electronic Theatre Controls, ColorSource 40AV
 - 2) Others contingent on pre-approval by Theatre Consultant.
 3. Provide 21" LCD flat panel video display monitor(s) with touchscreen capabilities and dust covers for use with "CC-1".
 4. Provide 21" LCD flat panel video display monitor(s) and dust covers for use with "CC-101".
 5. Provide (1) uninterruptible power supply (UPS) for use with the stage lighting control console "CC-1" and (1) UPS for use with "CC-101". The UPS shall be sized to power the control console and (2) LCD monitors. The UPS shall be suitable for floor or desk-top mounting. UPS shall be passively cooled, no fans or other noise generating devices shall be included.

6. Provide all related cables and accessories needed for a complete operating system that integrates the new stage lighting control and dimming system. All cables to be constructed from high quality data cable suitable for repeated flexing and portable operation, ProPlex or equal. These cables and accessories include but are not limited to:
 - a. (1) 15' CAT-5 data cable with RJ-45 connectors.
 - b. (3) 15' DMX512 data cable with XLR5 connectors.
 - c. (2) Console 18" gooseneck dimmable 'Littlite' or equal dimmable LED worklights for "CC-1", (1) Littlite for "CC-101". Lights shall either securely attach directly to console via an XLR or BNC-style connector or if detached Littlites they shall include a weighted base suitable for tabletop use.
 - 1) Detached dimmable Littlites shall be model #MV-18-LED with #CWB cast weighted base.
 - d. Control console dust cover.
 - e. (1) Keyboard and (1) mouse for each control console.
 - f. (2) 8GB USB flash drives for storing show and system information.

J. WIRELESS REMOTE FOCUS UNIT

1. The WRFU shall be a portable handheld touchscreen device for remote connection to the primary control console. Software for use on device shall be provided and installed prior to system checkout and training. Device shall utilize an 8" capacitive multi-touch display and shall be mounted in a rugged enclosure. Remote focus unit capabilities shall include:
 - a. Console programming functions including playback, parking, and patching of channels.
 - b. Direct selects and playback controls.
 - c. Color picker for selected fixtures.
2. Provide a wireless access point (WAP) that is PoE powered for use in providing wireless connectivity between control console and Android or iOS devices (tablets and phones) as well as wireless remote focus unit noted above.

2.4 ARCHITECTURAL LIGHTING CONTROL SYSTEM

A. The Architectural Lighting Control System shall control the following components and functions:

1. Houselighting Control for dimming of the permanently installed house light fixtures located in the auditorium.
2. Worklighting Control for switching of all permanently installed worklight fixtures located backstage, in the box boom and front catwalk areas.
3. Rehearsal Lighting Control for dimming of all portable lighting fixtures mounted in the FOH catwalk and on the stage lighting electric battens over the stage.
4. Running Light Control for dimming of permanently installed performance run light fixtures in the backstage stage area and for receptacles for portable run light circuits as indicated on project drawings.

5. Stage Submaster / Stage Preset Lighting Control shall provide the capability to record and playback scenes that have been created with the stage lighting control console. Playback of scenes shall be possible without the aid of the control console.
- B. The Architectural Lighting Control System shall not utilize control stations that are addressed using rotary encoders, DIP switches or other physical means at the individual station.
- C. Provide station power modules or repeater modules in sufficient quantities to support the number of control stations and layout as shown on project drawings.
- D. The Architectural Lighting Control System shall support the following system functionality:
 1. System shall support creation and scheduling of real time events via a network connected PC with a web browser. Real time events shall also be able to be created, modified, and monitored from LCD stations connected via the Stage Lighting Ethernet network.
 2. Houselight presets and stage presets shall have user-configurable fade times adjusted from a single page on any of the LCD stations via a password protected setup page. House or stage presets shall operate with the same fade time regardless of where they are recalled from, this includes multiple LCD pages, hard buttons on the SMP, or hard buttons on the PCS devices.
 3. Run light circuits shall include the capability to set a maximum level via a level fader on a password protected setup page. Run light circuits can then be toggled on and off via a single button per circuit without the level exceeding the maximum set on the fader.
 4. Logic shall be incorporated to manage power supply circuits for DMX512-controlled houselights. Features shall include:
 - a. Power supply circuits shall be turned on if any DMX control channel is above 0%.
 - b. Power supply circuits shall automatically turn off after a pre-determined time if no houselight DMX control channels are above 0%.
 5. The portable control stations (PCS-x) shall reflect the current state of circuits and presets in the system when re-connected to system receptacles.
 6. The system shall support the ability to separately lockout remote houselight stations (HCS-x) and remote worklights control stations (WCS-x) from any LCD screens in the system. When remote stations are locked out they shall exhibit behavior to indicate they are in a different state. Indications could include the button changing color or button illumination blinking several times.
 7. The system shall support group functionality of circuits such that a single button on a station or page of LCD station shall be able to control circuits that are individually switchable via other stations or LCD pages. The group button shall then be able to reflect a mixed state when all circuits within the group are not in the same state by changing the button illumination to another color (amber).
 8. The system shall allow any button, fader, or object on an LCD page for physical station to be in any space or room within the system configuration. Any button or object shall also be able to be excluded from room/space all off or global all off commands.
 9. The system configuration software shall have the ability to create full pages of multi-line text with system information and operating instructions.
 10. The system shall support remote operation of network-connected system touchscreen stations via WiFi-connected smartphones or tablets supplied by end-user. Application software shall be available for user download for a nominal cost via iOS and aOS software stores. Application shall connect via dedicated stage lighting WiFi network and shall mimic current state of all buttons and faders on touchscreen when connected.

E. STAGE MANAGER'S CONTROL PANEL (SMP-1)

1. Provide an integrated Stage Manager's Panel "SMP-1" that consists of separate control sections for Houselights, Worklights, Rehearsal Lights, Run Lights, Stage Submaster faders, and Stage Preset pushbuttons. The panel shall be a dedicated enclosure and shall contain physical faders & buttons as well as a 7" color LCD touchscreen display.
2. The Stage Manager's Panel shall provide the following capabilities and requirements for the facility:
 - a. Houselight Control: Houselight area controls via physical zone fader controls and a master fader, take-control, preset record, and lockout functions for houselight circuits.
 - b. Worklight Control: Control of non-dimmable worklights, lockout, and all-off functions for worklight circuits via pushbutton controls with LED indicators.
 - c. Rehearsal Light Control: Control of the rehearsal light circuits, all-off functions for rehearsal light circuits via pushbutton controls with LED indicators.
 - d. Run Lights: Control of hardwired or portable run light circuits via pushbuttons.
 - e. Stage Submaster & Stage Preset Control: Recording and playback of stage lighting via user recordable DMX snapshots. Stage Submasters shall be snapshots assigned to faders, Stage Presets shall be snapshots assigned to pushbuttons. Stage Submaster snapshot settings can be mixed to record Stage Presets.
3. The LCD touchscreen display shall mimic all functions available as physical faders and buttons on the "SMP-1" panel. The LCD shall also provide for additional functionality not available with physical controls including monitoring of real time events created in the architectural control system. Programming of LCD pages shall be submitted and reviewed with Theatre Systems Consultant 4 weeks prior to system commissioning.
4. Provide instructions for recording Houselight & Stage presets as well as general operation of architectural lighting control system. Instructions shall be provided as user selectable help screens on the 7" LCD touchscreen.
5. The Stage Managers Panel "SMP-1" shall be constructed as a shallow rack panel for mounting in control equipment rack "CER-2". All individual sections of the SMP shall fit within a single custom rack panel that is no larger than 1 rack unit in size than indicated on project drawings. All individual stations, except the LCD panel, shall mount to a custom punched panel with electronics attached to the rear side of the panel so as not to necessitate the use of bezels on individual components.

F. DMX CONTROL STATION (DRAMA CLASSROOM)

1. Provide a wall mounted DMX512 control station for use in recalling DMX snapshots without the use of a control console.
2. DMX control station shall be capable of storing up to 10 DMX presets. Each preset can be assigned a unique fade time from 0-to-999 seconds.
3. DMX control station pushbuttons can operate in radio-style operation where only one preset can be active at a time or in push-on, push-off style. Modes of operation are user selectable via jumpers on circuit board.
4. DMX control station shall provide for pile-on operation for merging of the incoming control signal with presets and shall contain a grandmaster for overall level control.
5. DMX control station shall fit in a standard 2-gang deep electrical backbox and shall be provided with a 10V class 2 "doorbell" transformer for powering the unit.
6. Basis of design: Doug Fleenor Design, Preset Ten Architectural Two (PRE10-A2).

G. PORTABLE CONTROL STATIONS (PCS-1 + PCS-2)

1. Provide portable, table-top mount control consolettes with control capabilities and features similar to those of the Stage Manager's Control Panel (SMP-1). See above section STAGE MANAGER'S CONTROL PANEL (SMP-1).
2. The 'PCS-1' consolette shall control houselights via physical faders and pushbuttons for presets. Fade rates for presets shall be user adjustable via a setup page on the Architectural Lighting LCD screens at 'SMP-1' or 'PCS-2' stations.
3. The 'PCS-2' consolette shall be a tabletop LCD station with a 7" color touchscreen control panel which replicates all control functions present at 'SMP-1'. Buttons presses and control logic between stations shall mimic each other at the two stations. 'PCS-2' shall be a low-profile station with a sturdy base and an angled face measuring not less than 30-degrees from horizontal for legibility of the LCD screen when seated at the control room counter or similar table.
4. The 'PCS-2' consolette shall connect to the architectural control system via Ethernet wiring
5. Provide each 'PCS' station with (1) 15' and (1) 50' portable control cable with positive lock quick disconnect multipin connectors at each end for connection to control receptacle stations as indicated on project drawings and in project specifications.

H. HOUSELIGHT CONTROL STATIONS (HCS)

1. Provide prewired house pushbutton stations with appropriately sized back boxes to control the house lights. 1 momentary contact pushbutton with LED indicator light shall be provided to take control and turn on and off the house lights to a preset intensity level (cleanup preset). The control stations shall be suitable for flush mounting in custom electrical back boxes and shall include smoked Plexiglas hinged covers with magnetic twist latches. The faceplates shall be engraved with appropriate identification.

I. WORKLIGHT CONTROL STATIONS (WCS)

1. Provide prewired worklight pushbutton stations with appropriately sized back boxes to control the stage worklights. 1 momentary contact pushbutton with an LED indicator light shall be provided for each control circuit to turn on and off the work or rehearsal light circuits. The faceplate shall be engraved with appropriate identification. The stations and labels are indicated on the project drawings. Stations shall have smoked Plexiglas hinged covers with magnetic twist latches where indicated on project drawings.

J. CONTROL PROCESSOR FOR ARCHITECTURAL LIGHTING SYSTEM

1. The control processor for the Architectural Lighting System shall be mounted in the control equipment rack (CER-1). The control processor shall be designed for single phase 2 wire with ground operation at a maximum of 20 amps, 120 volts 60 Hz AC. The control processor shall have the following characteristics and requirements:
2. Interface electronics for controlling all house light dimmers, worklight non-dims, rehearsal light non-dims, and the stage presets control system shall be mounted in the control equipment rack
3. The control processing device shall have a control module with a multi-character display and keypad for system configuration. The control module shall have a memory card slot for storing the system configuration.
4. All control connections shall be terminated via factory provided plug-in connectors.

2.5 STAGE LIGHTING FIXTURES

- A. Provide stage lighting instruments as indicated on the schedule of quantities on project drawings.

- B. All stage lighting instruments shall be provided with the following accessories:
1. Pipe-mounting C-clamp (except followspots and floor-mounted instruments) and hanger brackets if yoke is not integral to instrument.
 2. Floor trunnions for floor mounted fixtures.
 3. Color filter frame and 30" wire-rope safety cable with snap link closure.
- C. Provide 4-color LED programmable spotlights suitable for long throw applications. Fixtures shall include the following:
1. Die cast all metal housing, mounting yoke, accessory slots with locking capability for two accessories. Slot for glass or stainless steel patterns and soft focus diffuser.
 2. Built-in power supply, on-board processor, (60) Luxeon LED emitters with a minimum 20,000-hour L70 lamp life.
 3. Theatrical grade dimming and low noise cooling via a variable speed, temperature-controlled fan. RDM functionality for address and setting changes.
 4. DMX512 input and through connectors via 5-pin XLR connectors. Power in and thru via PowerCon connectors.
 5. Lens tubes and/or barrel assemblies of various beam widths or zoom ranges per schedule of quantities on project drawings.
 6. Acceptable product:
 - a. ETC ColorSource Spot.
 - b. Others contingent on pre-approval.
- D. Provide 4-color LED programmable wash lights suitable for long throw applications. Fixtures shall include the following:
1. Die cast all metal housing, mounting yoke, accessory slots with locking capability for two accessories.
 2. Built-in power supply, on-board processor, (40) Luxeon LED emitters with a minimum 20,000-hour L70 lamp life.
 3. Theatrical grade dimming and low noise cooling via a variable speed, temperature-controlled fan.
 4. DMX512 input and through connectors via 5-pin XLR connectors. Power in and thru via PowerCon connectors.
 5. Lenses to vary beamsread shall be provided per schedule of quantities on project drawings.
 6. Acceptable product:
 - a. ETC ColorSource PAR.
 - b. Others contingent on pre-approval.

- E. Provide two-cell, LED cyclorama floodlights with (2) 100-watt RGBA LED emitters, asymmetrical reflector, feed-thru PowerCon power and XLR5 DMX data connectors, power cord with grounded 5-15P Edison connector, yoke and pipe mount kit. Fixture shall incorporate RDM functionality to set DMX address and manage fixture settings.
1. Acceptable product: Altman Spectra Cyc 200.
 2. Others contingent on pre-approval by Theatre Consultant.
- F. Provide wide flood LED work lights suitable for long throw worklight applications with a minimum 40,000-hour L70 lamp life, 10,000 lumens of output, diffused lens in frame, adjustable yoke, L5-20P twist-lock connector. The fixtures shall have a CCT of 3,200 kelvin and a minimum CRI of 90. The fixture shall feature a built-in power supply and shall be passively cooled with no fans. Acceptable products:
1. Altman Lighting #WL-130.
 2. Others contingent on pre-approval by Theatre Consultant.
- G. Provide 6" or 8" Fresnel/PAR style LED spotlight for long throw worklight applications. (FOH Rehearsal Light & Black Box House Light)
1. Spotlight to utilize 3,000-degree Kelvin light engine with a CRI of 90 or greater and shall produce a minimum of 10,000 lumens of output.
 2. Spotlight shall be capable of on/off control via line voltage relay switching without the need for a separate data connection. The fixture shall turn on and output light in less than 1 second from application of power.
 3. Spotlight shall include DMX512 input and output data connections via XLR 5-pin connectors or via adaptor cables for precise control of dimming if desired.
 4. FOH rehearsal light fixtures shall be supplied with a power lead with a L5-20P grounded twistlock connector.
 5. Black box house light fixtures shall be supplied with a power lead with a 5-15P Edison connector.
 6. Spotlight shall have an adjustable beamspread from 15 to 72 degrees or shall vary beamspread via interchangeable lenses.
 7. Spotlight shall be cooled passively or via silent active cooling (less than 19dBA at 0.5M).
 8. Acceptable products:
 - a. Altman Pegasus8 LED Fresnel (FOH Rehearsal Light)
 - b. Altman Pegasus6 LED Fresnel (Black Box House Light)
 - c. Electronic Theatre Controls: Source 4WRD PAR, Gallery Edition, with MFL and WFL lenses
 - d. Other contingent on pre-approval by Theatre Consultant.

- H. Provide wide flood PAR-style or Fresnel spotlight with 575 or 500 watt, 115V, 1,500 or 500 hour lamp, 36" pigtail with grounded stage pin connector. Fixture to include an enhanced aluminum reflector, three heat resistant borosilicate glass lenses with oblong beams for MFL, WFL, and XWFL distributions or a zoom mechanism for 16-70-degree field angle adjustment (fresnel). Lenses for PAR's shall rotate 360-degrees and include a thermally insulated lens ring for lenses rotation adjustment. (Run Light).
1. Acceptable product:
 - a. E.T.C. Source Four PAR EA w/ MFL, WFL, XWFL lenses
 - b. Altman 65Q Fresnel
 - c. Others contingent on pre-approval by Theatre Consultant.
 2. Run light fixtures shall each be supplied with a 4-leaf barndoor with a safety cable permanently attached.
- I. Provide a ghostlight fixture consisting of a 72" tall base and stand assembly with a medium screw base socket enclosed with a protective basket. Base to include 3 locking casters. Fixture shall include 15' of 12/3 type SJ power cord with a 5-15P parallel blade+ground connector installed. Supply with (1) retrofit LED lamp, A-21 size, approximately 20 watts, Phillips #451906 or equal. Ghost light basis of design: Altman Lighting: Ghost-Light.
- J. Spare Lamps: Provide a quantity of spare lamps equal to 30% of the quantity of each of the above different types of fixtures but no less than 5 spares for any type unless noted otherwise.
- K. Provide 1200 Watt HMI Followspots. Followspots to include lamp, an internal ballast, igniter, circuit breaker, and illuminate on/off rocker switch. Other features include:
1. 6-color self-canceling boomerang
 2. Heavy duty dowser
 3. Heavy duty nichrome steel iris
 4. Stainless steel trim shutters
 5. Telescoping floor stand with casters and leveling jacks
- L. Followspots to be Lycian SuperStar 1.2K Model 1275 or approved equal.
- M. Provide (1) spare lamp per each followspot.
- N. STAGE LIGHTING FIXTURES EQUIPMENT LIST:
1. Stage lighting fixture quantities per schedules on project drawings.

2.6 STAGE LIGHTING ACCESSORIES

- A. Provide stage lighting cable and accessories as indicated on the schedule of equipment quantities on project drawings. Cables shall be fabricated per the following criteria and per details on project drawings.
1. All extension cables shall be marked near each end for length identification per details on project drawings. Labels shall be covered with clear, shrink-wrap tubing. Utilize 3/4" wide Scotch 35 Color Coding Vinyl Electrical Tape for coloring. Length color code is as follows:
 - a. 6' = Yellow
 - b. 10' = Red
 - c. 15' = (1) Yellow + (1) Red w/ 3/8" gap in-between

- d. 20' = (2) Red w/ 3/8" gap in-between
 - e. 25' = Orange
 - f. 50' = Brown
 - g. 75' = (1) Brown + (1) Orange
2. All data extension and adaptor cables utilizing XLR 3,4,5 or 6-pin connectors shall utilize Neutrik XX-series connectors with gold plated contacts, black shell and colored bushings to identify cable function. Network extension cables shall utilize Neutrik Ethercon connectors. Bushing colors shall be as follows:
 - a. Network - XLR Ethercon = Blue
 - b. DMX512 - XLR 5-pin = Violet
 - c. DMX512 - XLR 3-pin = Gray
 - d. Power/Data - XLR 4-pin = Green
 3. DMX data cables and power supply/data cables shall be terminated with heat shrink tubing over the drain wire and clear heat shrink tubing over the portion of cable where the outer jacket has been stripped from individual conductors.
 4. Provide and install a tie-line with each power extension cable for securing cables when coiled. Provide a Velcro tie-wrap for all data and PowerCon extension cables. Tie-line shall be 1/8" black cotton trick line/tie-line, unglazed, attached to cables with clove hitch and half-hitch knots, minimum 36" long.
 5. All extension, adaptor and miscellaneous cables shall be provided with a 3" long clear length of heat shrink tubing installed on cables for owner-provided labeling.

B. Extension cables

1. Provide CAT-5 Ethernet data portable extension cables with TMB ProPlex PCCAT5EP cable & Neutrik EtherCon RJ-45 connectors with black shells and colored bushing to identify cable function.
2. Provide portable DMX512 control extension cables constructed from TMB ProPlex PC224P cable with heavy-duty jacket and Neutrik 5-pin XLR connectors with gold plated contacts, black shells, and colored bushings to identify cable function.
3. Provide 12/3 type SO portable stage extension cables with male and female grounded stage pin connectors.
4. Provide 12/3 type SO portable stage extension cables with male and female grounded 5-20 Edison connectors.
5. Provide 12/3 type SO portable stage extension cables with male and female grounded L5-20 connectors.
6. Provide Powercon jumper cables for daisy-chain of LED wash lights.
7. All extension cables shall be marked near each end per details on project drawings. Labels shall be covered with 3" long, clear, shrink-wrap tubing. Install tie-line with each extension cable for securing cables when coiled. Provide colored bushings for data cables to identify functions per detail drawings. All data connectors shall be either Neutrik X-series (Network) or Neutrik XX-series (DMX512 cables).

C. Adaptor & Miscellaneous Cables

1. Provide molded-rubber-cable twofers with 20-amp grounded stage pin connectors. Lengths and quantities per schedules on project drawings.
2. Provide 12/3 female grounded stage-pin to male grounded Edison adaptors.
3. Provide 12/3 male grounded stage pin to female grounded Edison adaptors.

4. Provide DMX5-pin turnaround cables, XLR5M-to-XLR5M, XLR5F-to-XLR5F.
 5. Provide DMX adaptor cables, XLR3M-to-XLR5F, XLR3F-to-XLR5M.
 6. Provide DMX terminating plug, XLR5M with 120-ohm resistor across pins 2 and 3.
 7. All DMX data adaptor cables shall be fabricated from either Neutrik XX-series connectors with gold plated contacts, black shell and colored bushings to identify cable function per detail drawings.
- D. Provide stage lighting tophats to fit 19°, 26°, 36°, 50° ellipsoidal reflector spotlights. Sizes and quantities per schedules on project drawings. Tophats shall have a safety cable permanently affixed.
 - E. Provide 4-pane stage lighting barndoors to fit Parnel or Fresnel spotlights and LED washlights. Barndoors shall have a safety cable permanently affixed.
 - F. Tophats, barndoors, and color extenders shall have a safety cable permanently affixed via a galvanized aircraft cable attached to the device with a loop terminated with a Nicopress sleeve and with a snap hook captured at the other end via a loop and Nicopress sleeve.
 - G. Provide template holder for ellipsoidal reflector spotlights for A-size patterns.
 - H. Provide 3,000 spool of 1/8" black unglazed tieline.
 - I. Provide road cases for storage of portable stage circuit extension cables, control cables, two-fers, adaptors, and accessories. Road cases shall have the following features:
 1. Case construction shall conform to A.T.A. standards, specification 300, category 1.
 2. Case shall be of the hinged-lid, rolling variety. Approximate outside dimensions of case shall be 40" long by 25" wide. The storage section shall be 24" high with an upper hinged lid section. With casters the overall height of the case shall be approximately 30".
 3. Cases shall be constructed from 1/2" plywood with a fiberglass laminate exterior surface bonded to plywood. Line the inside of the case with outdoor carpet or provide another method for limiting splintering along the inside walls of the case. Laminate surface color: BLACK.
 4. All fittings and edges shall be fabricated with tapered aluminum and shall be attached via split steel rivets every 3". Aluminum tongue-in-groove fittings shall be used at the perimeters of the lid to ensure positive alignment. A continuous length steel piano hinge shall be utilized for the lid along with 2 nylon straps to limit lid travel. (2) recessed spring-loaded latches shall be provided opposite hinged side along with (4) recessed spring loaded handles with foam grips at the ends of the case. Steel ball corners shall be provided at each corner of the case. Provide (4) heavy duty ball-bearing casters with a minimum load bearing capacity of 225 pounds each. Attach casters to bottom of case with reinforcing caster plates. Install (4) caster cups in lid of case for ease of stacking cases.
 5. Provide a removable wooden partition perpendicular to the long side of the case at the case center. Provide guides for the partition to slide into and a rounded rectangular hole near the top of the partition for a hand hold. Partition to be constructed from 1/2" wooden material that is resistant to splintering.
 6. Stencil with white paint the top and 4 sides of the case with the name of the owner or auditorium (verify with Architect prior to fabrication), a unique case # (#1 through 3 or similar) and the text "STAGE LIGHTING" in 1" high block letters.
 7. Case manufacturer shall be equal to Jan-al "Rhino ATA" or equivalent contingent on approval of the Theatre Consultant. Quantity per schedule on project drawings.

2.7 ACCEPTABLE STAGE LIGHTING EQUIPMENT MANUFACTURERS

- A. Acceptable stage lighting dimming and control manufacturers
 - 1. Electronic Theatre Controls (ETC)
3031 Pleasant View Road
Middleton, WI 53562-0979
800-688-4116
Acceptable dimmers: Sensor
 - 2. Strand Lighting
10911 Petal Street
Dallas, TX 75238
214-647-8031
Acceptable dimmers: C21
- B. Acceptable stage lighting fixture manufacturers
 - 1. Electronic Theatre Controls (ETC)
 - 2. Strand Lighting
 - 3. Altman Stage Lighting
- C. Acceptable dimmer circuit distribution equipment manufacturers
 - 1. Electronic Theatre Controls (ETC)
 - 2. Strand Lighting
 - 3. SSRC
 - 4. Altman Stage Lighting

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Contractor shall furnish and install a completely functioning dimming system. All equipment, fittings, and peripheral devices for correct system operation shall be quoted and supplied.
- B. Installation shall be in conformance with local, state and N.E.C. codes specifications and in accord with manufacturer's recommendations.
- C. All lighting instruments and items of equipment, and individual components where applicable standards have been established, shall be listed by Underwriter's Laboratories, Inc. and shall be the U/L or ETL label when delivered and installed on job.
- D. All Ethernet cabling shall be category 5e UTP and shall conform to TIA-568B standard and shall be installed, terminated, and certified by The Systems Integrator.
- E. No part of the system shall be energized before being checked and the installation approved.
- F. Protection and cleaning:
 - 1. Materials and Equipment: Cover all equipment stored or installed on the site with polyethylene sheets or approved equivalent, to protect equipment from dust, moisture, plaster, cement, paint or work of other trades.

2. Storage: Provide proper and adequate storage facilities.
3. Damage: Replace all damaged or defective work, materials, or equipment. Install sensitive or delicate equipment after major construction work is completed.
4. Site Cleaning: Regularly remove waste and rubbish and maintain order.
5. Equipment Finish: Clean and polish all surfaces.
6. Acceptance: Remove all debris, dirt, grease, and oil from building surfaces caused by installation work. Clean and vacuum all rooms in which installation work has occurred.

G. Installation Notes:

1. Each dimmer circuit requires a separate hot and separate neutral. NO COMMON NEUTRALS.
2. The theatrical stage lighting drawings are diagrammatic only. Do not scale the drawings to determine the location of equipment.
3. Do all drilling, cutting, channeling and patching required to install lighting equipment and electrical work as indicated or herein specified. All holes, curbs, etc. in floors, ceilings, and walls shall be patched, unless indicated otherwise. Paint all new exposed electrical raceways, cabinets, enclosures, and fittings to match in color adjacent surfaces in finished areas.
4. Seal all penetrations through fire rated walls, ceilings, floors, etc., to maintain the fire rating. Furnish and install fire rated enclosures for all equipment penetrating into fire rated envelopes, spaces, etc.
5. Location of all conduit runs and junction boxes must be approved by the Theatre Systems Consultant and Electrical Engineer prior to actual construction.

3.2 SYSTEMS INTEGRATOR INSTALLATION RESPONSIBILITIES

A. Systems integrator shall be responsible for the following:

1. Verify mounting locations for all wiring devices with installing contractor.
2. Verify all data cable types and wiring topologies with installing contractor based on system manufacturer requirements.
3. Coordinate early release of backboxes or other equipment required for rough-in.
4. Pre-configure and test all permanently installed intelligent architectural fixtures such as DMX-controlled fixtures that are connected to or controlled by the theatrical lighting systems.
5. Make a minimum of 5 site visits prior to initial system commissioning to monitor jobsite progress and to coordinate with the installing contractor.
6. Coordinate multi-cable and data cable installation supported by stage rigging with rigging contractor to ensure that cable is arranged per project drawings.
7. Terminate all stage lighting data wiring connected to the stage lighting dimming and control equipment even if the Systems Integrator was not part of the chain-of-supply for select pieces of equipment (DMX or 0-10V controlled lighting fixtures).
8. Test all Ethernet network segments and provide a detailed test report to Theatre Consulting.

- a. A report with individual test reports for all Ethernet cable segments shall be submitted to the consultant 5 days prior to commencement of the final punch list inspection. The report should be generated by a network analyzer similar to the Fluke DSP-4000 series
9. As an authorized field service commissioning agent for the primary theatrical lighting equipment vendor, commission the entire theatrical lighting dimming and control system.
 - a. Configure control data distribution system and architectural lighting control system with the following parameters:
 - 1) Ethernet-to-DMX node ports configured as outputs at field wiring devices shall be configured as DMX universe #2.
 - 2) Ethernet-to-DMX node ports configured as inputs at field wiring devices shall be configured as DMX universe #1.
 - 3) All portable 2-port Ethernet-to-DMX nodes shall be configured with port #1 assigned to DMX universe #1 and port #2 configured as DMX universe #2.
 - 4) Ethernet-to-DMX node ports for nodes installed in equipment racks shall be configured per project drawings.
 - 5) Temporarily connect all portable nodes at field locations to ensure functionality of node with system. Return portable nodes to owner after system checkout, acceptance, and training
 - 6) The control network and dimming system shall be configured so that architectural lighting circuits (house lights, work lights, rehearsal lights, running lights) are not controlled by the stage lighting console.
 - 7) The control network and dimming system shall be configured so that the stage submaster faders and stage preset pushbuttons can record all DMX addresses in universe #2 and all addresses in universe #1 except for the architectural lighting circuits.
 - 8) The programming of the architectural lighting touchscreen stations and all button and fader stations shall be configured and tested with offline software 4 weeks prior to the expected system commissioning date in conjunction with the Theatre Consultant.
 - a) All pushbuttons at remote WCS and HCS stations shall utilize dim blue indicators when associated circuit(s) is off and bright green when on. All pushbuttons shall flash with a slow red indicator or use another scheme to indicate when a button is pressed that the station is locked out.
 - b) Instructions for recording Houselight & Stage presets as well as general operation of architectural lighting control system. Instructions shall be provided as user selectable help screens on the 7" LCD touchscreen. Circuit #'s for architectural lighting power circuits shall be listed along with help screens.
10. Verify that all manufactured items delivered to the project site are fabricated per approved submittal drawings prior to installation.
11. Coordinate receiving of portable theatrical equipment and prevent from loss or damage until time of installation or turnover.
12. Provide trained and highly qualified theatrical stage lighting technicians to properly hang and focus aim adjust the stage lighting spotlight fixtures. This installation shall consist of the following:
 - a. Unpack light fixture, install lamp, bench focus fixture, install c-clamp, safety cable, and any related hardware or accessories, dispose of packing materials.

- b. Hang fixtures and connect to power circuit receptacles as noted on initial light plot. Install portable data cable for intelligent fixtures.
 - c. Install any color filters noted on initial light plot in project drawings.
 - d. For intelligent, programmable fixtures perform a complete setup including assigning DMX addresses and applying other profile settings as requested by Theatre System Consultant and as required to provide an integrated functioning system.
 - e. Do not install fixtures until facility is reasonably dust free to prevent the accumulation of dust and dirt on lenses and reflectors. If facility is not dust free place plastic bags over fixtures and until time of checkout. Unplug fixtures to prevent accidental activation while fixtures are covered.
 - f. Maintain an inventory of how many sheets of color have been used as well as any cable or accessories installed for the purpose of verifying inventory of system accessories at time of final checkout.
 - g. Patch all lighting fixtures at control console and verify that entire light plot functions normally when controlled by primary control console and architectural control system. Verify that fixture profiles are installed for all intelligent fixtures provided as part of the project. Obtain missing profiles from the control console manufacturer or create full function profiles with a personality editor.
- 13. Provide training sessions to end-user as defined elsewhere in specification.
 - 14. Deliver project closeout documents including O&M manuals for all theatrical lighting equipment as well as as-built submittal drawings. See additional requirements in project general conditions documents.

3.3 TESTING AND COMPLETION

- A. Provide all instruments for testing and demonstrate in presence of the School's Representatives that all circuits and wiring tests free of shorts and grounds.
- B. Furnish all labor, instruments, appliances, equipment, and materials necessary to demonstrate to the School that the installations perform as required and are as specified herein.
- C. The School reserves the right to make independent tests of all equipment furnished to determine whether or not equipment complies with requirements specified herein and to accept or reject any or all equipment on basis of results thereby obtained.
- D. Within 14 days of written request, the Systems Integrator shall provide a factory engineer to check installed systems and make any adjustments or modifications necessary for proper operation
- E. Should any follow-up checkout and inspection visits be required by the Architect, Electrical Engineer or Theatre Systems Consultant due to any installation caused matters after the approved completion of the project, the Contractor shall bear this cost at the Architect's, Engineer's and Consultant's standard hourly rates. This shall be scheduled and approved in writing.

3.4 TRAINING AND INSTRUCTION

- A. The stage lighting equipment manufacturer and/or the Contractor shall provide operations and maintenance instruction to School personnel as follows:
 - 1. A minimum of two (2) and not to exceed four (4) hours of operations instruction for the School's faculty, staff, and students.
 - 2. A minimum of one (1) and not to exceed two (2) hours of maintenance instruction for the School District's maintenance staff

- B. All training sessions shall be coordinated with the school schedule. Cost of such instructional services shall be part of the Contractor's bid.
- C. Review of written operations and maintenance manuals and submittal drawings shall take place during these training sessions.

END OF SECTION

SECTION 26 56 68

SPORTS LIGHTING

1. PART GENERAL

1.1 SECTION INCLUDES

- A. Exterior luminaires and accessories
- B. Lamps
- C. Poles outdoor applications

1.2 SUBMITTALS

- A. Submit COMPLETE product data and performance evaluations as required by this specification for review by the Architect/Engineer. The following performance criterion establishes the minimum performance level that must be achieved. Failure to comply with the following performance criteria and specifications will require complete re-submittals with all necessary revisions to the sports field lighting system. ALL REVISIONS WILL BE AT NO COST TO THE OWNER. FAILURE TO COMPLY SHALL BE CONSIDERED REASONABLE CAUSE FOR REJECTION OF BID.
- B. The performance evaluations shall consist of the following venues/areas:
 - 1. Outdoor Baseball and Softball fields
 - 2. Outdoor Football fields
 - 3. Outdoor Soccer fields
 - 4. Outdoor tennis courts
 - 5. Outdoor pool
- C. Include scaled drawings/prints, on a minimum 30" x 42" size drawing, of the entire field/court/ice, for each of the evaluations showing manufacturer's photometric performance and summary to verify compliance with design criteria as outlined in this specification.
- D. Include scaled drawings/prints of the "spill light" out to a radius of 450' from center of each field. Provide horizontal initial foot candle calculations. beyond the court at Event Level to the last row of seating in the lower bowl at Concourse Level. Take into account elevation change.
- E. Include technical specification cutsheet of lamp used in calculations indicating initial lumens at 100 hours burn in and mean lumens at 40% rated life for both vertical and horizontal lamp positioning. Include rated lamp life in hours.
- F. Include technical specification cutsheets of fixtures, drivers enclosures, poles, engineered base design per pole, and all necessary mounting hardware and accessories.
- G. Include electrical load summary table with specific KVA load per pole for each evaluation. KVA load shall include actual ballast load or input KVA and not just lamp wattage total.

1.3 EXTRA STOCK

- A. Provide extra stock under provisions of Section 26 05 00. Turn over to Owner prior to project closeout and final payment.
- B. Lamps: Provide a total of twelve (12) extra high wattage metal LED lamps used in the sports lighting and emergency lighting fixtures.
- C. Provide a total of six (6) extra drivers used in the sports lighting drivers enclosures.

1.4 DELIVERY, STORAGE, AND HANDLING

- A. Deliver products to site under provisions of Section 26 05 00.
- B. Store and protect products under provision of Section 26 05 00.
- C. Handle metal poles carefully to prevent breakage and damage to finish.

2. PART PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

Outdoor

- A. Musco or approved District equal.

2.2 GENERAL

- A. Manufacturer shall have a minimum of 5-years' experience in the design, manufacturing, and installation support of their sports lighting system.
- B. Sports lighting system shall be UL listed as a complete system.
- C. Outdoor Fixtures and structural system shall withstand 100 mph constant wind forces with a 1.3 gust factor without misalignment to crossarms or individual fixture aiming.
- D. Manufacturer shall provide a minimum of 5-year warranty, from date of Owner accepted installation, against defects in material. All parts and labor to replace will be at no cost to the Owner. The alignment/aiming of individual fixtures shall be warranted against any movement over this same 5-year period. Lamps shall be warranted for two years from date of Owner accepted installation. Lamps failed within this time shall be replaced and installed at no cost to the Owner by the sports lighting manufacturer.

2.3 PERFORMANCE DESIGN CRITERIA

Outdoor

- A. Calculations for Outdoor Baseball Fields, Football Fields, Soccer Fields, Swimming Pool and Tennis Courts
 - 1. Photometric analysis shall state the maintained horizontal footcandle level at 3' above playing field level using a 20' x 20' grid. Test points shall include the sidelines and endline.
 - 2. The average maintained horizontal light level shall have a maximum:minimum ratio of 1.7:1 or less.
 - 3. Calculations shall include a light loss factor in addition to any applicable tilt factor and ballast factor. The light loss factor, LLF, shall be the combination of the lamp lumen depreciation, LLD, and the luminaire dirt depreciation, LDD. For calculations, use a LDD=0.90. The LLD shall be determined by the lamp manufacturer's stated mean lumens at 40% rated life divided by the 100 hour burn in initial lumens.
 - 4. Calculations shall state the final design lumens used per fixture. The final design lumens are calculated by multiplying the 100 HR initial lamp lumens by the light loss factor (LLF), and applicable ballast factor and tilt factor.
 - 5. Include "spill light" calculation showing maintained horizontal and vertical footcandles at 3' above grade along the property line.

6. Calculations shall include Maximum-to-Minimum Ratio, Coefficient of Variation, and Uniformity Gradients as defined by the Illuminating Engineering Society of North America.

B. Outdoor Lighting System Levels

1. Outdoor Baseball and Softball Fields:

- a. IESNA RP-6, Class: III.
- b. Facility Type: Insert type.
- c. Horizontal Illuminance:
 - 1) Infield: 50 fc.
 - 2) Outfield: 30 fc.

2. Outdoor Football Fields*:

- d. IESNA RP-6, Class: II.
- e. Facility Type: Insert type.
- f. Horizontal Illuminance: 50fc.

*Readings taken at grade. All other readings taken at 36".

3. Outdoor Soccer Fields:

- g. IESNA RP-6, Class: III.
- h. Facility Type: Insert type.
- i. Horizontal Illuminance: 50 fc.

4. Outdoor Tennis Courts:

- j. IESNA RP-6, Class: III.
- k. Facility Type: Insert type.
- l. Horizontal Illuminance: 50 fc.

5. Outdoor Pool:

- m. Horizontal Illuminance: 50 fc.
- n. IESMA RP-6, Class: III

C. Outdoor Luminaire Mounting Height: Comply with recommendations in IESNA RP-6, Section 3.

2.4 FIXTURES

- A. Outdoor The sports floodlights optical assembly shall be a one piece spun aluminum parabolic type reflector finished inside and out with a corrosion resistant anodized finish for maximum optical performance and lumen maintenance.

- B. Outdoor The optical assembly shall include a thermal and impact resistant glass lens in a stainless steel hinged doorframe. The doorframe shall be permanently attached to the reflector by the stainless steel hinge and held in place with stainless steel spring latches. The doorframe shall include a concentric butt-welded high temperature solid silicone gasket. The reflector shall also include a granular charcoal filter to protect the internal reflective surface from photometric degradation caused by the entry of dust and other fine particulate.
- C. The optical assembly shall include a thermal resistant, vibration dampening lamp support positioned opposite of the lamp base so as to not interfere with light distribution. This support will dampen vibrations, which otherwise would decrease overall lamp life and maintain proper position of lamp within reflector.
- D. Outdoor All fixtures mounted on the sideline poles shall be provided with means to minimize glare and spill lighting. Use of internal louvers and/or external visors shall be securely assembled to the optical housing.
- E. All sports floodlights and work floodlights shall utilize the same wattage and lamp source for consistency in relamping and maintenance. Each fixture shall have a lockable aiming mechanism that will allow fixture to be rotated for relamping and repositioned without reaiming.
- F. Outdoor The sports floodlights shall mount to the crossarms with a fully adjustable mounting bracket to allow aiming of fixture. The ballast assembly shall be remote from the fixture in a separate enclosure mounted near the base of the pole (10 feet above grade). Wiring between the remote ballast enclosure(s) and fixtures shall be via a wiring harness located within the pole.
- G. All wiring on the Luminaire assembly shall meet California Electric Code and shall pass from each Luminaire on the assembly through protective enclosures to join in a common enclosure. Each luminaire shall have individual supplemental fuse protection located in remote ballast boxes. Fusing must be UL listed. In-line is not acceptable.

2.5 DRIVER ENCLOSURE

- A. Outdoor Each pole shall utilize remote NEMA 3R ballast enclosure(s) as required to control the associated number of fixtures on the pole.
- B. Outdoor Enclosure shall be hot dipped galvanized sized to house up to a maximum of six (6) ballasts, a main breaker sized for load served, capacitors, and fuse blocks to individually protect each ballast.
- C. Outdoor Enclosures to be securely mounted on side of pole at approximately 10' above grade with gasketed wire access for main power feed and manufacturer's pre-fabricated wiring harness going to fixtures.
- D. Outdoor Voltage rating for all sports floodlighting driver enclosures shall be 480 volt, 3-phase. Feed conductors shall route within pole and terminate at 3-pole main breaker within enclosure. Enclosure shall be prewired from main breaker through individual fusing to ballast.
- E. Supply extra stock of driver to Owner as specified.

2.6 Outdoor WIRING HARNESS

- A. The wiring harness between the fixtures and remote ballast enclosure(s) shall be multi-conductor type cable with an overall outer PVC jacket for physical protection. Minimum conductor size shall be #14AWG with individual color-coated insulation jacket to facilitate any troubleshooting. All conductors shall be stranded copper with 600-volt insulation with 90°C temperature rating.
- B. In addition to the outer PVC jacket around the multiple conductors, provide rubber bumpers spaced no greater than 10' on-center to minimize possible abrasion of outer PVC jacket on interior finish of pole.

- C. Include stainless steel wire mesh strain relief at top of wiring harness and secure to inside top of pole.
- D. Each end of wiring harness shall have a quick connector plug for ease of installation.
- E. Each wiring harness shall be tested at the factory to verify proper operation between ballast and fixture and to minimize field installation time.

2.7 Outdoor POLES

- A. Comply with AASHTO LTS-3 for poles or other support structures, brackets, arms, appurtenances, base, anchorage, and foundation.
- B. Wind-Load Strength of Total Support Assembly: Adequate to carry support assembly plus luminaires without failure, permanent deflection, or whipping in steady winds of 100 mph with a gust factor of 1.3.
- C. Mountings, Fasteners, and Appurtenances: Corrosion resistant, compatible with support components, and shall not cause galvanic action at contact points.
 - 1. Steel Components: Hot-dip galvanized after fabrication, complying with ASTM A 123 / A 123M.
 - 2. Mounting Hardware Fasteners: Hot-dip galvanized, complying with ASTM A 153 / A 153M.
- D. Poles shall be sectional type hot dipped galvanized steel poles to achieve minimum fixture mounting height specified. All poles shall include grounding lug, wire access handhole, remote ballast enclosure(s) mounting brackets and wiring access, lightning terminal atop pole, and jacking brackets. Contractor/Manufacturer may use prestressed centrifugally spun concrete poles meeting all structural requirements at their discretion.
- E. Pole base may either be a prestressed centrifugally spun concrete base pier or direct embedded hot dipped galvanized steel pole with black tar coating entire embedded length or a poured in place foundation concrete base.
- F. The foundation for either prestressed concrete base or base plate steel pole or direct embedded steel pole shall be designed around standard auger sizes with concrete fill to achieve a minimum 28-day compression strength of 3000 psi or greater as required by manufacturer's structural design analysis. Crushed rock or earth backfill is not acceptable!
- G. The sports lighting system manufacturer shall provide complete calculations within submittals verifying that the lighting pole meets the wind load requirements specified herein.
- H. The sports lighting structure system shall be designed to withstand an Isotach wind velocity of 90 mph plus a 1.3 gust factor, including the total effective projected area and weight of the fixtures and complete assembly. The loads computed by this method shall not be less than those based on 1 90 mph wind with an exposure "B" per California Building Code 2000 and ASCE 7-98.
- I. Sports lighting system manufacturer shall provide complete calculations within submittals verifying that the lighting pole meets the wind load requirements specified herein.
- J. Each section of the pole shaft shall be of a single ply of steel with no welded splices, and having only one longitudinal seam weld. Each slip joint shall be assembled in the field by slipping the upper section over the lower section by a minimum lap of 1.5 times the largest inside diameter of the upper section. The pole cross section shall be rounded or 16-sided with a four-inch corner radius. The pole shaft sections shall be high strength steel meeting the requirements of ASTM A595 Grade A or B or ASTM A572 Grade 65.
- K. Poles shall be hot-dipped galvanized in accordance with the requirements of ASTM A123. Each component must be completely coated in a single dip. No double dipping will be allowed. All miscellaneous hardware shall be galvanized per ASTM A153.

- L. Each pole shall include a ½" diameter by 48" tall solid copper lightning protection air terminal with nickel plated tip.
- M. Crossarms shall be fabricated from hot dipped galvanized tubular steel. All mounting brackets and hardware shall be galvanized to ASTM A123 requirements.
- N. Manufacturer of sports lighting structure shall receive soil tests from Owner to properly design pole foundations.
- O. Manufacturer shall include cost to hire the services of a licensed Structural Engineer to review soil tests and design appropriate pole foundations. Include signed foundation drawings, calculations and all installation requirements in sports lighting system submittal.
- P. The poles shall have a 1" diameter grommet drilled in the pole shaft, prior to galvanizing, and furnished with a rubber plug for future speaker wiring access. This grommet shall be located approximately 12" below the externally mounted cross-arm or bracket and shall be suitable for supporting up to 4 speakers.

3. PART EXECUTION

3.1 DELIVERY AND STORAGE

- A. Deliver products to the site under provisions of Section 26 05 00.
- B. Store and protect products under provisions of Section 26 05 00.
- C. Maintain factory wrapping or provide an additional heavy canvas or heavy plastic cover to protect remote ballast enclosures, fixtures and sockets, etc., from dirt, water, construction debris, and traffic.

3.2 INSTALLATION

- A. Manufacturer's representative to be on-site a minimum of two (2) days to provide instruction and assistance with installation of sports lighting system. Complete installation shall be in accordance with manufacturer's requirements and design intent as shown on the drawings.
- B. Aiming: The manufacturer shall provide a mechanical positioning device for each Luminaire on the assembly which shall be set at the factory by the manufacturer based upon computer calculated aiming information, such that each assembly is delivered to the job site as one composite light source. The device shall provide positions for the initial installation and provide for repositioning of the aiming after relamping. The manufacturer shall also supply drawings showing the aiming point locations of each Luminaire.
- C. Handle in accordance with manufacturer's written instructions. Lift only with brackets provided for the purpose. Handle carefully to avoid damage to poles, fixtures, ballast enclosures and all internal components, and finish. Touch up any scratches through galvanized finish with manufacturer supplied galvanizing paint.
- D. Electrical Contractor to provide matching locking receptacle adjacent to each Sports Floodlight, Type A1, or Work Floodlight, Type A2, for power. All Sports and Work Floodlights, Type A1 and A2, shall be controlled through the low voltage lighting control system.
- E. Relamp luminaires that have failed at completion of work.
- F. Turnover extra stock of lamps and ballasts to Owner at completion of work.
- G. Clean fixture reflectors and lenses from all dirt, dust, debris, etc., prior to mounting to catwalk. Verify lenses and gasketing are properly seated to maintain tight seal.

- H. Outdoor All pole base excavations shall be inspected by a qualified geotechnical engineering firm hired by the installer. The geotechnical engineering firm will certify the bearing pressure and lateral earth pressures before placing concrete and reinforcing steel.

3.3 PERFORMANCE VERIFICATION

- A. Manufacturer's representative shall be on-site at completion of installation to verify that the contractor has met the manufacturer's requirements.
- B. Manufacturer to supply plot of entire baseball and softball fields, football fields, soccer fields, outdoor tennis courts, and pool initial point-by-point photometric calculations to Contractor and Architect/Engineer. Contractor shall measure and record horizontal and vertical footcandle levels at field surface to verify initial design footcandle level and maximum to minimum ratio. All sports floodlights shall be operated for a minimum of 50 hours up to 100 hours prior to measuring light levels. Notify Architect/Engineer a minimum of 5 business days in advance of test.
- C. The meter shall measure the true horizontal footcandles. Measurements obtained by angling meter perpendicular to the light source will not be accepted.
- D. Contractor shall obtain factory assistance to re-aim fixtures as required to meet design performance criteria. Retest and record after re-aiming fixtures.
- E. Contractor shall submit report of the performance verification to the Architect/Engineer prior to final payment.

3.4 WARRANTY

- A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of equipment that fail in materials or workmanship within specified warranty period. Manufacturer may exclude lightning damage, hail damage, vandalism, abuse and unauthorized repairs and alterations from special warranty coverage.
 - 1. Luminaire Warranty: Luminaire and luminaire assembly (excluding fuses and lamps) shall be free from defects in materials and workmanship for a period of 5 years from date of Substantial Completion.
 - 2. Lamp Warranty:
 - a. Replace lamps and fuses that fail within 24 months from date of Substantial Completion.
 - b. Provide replacement lamps and fuses that fail within the second 12 months from date of Substantial Completion.
 - 3. Alignment Warranty: Accuracy of alignment of luminaires shall remain within specified illuminance uniformity ratios for period of 5 years from date of Substantial Completion.

3.5 DEMONSTRATION

- A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain sports lighting systems. Refer to Division 1 Section "Demonstration and Training."

END OF SECTION

SECTION 27 05 00

BASIC COMMUNICATIONS SYSTEMS REQUIREMENTS

1. PART GENERAL

1.1 SECTION INCLUDES

- A. Basic Communications Systems Requirements specifically applicable to Division 27 sections, in addition to Division 1 - General Requirements.
- B. All materials and installation methods shall conform to the applicable standards, guidelines and codes referenced herein and within each specification section.

1.2 REFERENCES

- A. OSHPD - Office of State Wide Health Planning and Development (California)
- B. CCR California Code of Regulation
- C. CBC California Building Code
- D. CFC California Fire Code
- E. CEC California Electric Code
- F. CMC California Mechanical Code
- G. CPC California Plumbing Code
- H. California Title 24 - Building Energy Efficiency Standards
- I. SCAQMD Southern California Air Quality Management Division

1.3 SCOPE OF WORK

- A. This Specification and the accompanying drawings govern the work involved in furnishing, installing, testing and placing into satisfactory operation the Communications Systems as shown on the drawings and specified herein.
- B. Each Contractor shall provide all new materials as indicated in the schedules on the drawings, and/or in these specifications, and all items required to make their portion of the Communications Systems a finished and working system.
- C. Description of Systems include but are not limited to the following:
 - 1. Complete Structured Cabling System including, but not limited to:
 - a. Voice and data backbone cabling and terminations.
 - b. Voice and data horizontal cabling and terminations.
 - c. Information outlets (IOs) including faceplates, jacks and labeling.
 - d. Equipment racks, cabinets, cable management and equipment.
 - e. Telecommunication Room equipment including patch panels, optical distribution cabinets, and termination blocks.
 - f. Cabling pathways.
 - g. Grounding and Bonding
 - h. Testing
 - 2. Complete Audio/Visual Systems.
 - a. Classroom AV System.
 - b. Lab Classroom AV System.
 - c. Conference Room AV System.
 - d. Football System Public Address System.

3. Complete Paging Systems.
 - a. Speaker cabling, network audio cabling and terminations.
 - b. Amplifiers, Speakers, and microphones.
 - c. Message server and VOIP interface.
4. Complete Clock Systems.
 - a. RF Base station.
 - b. Battery operated clocks.
5. Mounting and patching of wireless access points provided by others.
6. Low Voltage Communications Wiring (less than +120VAC) as specified and required for proper system control and communications.
7. All associated electrical backboxes, conduit, miscellaneous cabling, and power supplies required for proper system installation and operation as defined in the "Suggested Matrix of Scope Responsibility".
8. Firestopping of penetrations as described in Division 7.

1.4 DIVISION OF WORK BETWEEN ELECTRICAL AND COMMUNICATIONS CONTRACTORS

- A. Division of work is the responsibility of the Prime Contractor. Any scope of work described in the contract document shall be sufficient for including said requirement in the project. The Prime Contractor shall be solely responsible for determining the appropriate subcontractor for the described scope. In no case shall the project be assessed an additional cost for scope that is described in the contract documents. The following division of responsibility is a guideline based on typical industry practice.
- B. Definitions:
 1. "Electrical Contractor" as referred to herein refers to the Contractors listed in Division 26 of this Specification.
 2. "Electrical Contractor" shall also refer to the Contractor listed in Division 27 of this specification when the "Suggested Matrix of Scope Responsibility" indicates the work shall be provided by the EC. Refer to the Contract Documents for the "Suggested Matrix of Scope Responsibility".
 3. "Technology Contractor" as referred to herein refers to the Contractors listed in Division 27 of this Specification.
 4. Low Voltage Technology Wiring: The wiring (less than 120VAC) associated with the Technology Systems, used for analog and/or digital signals between equipment.
 5. Telecommunications/Technology Rough-in: Relates specifically to the backboxes, necessary plaster rings and other miscellaneous hardware required for the installation and mounting of the telecommunications/technology outlet. Rough-in shall include conduit from the information outlet backbox to above the lay-in ceiling. Where surface mounted backboxes are required, conduit shall be routed to above the lay-in ceiling.
- C. General:
 1. The purpose of these specifications is to outline typical Electrical and Technology Contractor's work responsibilities as related to technology systems including telecommunications rough-in, audio/visual systems rough-in, conduit, power wiring, and low voltage communications and technology wiring. The prime contractor is responsible for all divisions of work.

2. The exact wiring requirements for much of the equipment cannot be determined until the systems have been purchased and submittals are approved. Therefore, only known wiring, conduits, raceways, and electrical power as related to such items, is shown on the technology drawings. Other wiring, conduits, raceways, junction boxes, and electrical power not shown on the technology drawings but required for the successful operation of the systems shall be the responsibility of the Technology Contractor and included in the Contractor's bid.
3. Where the Electrical Contractor is required to install conduit, conduit sleeves and/or power connections in support of technology systems, the final installation shall not begin until a coordination meeting between the Electrical Contractor and the Technology Contractor has convened to determine the exact location and requirements of the installation.
4. Where the Electrical Contractor is required to install cable tray that will contain low voltage technology wiring, the installation shall not begin until the Technology Contractor has completed a coordination review of the cable tray shop drawing.
5. This Contractor shall establish electrical and technology utility elevations prior to fabrication and installation. The Technology Contractor shall cooperate with the Electrical Contractor and the determined elevations in accordance with the guidelines below. This Contractor shall coordinate utility elevations with other trades. When a conflict arises, priority shall be as follows:
 - a. Lighting Fixtures
 - b. Gravity Flow Piping, including Steam and Condensate
 - c. Sheet Metal
 - d. Electrical Busduct
 - e. Cable Trays, including 12" access space
 - f. Sprinkler Piping and other Piping
 - g. Conduit and Wireway
 - h. Open Cabling

D. Electrical Contractor's Responsibility:

1. Assumes all responsibility for all required conduit and power connections when shown on the "Suggested Matrix of Scope Responsibility" to be provided by the Electrical Contractor.
2. Responsible for Communications Systems grounding and bonding.
3. This Contractor is responsible for coordination of utilities with all other Contractors. If any field coordination conflicts are found, the Contractor shall coordinate with other Contractors to determine a viable layout.

E. Technology Contractor's Responsibility:

1. Assumes all responsibility for the low voltage technology wiring of all systems, including cable support where open cable is specified.
2. Assumes all responsibility for all required backboxes, conduit and power connections not specifically shown as being provided by the Electrical Contractor on the "Suggested Matrix of Scope Responsibility."
3. Assumes all responsibility for providing and installing all ladder rack and other cable management hardware (as defined herein).
4. Responsible for providing the Electrical Contractor with the required grounding lugs or other hardware for each piece of technology equipment which is required to be bonded to the technology bonding system.

5. This Contractor is responsible for coordination of utilities with all other Contractors. If any field coordination conflicts are found, the Contractor shall coordinate with other Contractors to determine a viable layout.

1.5 COORDINATION DRAWINGS

A. Definitions:

1. Coordination Drawings: A compilation of the pertinent layout and system drawings that show the sizes and locations, including elevations, of system components and required access areas to ensure that no two objects will occupy the same space.
 - a. Mechanical trades shall include, but are not limited to, mechanical equipment, ductwork, fire protection systems, plumbing piping, medical gas systems, hydronic piping, steam and steam condensate piping, and any item that may impact coordination with other disciplines.
 - b. Electrical trades shall include, but are not limited to, electrical equipment, conduit 1.5" and larger, conduit racks, cable trays, pull boxes, transformers, raceway, busway, lighting, ceiling-mounted devices, and any item that may impact coordination with other disciplines.
 - c. Technology trades shall include, but are not limited to, technology equipment, racks, conduit 1.5" and larger, conduit racks, cable trays, ladder rack, pull boxes, raceway, ceiling-mounted devices, and any item that may impact coordination with other disciplines.
 - d. Maintenance clearances and code-required dedicated space shall be included.
 - e. The coordination drawings shall include all underground, underfloor, in-floor, in chase, and vertical trade items.
2. The contractors shall use the coordination process to identify the proper sequence of installation of all utilities above ceilings and in other congested areas, to ensure an orderly and coordinated end result, and to provide adequate access for service and maintenance.

B. Participation:

1. The contractors and subcontractors responsible for work defined above shall participate in the coordination drawing process.
2. One contractor shall be designated as the Coordinating Contractor for purposes of preparing a complete set of composite electronic CAD coordination drawings that include all applicable trades, and for coordinating the activities related to this process. The Coordinating Contractor for this project shall be the Mechanical Contractor.
 - a. The Coordinating Contractor shall utilize personnel familiar with requirements of this project and skilled as draftspersons/CAD operators, competent to prepare the required coordination drawings.
3. Electronic CAD drawings shall be submitted to the Coordinating Contractor for addition of work by other trades. IMEG will provide electronic file copies of ventilation drawings for contractor's use if the contractor signs and returns an "Electronic File Transfer" waiver provided by IMEG. IMEG will not consider blatant reproductions of original file copies an acceptable alternative for coordination drawings.

C. Drawing Requirements:

1. The file format and file naming convention shall be coordinated with and agreed to by all contractors participating in the coordination process and the Owner.
 - a. Scale of drawings:
 - 1) General plans: 1/4 Inch = 1'-0" (minimum).
 - 2) Mechanical, electrical, communication rooms, and including the surrounding areas within 10 feet: 1/2 Inch = 1'-0" (minimum).
 - 3) Shafts and risers: 1/2 Inch = 1'-0" (minimum).
 - 4) Sections of shafts and mechanical and electrical equipment rooms: 1/4 Inch = 1'-0" (minimum).
 - 5) Sections of congested areas: 1/2 Inch = 1'-0" (minimum).
2. Ductwork layout drawings shall be the baseline system for other components. Ductwork layout drawings shall be modified to accommodate other components as the coordination process progresses.
3. There may be more drawings required for risers, top and bottom levels of mechanical rooms, and shafts.
4. The minimum quantity of drawings will be established at the first coordination meeting and sent to the A/E for review. Additional drawings may be required if other areas of congestion are discovered during the coordination process.

D. General:

1. Coordination drawing files shall be made available to the A/E and Owner's Representative. The A/E will only review identified conflicts and give an opinion, but will not perform as a coordinator.
2. A plotted set of coordination drawings shall be available at the project site.
3. Coordination drawings are not shop drawings and shall not be submitted as such.
4. The contract drawings are schematic in nature and do not show every fitting and appurtenance for each utility. Each contractor is expected to have included in his/her bid sufficient fittings, material, and labor to allow for adjustments in routing of utilities made necessary by the coordination process and to provide a complete and functional system.
5. The contractors will not be allowed additional costs or time extensions due to participation in the coordination process.
6. The contractors will not be allowed additional costs or time extensions for additional fittings, reroutings or changes of duct size, that are essentially equivalent sizes to those shown on the drawings and determined necessary through the coordination process.
7. The A/E reserves the right to determine space priority of equipment in the event of spatial conflicts or interference between equipment, piping, conduit, ducts, and equipment provided by the trades.
8. Changes to the contract documents that are necessary for systems installation and coordination shall be brought to the attention of the A/E.

9. Access panels shall preferably occur only in gypsum board walls or plaster ceilings where indicated on the drawings.
 - a. Access to mechanical, electrical, technology, and other items located above the ceiling shall be through accessible lay-in ceiling tile areas.
 - b. Potential layout changes shall be made to avoid additional access panels.
 - c. Additional access panels shall not be allowed without written approval from the A/E at the coordination drawing stage.
 - d. Providing additional access panels shall be considered after other alternatives are reviewed and discarded by the A/E and the Owner's Representative.
 - e. When additional access panels are required, they shall be provided without additional cost to the Owner.
10. Complete the coordination drawing process and obtain signoff of the drawings by all contractors prior to installing any of the components.
11. Conflicts that result after the coordination drawings are signed off shall be the responsibility of the contractor or subcontractor who did not properly identify their work requirements, or installed their work without proper coordination.
12. Updated coordination drawings that reflect as-built conditions may be used as record documents.

1.6 QUALITY ASSURANCE

A. Telecommunications Structured Cabling System Standards:

1. All work and equipment shall conform to the most current ratified version of the following published standards unless otherwise indicated that draft standards are to be followed:
 - a. ANSI/NECA/BICSI 568 - Standard for Installing Commercial Building Telecommunications Cabling
 - b. ANSI/TIA-568-C.0 - Generic Telecommunications Cabling for Customer Premises
 - 1) C.1 - Commercial Building Telecommunications Standard
 - 2) C.2 - Balanced Twisted-Pair Telecommunications Cabling and Components Standard
 - 3) C.3 - Optical Fiber Cabling Components Standard
 - 4) C.4 - Broadband Coaxial Cabling and Components Standard
 - c. ANSI/TIA-569-C - Telecommunications Pathways and Spaces
 - d. ANSI/TIA-606-B - Administration Standard for Commercial Telecommunications Infrastructure
 - e. ANSI/TIA-607-B - Commercial Building Grounding (Earthing) and Bonding Requirements for Telecommunications
 - f. ANSI/TIA-758-B - Customer-Owned Outside Plant Telecommunications Standard
 - g. ANSI/TIA-862-A - Building Automation Systems Cabling Standard

- h. ANSI/TIA-1152 - Requirements for Field Test Instruments and Measurements for Balanced Twisted-Pair Cabling
 - i. ANSI/TIA/EIA-598-C - Optical Fiber Cable Color Coding
 - j. NFPA 70 (NEC) - National Electrical Code (Current Edition)
 - k. UL 444 - Standard for Safety for Communications Cable
 - l. California Code of Regulation Title 24, Article E725
- B. Refer to individual sections for additional Quality Assurance requirements.
- C. Qualifications:
 - 1. Only products of reputable manufacturers as determined by the Architect/Engineer will be acceptable.
 - 2. The installing Contractor shall be certified by the manufacturer of the structured cabling system. Certification of Contractor shall have been in place for a minimum of one (1) year prior to bidding this project. Documentation of certification is required at the time of bid. Shop drawings will not be approved until proof of certification is submitted. Refer to the end of this specification section for certification documentation requirements.
 - 3. Each Contractor and their subcontractors shall employ only workers who are skilled in their respective trades and fully trained. All workers involved in the termination of cabling shall be individually certified by the manufacturer.
 - 4. The Contractor shall be experienced in all aspects of this work and shall be required to demonstrate direct experience on recent systems of similar type and size.
 - 5. The Contractor shall own and maintain tools and equipment necessary for successful installation and testing of optical and copper structured cabling systems and have personnel adequately trained in the use of such tools and equipment.
 - 6. The Contractor must have a BICSI RCDD (Registered Communications Distribution Designer) or CNet CNIDP (Certified Network Infrastructure Design Professional) on-staff serving as a project manager. Project shop drawings and test reports shall be stamped by the RCDD or CNIDP.
 - 7. A resume of qualification shall be submitted with the Contractor's bid indicating the following:
 - a. Documentation of certification of This Contractor by the proposed structured cabling system manufacturer as required at the end of this specification section.
 - b. A technical resume of experience for the Contractor's project manager and on-site installation supervisor assigned to this project.
 - c. Resume and certification of the RCDD or CNIDP for the project as required by the form at the end of this specification section.
- D. Compliance with Codes, Laws, Ordinances:
 - 1. Conform to all requirements of the State of California Codes, Laws, Ordinances and other regulations having jurisdiction.
 - 2. Conform to all published standards of Oxnard School District.
 - 3. In the event there are no local codes having jurisdiction over this job, the current issue of the National Electrical Code shall be followed.

4. If there is a discrepancy between the codes and regulations having jurisdiction over this installation, and these specifications, Architect/Engineer shall determine the method or equipment used.
5. If the Contractor notes, at the time of bidding, any parts of the drawings and specifications which are not in accordance with the applicable codes or regulations, he shall inform the Architect/Engineer in writing, requesting a clarification. If there is insufficient time to follow this procedure, he shall submit with the proposal, a separate price required to make the system shown on the drawings comply with the codes and regulations.
6. Verify the installation environment prior to purchasing or installing any cable. Cable installed in a plenum environment shall be appropriately rated. Bring all discrepancies between the contract documents and installation conditions to the attention of the Architect/Engineer prior to purchase or installation.
7. All changes to the system made after the letting of the contract, in order to comply with the applicable codes or the requirements of the Inspector, shall be made by the Contractor without cost to the Owner.

E. Permits, Fees, Taxes, Inspections:

1. Procure all applicable permits and licenses.
2. Abide by all applicable laws, regulations, ordinances, and other rules of the State or Political Subdivision wherein the work is done, or as required by any duly constituted public authority.
3. Pay all applicable charges for such permits or licenses that may be required.
4. Pay all applicable fees and taxes imposed by the State, Municipal and/or other regulatory bodies.
5. Pay all charges arising out of required inspections due to codes, permits, licenses or as otherwise may be required by an authorized body.
6. Pay all charges arising out of required contract document reviews associated with the project and as initiated by the Owner or authorized independent agency/consultant.
7. Pay any charges by the service provider related to the service or change in service to the project.
8. All equipment and materials shall be as approved or listed by the following (unless approval or listing is not applicable to an item by all acceptable manufacturers):
 - a. Factory Mutual
 - b. Underwriters' Laboratories, Inc.

F. Service Provider Requirements:

1. Secure from the telecommunications service provider all applicable requirements.
2. Comply with all service provider requirements.
3. The Owner shall make application for and pay for new telecommunications service equipment and installation. The Contractor shall coordinate schedule and requirements with the Owner and service provider.

G. Examination of Drawings:

1. The drawings for the technology systems work are diagrammatic, intended to convey the scope of the work and to indicate the general arrangements and locations of equipment etc., and the approximate sizes of equipment.

2. Contractor shall determine the exact locations of equipment and the exact routing of cabling to best fit the layout of the job. Scaling of the drawings will not be sufficient or accurate for determining this layout. Where a specific route is required, such route will be indicated on the drawings.
3. Where job conditions require reasonable changes in indicated arrangements and locations, such changes shall be made by the Contractor at no additional cost to the Owner.
4. If an item is either shown on the drawings, called for in the specifications or required for proper operation of the system, it shall be considered sufficient for including same in this contract.
5. The determination of quantities of material and equipment required shall be made by the Contractor from the drawings. Schedules on the drawings and in the specifications are completed as an aid to the Contractor but where discrepancies arise, the greater number shall govern.
6. Where words "provide", "install", or "furnish" are used on the drawings or in the specifications, it shall be taken to mean, to furnish, install and terminate completely ready for operation, the items mentioned.

H. Electronic Media/Files:

1. Construction drawings for this project have been prepared utilizing Revit.
2. Contractors and Subcontractors may request electronic media files of the contract drawings and/or copies of the specifications. Specifications will be provided in PDF format.
3. Upon request for electronic media, the Contractor shall complete and return a signed "Electronic File Transmittal" form provided by IMEG.
4. If the information requested includes floor plans prepared by others, the Contractor will be responsible for obtaining approval from the appropriate Design Professional for use of that part of the document.
5. The electronic contract documents can be used for preparation of shop drawings and as-built drawings only. The information may not be used in whole or in part for any other project.
6. The drawings prepared by IMEG for bidding purposes may not be used directly for ductwork layout drawings or coordination drawings.
7. The use of these CAD documents by the Contractor does not relieve them from their responsibility for coordination of work with other trades and verification of space available for the installation.
8. The information is provided to expedite the project and assist the Contractor with no guarantee by IMEG as to the accuracy or correctness of the information provided. IMEG accepts no responsibility or liability for the Contractor's use of these documents.

I. Field Measurements:

1. Before ordering any materials, this Contractor shall verify all pertinent dimensions at the job site and be responsible for their accuracy.
2. Field conditions that will result in telecommunications drops that exceed the length limitations identified in the contract documents shall be brought to the attention of the Architect/Engineer prior to installation. The cost of reworking cabling that is too long, that was not brought to the written attention of the Architect/Engineer will be borne entirely by the Contractor.

3. This Contractor shall provide the Architect/Engineer with written documentation of any cabling drops that will not be able to use the cable tray (where cable tray is available) due to the resulting cabling lengths. This documentation shall be submitted prior to installation and installation shall not commence until approved by the Architect/Engineer.

1.7 SUBMITTALS

- A. Submittals shall be required for the following items, and for additional items where required elsewhere in the specifications or on the drawings.

1. Submittals list:

Referenced Specification	Submittal Item
<u>Section</u>	
27 05 26	Communications Bonding
27 05 28	Interior Communications Pathways
27 05 43	Exterior Communications Pathways
27 05 53	Identification and Administration
27 11 00	Communication Equipment Rooms
27 13 00	Backbone Cabling Requirements
27 15 00	Horizontal Cabling Requirements
27 17 10	Testing
27 41 00	Professional Audio Video System
27 51 13	Paging Systems
27 53 13	Central Clock System

- B. General Submittal Procedures: In addition to the provisions of Division 1, the following are required:

1. Transmittal: Each transmittal shall include the following:

- a. Date
- b. Project title and number
- c. Contractor's name and address
- d. Description of items submitted and relevant specification number
- e. Notations of deviations from the contract documents
- f. Other pertinent data

2. Submittal Cover Sheet: Each submittal shall include a cover sheet containing:

- a. Date
- b. Project title and number
- c. Architect/Engineer
- d. Contractor and subcontractors' names and addresses
- e. Supplier and manufacturer's names and addresses
- f. Description of item submitted (using project nomenclature) and relevant specification number
- g. Notations of deviations from the contract documents
- h. Other pertinent data
- i. Provide space for Contractor's review stamps

3. Composition:

- a. Submittals shall be submitted using specification sections and the project nomenclature for each item.
- b. Individual submittal packages shall be prepared for items in each specification section. All items within a single specification section shall be packaged together where possible. An individual submittal may contain items from multiple specifications sections if the items are intimately linked (e.g., pumps and motors).

- c. All sets shall contain an index of the items enclosed with a general topic description on the cover.
- 4. Content: Submittals shall include all fabrication, erection, layout, and setting drawings; manufacturers' standard drawings; schedules; descriptive literature, catalogs and brochures; performance and test data; wiring and control diagrams; dimensions; shipping and operating weights; shipping splits; service clearances; and all other drawings and descriptive data of materials of construction as may be required to show that the materials, equipment or systems and the location thereof conform to the requirements of the contract documents.
- 5. Contractor's Approval Stamp:
 - a. The Contractor shall thoroughly review and approve all shop drawings before submitting them to the Architect/Engineer. The Contractor shall stamp, date and sign each submittal certifying it has been reviewed.
 - b. Unstamped submittals will be rejected.
 - c. The Contractor shall provide proof of RCDD or CNIDP review on the submittal.
 - d. The Contractor's review shall include, but not be limited to, verification of the following:
 - 1) Only approved manufacturers are used.
 - 2) Addenda items have been incorporated.
 - 3) Catalog numbers and options match those specified.
 - 4) Performance data matches that specified.
 - 5) Electrical characteristics and loads match those specified.
 - 6) Equipment connection locations, sizes, capacities, etc. have been coordinated with other affected trades.
 - 7) Dimensions and service clearances are suitable for the intended location.
 - 8) Equipment dimensions are coordinated with support steel, housekeeping pads, openings, etc.
 - 9) Constructability issues are resolved (e.g., weights and dimensions are suitable for getting the item into the building and into place, sinks fit into countertops, etc.).
 - e. The Contractor shall review, stamp and approve all subcontractors' submittals as described above.
 - f. **The Contractor's approval stamp is required on all submittals. Approval will indicate the Contractor's review of all material and a complete understanding of exactly what is to be furnished. Contractor shall clearly mark all deviations from the contract documents on all submittals. If deviations are not marked by the Contractor, then the item shall be required to meet all drawing and specification requirements.**
- 6. Submittal Identification and Markings:
 - a. The Contractor shall clearly mark each item with the same nomenclature applied on the drawings or in the specifications.
 - b. The Contractor shall clearly indicate the size, finish, material, etc.
 - c. Where more than one model is shown on a manufacturer's sheet, the Contractor shall clearly indicate exactly which item and which data is intended.
 - d. All marks and identifications on the submittals shall be unambiguous.
- 7. Schedule submittals to expedite the project. Coordinate submission of related items.

8. Identify variations from the contract documents and product or system limitations that may be detrimental to the successful performance of the completed work.
9. Reproduction of contract documents alone is not acceptable for submittals.
10. Incomplete submittals will be rejected without review. Partial submittals will only be reviewed with prior approval from the Architect/Engineer.
11. Submittals not required by the contract documents may be returned without review.
12. The Architect/Engineer's responsibility shall be to review one set of shop drawing submittals for each product. If the first submittal is incomplete or does not comply with the drawings and/or specifications, the Contractor shall be responsible to bear the cost for the Architect/Engineer to recheck and handle the additional shop drawing submittals.
13. Submittals shall be reviewed and approved by the Architect/Engineer **before** releasing any equipment for manufacture or shipment.
14. Contractor's responsibility for errors, omissions or deviation from the contract documents in submittals is not relieved by the Architect/Engineer's approval.

C. Electronic Submittal Procedures:

1. Distribution: Email submittals as attachments to all parties designated by the Architect/Engineer, unless a web-based submittal program is used.
2. Transmittals: Each submittal shall include an individual electronic letter of transmittal.
3. Format: Electronic submittals shall be in PDF format only. Scanned copies, in PDF format, of paper originals are acceptable. Submittals that are not legible will be rejected. Do not set any permission restrictions on files; protected, locked, or secured documents will be rejected.
4. File Names: Electronic submittal file names shall include the relevant specification section number followed by a description of the item submitted, as follows. Where possible, include the transmittal as the first page of the PDF instead of using multiple electronic files.
 - a. Submittal file name: 27 XX XX.description.YYYYMMDD
 - b. Transmittal file name: 27 XX XX.description.YYYYMMDD
5. File Size: Electronic file size shall be limited to a maximum of 4MB. Larger files shall be transmitted via a pre-approved method.

1.8 CHANGE ORDERS

- A. A detailed material and labor take-off shall be prepared for each change order along with labor rates and mark-up percentages. Change orders with inadequate breakdown will be rejected.
- B. Change order work shall not proceed until authorized.

1.9 EQUIPMENT SUPPLIERS' INSPECTION

- A. The following equipment shall not be placed in operation until a representative of the manufacturer has inspected the installation and certified that the equipment is properly installed and that the equipment is ready for operation:
 1. Firestopping, including mechanical firestop systems.

1.10 PRODUCT DELIVERY, STORAGE, HANDLING & MAINTENANCE

- A. Exercise care in transporting and handling to prevent damage to fixtures, equipment and materials.

- B. Store materials on the site to prevent damage.
- C. Keep fixtures, equipment and materials clean, dry and free from deleterious conditions.

1.11 NETWORK / INTERNET CONNECTED EQUIPMENT

- A. These specifications may require certain equipment or systems to have network, Internet and/or remote access capability ("Network Capability"). Any requirement for Network Capability shall be interpreted only as a functional capability and is not to be construed as authority to connect or enable any Network Capability. Network Capability may only be connected or enabled with the express written consent of the Owner.

1.12 WARRANTY

- A. At a minimum, provide a one (1) year warranty for all equipment, materials, and workmanship. Individual specifications sections within Division 27 may require additional warranty requirements for specific equipment or systems.
- B. The warranty period for the entire installation described in this Division of the specifications shall commence on the date of substantial completion unless a whole or partial system or any separate piece of equipment or component is put into use for the benefit of any party other than the installing contractor with prior written authorization. In this instance, the warranty period shall commence on the date when such whole system, partial system or separate piece of equipment or component is placed in operation and accepted in writing by the Owner or their representative.
- C. Warranty requirements shall extend to correction, without cost to the final user, of all work and/or equipment found to be defective or nonconforming to the contract documents. The Contractor shall bear the cost of correcting all damage resulting from such defects or nonconformance with contract documents exclusive of repairs required as a result of improper maintenance or operation, or of normal wear as determined by the Architect/Engineer.

1.13 INSURANCE

- A. This Contractor shall maintain insurance coverage as set forth in Division 1 of these specifications.

1.14 MATERIAL SUBSTITUTION

- A. Where several manufacturers' names are given, the first named manufacturer constitutes the basis for job design and establishes the equipment quality required.
- B. Equivalent equipment manufactured by the other named manufacturers may be used. Contractor shall ensure that all items submitted by these other manufacturers meets all requirements of the drawings and specifications and fits in the allocated space. The Architect/Engineer shall make the final determination of whether a product is equivalent.
- C. Any material, article or equipment of other unnamed manufacturers which will adequately perform the services and duties imposed by the design and is of a quality equal to or better than the material, article or equipment identified by the drawings and specifications may be used if approval is secured in writing from the Architect/Engineer via addendum. The Contractor bears full responsibility for the unnamed manufacturers equipment adequately meeting the intent of design. The Architect/Engineer may reject manufacturer at time of shop drawing submittal. The Contractor assumes all costs incurred by other trades on the project as a result of changes necessary to accommodate the offered material, equipment or installation method.
- D. Should this Contractor be unable to secure approval from the Architect/Engineer for other unnamed manufacturers as outlined above, this Contractor may list voluntary add or deduct prices for alternate materials on the bid form. These items will not be used in determining the low bidder. Should a voluntary alternate material be accepted, This Contractor shall assume all costs that may be incurred as a result of using the offered material, article or equipment necessitating extra expense on This Contractor or on the part of other Contractors whose work is affected.

2. PART PRODUCTS

- 2.1 Cable Jacket Rating: This project requires all cable jackets to carry a plenum rating.
- 2.2 Refer to individual sections.

3. PART EXECUTION

3.1 JOBSITE SAFETY

- A. Neither the professional activities of the Architect/Engineer, nor the presence of the Architect/Engineer or his or her employees and subconsultants at a construction site, shall relieve the Contractor and any other entity of their obligations, duties and responsibilities including, but not limited to, construction means, methods, sequence, techniques or procedures necessary for performing, superintending or coordinating all portions of the work of construction in accordance with the contract documents and any health or safety precautions required by any regulatory agencies. The Architect/Engineer and his or her personnel have no authority to exercise any control over any construction contractor or other entity or their employees in connection with their work or any health or safety precautions. The Contractor is solely responsible for jobsite safety. The Architect/Engineer and the Architect/Engineer's consultants shall be indemnified and shall be made additional insureds under the Contractor's general liability insurance policy.

3.2 GENERAL INSTALLATION REQUIREMENTS

- A. Installation of all conduit and cabling shall comply with Sections 26 05 33 and 26 05 13. Additional conduit requirements described within this Division shall be supplemental to the requirement described in Section 26 05 33. Should conflicts exist between the two Divisions the more stringent (more expensive material and labor) condition shall prevail until bidding addendum or construction clarification or RFI can be submitted and responded to. In no case shall the Contractor carry the least stringent condition in the pricing.
- B. It is the Contractor's responsibility to survey the site and include all necessary costs to perform the installation as specified.
- C. All cables and devices installed in damp or wet locations, including any underground or underslab location, shall be listed as suitable for use in such environments. Follow manufacturer's recommended installation practices for installing cables and devices in damp or wet locations. Any cable or device that fails as a result of being installed in a damp or wet location shall be replaced at the Contractor's expense.

3.3 FIELD QUALITY CONTROL

- A. General:
 - 1. Refer to specific Division 27 sections for further requirements.
 - 2. The Contractor shall conduct all tests required and applicable to the work both during and after construction of the work.
 - 3. The necessary instruments and materials required to conduct or make the tests shall be supplied by the Contractor who shall also supply competent personnel for making the tests who has been schooled in the proper testing techniques.
 - 4. In the event the results obtained in the tests are not satisfactory, This Contractor shall make such adjustments, replacements and changes as are necessary and shall then repeat the test or tests which disclose faulty or defective work or equipment, and shall make such additional tests as the Architect/Engineer or code enforcing agency deems necessary.
 - 5. All communications cable tests that fail, including those due to excessive cabling lengths, shall be remedied by the Contractor without cost to the project.

B. Protection of cable from foreign materials:

1. It is the Contractor's responsibility to provide adequate physical protection to prevent foreign material application or contact with any cable type. Foreign material is defined as any material that would negatively impact the validity of the manufacturer's performance warranty. This includes, but is not limited to, overspray of paint (accidental or otherwise), drywall compound, or any other surface chemical, liquid or compound that could come in contact with the cable, cable jacket or cable termination components.
2. Application of foreign materials of any kind on any cable, cable jacket or cable termination component will not be accepted. It shall be the Contractor's responsibility to replace any component containing overspray, in its entirety, at no additional cost to the project. Cleaning of the cables with harsh chemicals is not allowed. This requirement is regardless of the PASS/FAIL test results of the cable containing overspray. Should the manufacturer and warrantor of the structured cabling system desire to physically inspect the installed condition and certify the validity of the structured cabling system (via a signed and dated statement by an authorized representative of the structured cabling manufacturer), the Owner may, at their sole discretion, agree to accept said warranty in lieu of having the affected cables replaced. In the case of plenum cabling, in addition to the statement from the manufacturer, the Contractor shall also present to the Owner a letter from the local Authority Having Jurisdiction stating that they consider the plenum rating of the cable to be intact and acceptable.

3.4 PROJECT CLOSEOUT

A. Refer to the Division 1 Section: PROJECT CLOSEOUT for requirements. The following paragraphs supplement the requirements of Division 1.

B. Final Jobsite Observation:

1. The Architect/Engineer will not perform a final jobsite observation until the project is ready. This is not dictated by schedule, but rather by completeness of the project.
2. Refer to the end of this specification section for a "STATEMENT INDICATING READINESS FOR FINAL JOBSITE OBSERVATION."
3. The Contractor shall sign this form and return it to the Architect/Engineer so that the final observation can commence.

C. Before final payment will be authorized, this Contractor must have completed the following:

1. Submitted operation and maintenance manuals to the Architect/Engineer for review.
2. Submitted bound copies of approved shop drawings.
3. Record documents including edited drawings and specifications accurately reflecting field conditions, **inclusive** of all project revisions, change orders, and modifications.
4. Submitted a report stating the instructions given to the Owner's representative complete with the number of hours spent in the instruction. The report shall bear the signature of an authorized agent of This Contractor and shall be signed by the Owner's representative as having received the instructions.
5. Submitted testing reports for all systems requiring final testing as described herein.
6. Submitted start-up reports on all equipment requiring a factory installation inspection and/or start.
7. Provide spare parts, maintenance, and extra materials in quantities specified in individual specification sections. Deliver to project site; submit receipt to Architect/Engineer prior to final payment being approved.

8. Provide System Assurance Warranty certificate for the telecommunications system.

3.5 OPERATION AND MAINTENANCE MANUALS

A. General:

1. Provide an electronic copy of the O&M manuals as described below for Architect/Engineer's review and approval. The electronic copy shall be corrected as required to address the Architect/Engineer's comments. Once corrected, electronic copies and paper copies shall be distributed as directed by the Architect/Engineer.
2. Approved O&M manuals shall be completed and in the Owner's possession prior to Owner's acceptance and at least 10 days prior to instruction of operating personnel.

B. Electronic Submittal Procedures:

1. Distribution: Email the O&M manual as attachments to all parties designated by the Architect/Engineer.
2. Transmittals: Each submittal shall include an individual electronic letter of transmittal.
3. Format: Electronic submittals shall be in PDF format only. Scanned copies, in PDF format, of paper originals are acceptable. Submittals that are not legible will be rejected. Do not set any permission restrictions on files; protected, locked, or secured documents will be rejected.
4. File Names: Electronic submittal file names shall include the relevant specification section number followed by a description of the item submitted, as follows. Where possible, include the transmittal as the first page of the PDF instead of using multiple electronic files.
 - a. O&M file name: O&M.div27.contractor.YYYYMMDD
 - b. Transmittal file name: O&Mtransmittal.div27.contractor.YYYYMMDD
5. File Size: Electronic file size shall be limited to a maximum of 4MB. Larger files shall be divided into files that are clearly labeled as "1 of 2", "2 of 2", etc.
6. Provide the Owner with an approved copy of the O&M manual on compact discs (CD), digital video discs (DVD), or flash drives with a permanently affixed label, printed with the title "Operation and Maintenance Instructions", title of the project and subject matter of disc/flash drive when multiple disc/flash drives are required.
7. All text shall be searchable.
8. Bookmarks shall be used, dividing information first by specification section, then systems, major equipment and finally individual items. All bookmark titles shall include the nomenclature used in the construction documents and shall be an active link to the first page of the section being referenced.

C. Operation and Maintenance Instructions shall include:

1. Title Page: Include title page with project title, Architect, Engineer, Contractor, all subcontractors, and major equipment suppliers, with addresses, telephone numbers, website addresses, email addresses and point of contacts. Website URLs and email addresses shall be active links in the electronic submittal.
2. Table of Contents: Include a table of contents describing specification section, systems, major equipment, and individual items.
3. Copies of all final approved shop drawings and submittals. Include Architect's/Engineer's shop drawing review comments. Insert the individual shop drawing directly after the Operation and Maintenance information for the item(s) in the review form.

4. Copy of final approved test and balance reports.
5. Copies of all factory inspections and/or equipment startup reports.
6. Copies of warranties.
7. Schematic wiring diagrams of the equipment that have been updated for field conditions. Field wiring shall have label numbers to match drawings.
8. Dimensional drawings of equipment.
9. Capacities and utility consumption of equipment.
10. Detailed parts lists with lists of suppliers.
11. Operating procedures for each system.
12. Maintenance schedule and procedures. Include a chart listing maintenance requirements and frequency.
13. Repair procedures for major components.
14. List of lubricants in all equipment and recommended frequency of lubrication.
15. Instruction books, cards, and manuals furnished with the equipment.

3.6 INSTRUCTING THE OWNER'S REPRESENTATIVE

- A. Adequately instruct the Owner's designated representative or representatives in the maintenance, care, and operation of the complete systems installed under this contract.
- B. Provide verbal and written instructions to the Owner's representative or representatives by FACTORY PERSONNEL in the care, maintenance, and operation of the equipment and systems.
- C. The Owner has the option to make a video recording of all instructions. Coordinate schedule of instructions to facilitate this recording.
- D. The Architect/Engineer shall be notified of the time and place for the verbal instructions to be given to the Owner's representative so that their representative can be present if desirable.
- E. Refer to the individual specification sections for minimum hours of instruction time for each system.
- F. Operating Instructions:
 1. The Contractor is responsible for all instructions to the Owner and/or Owner's operating staff on the Communications Systems.
 2. If the Contractor does not have Engineers and/or Technicians on staff who can adequately provide the required instructions on system operation, performance, troubleshooting, care and maintenance, they shall include in the bid an adequate amount to reimburse the Owner for the Architect/Engineer to perform these services.

3.7 SYSTEM COMMISSIONING

- A. The Communications Systems included in the construction documents are to be complete and operating systems. The Architect/Engineer will make periodic job site observations during the construction period. The system start-up, testing, configuration, and satisfactory system performance is the responsibility of the Contractor. This shall include all calibration and adjustments of electrical equipment controls, equipment settings, software configuration, troubleshooting and verification of software, and final adjustments that may be required.

- B. All operating conditions and control sequences shall be simulated and tested during the start-up period.
- C. The Contractor, subcontractors, and equipment suppliers are expected to have skilled technicians to ensure that the system performs as designed. If the Architect/Engineer is requested to visit the job site for the purpose of trouble shooting, assisting in the satisfactory start-up, obtaining satisfactory equipment operation, resolving installation and/or workmanship problems, equipment substitution issues or unsatisfactory system performance, including call backs during the warranty period through no fault of the design; the Contractor shall reimburse the Owner on a time and material basis for services rendered at the Architect/Engineer's standard hourly rates in effect at the time the services are requested. The Contractor shall be responsible for making payment to the Owner for services required that are product, installation or workmanship related. Payment is due within 30 days after services are rendered.

3.8 RECORD DOCUMENTS

- A. Refer to the Division 1 Section: PROJECT CLOSEOUT for requirements. The following paragraphs supplement the requirements of Division 1.
- B. Mark specifications to indicate approved substitutions, change orders, and actual equipment and materials used.
- C. This Contractor shall maintain at the job site, a separate and complete set of technology drawings which shall be clearly and permanently marked and noted in complete detail any changes made to the location and arrangement of equipment or made to the Technology Systems and wiring as a result of building construction conditions or as a result of instructions from the Architect or Engineer. All Change Orders, RFI responses, Clarifications and other supplemental instructions shall be marked on the documents. Record documents that merely reference the existence of the above items are not acceptable. Should This Contractor fail to complete Record Documents as required by this contract, This Contractor shall reimburse Architect/Engineer for all costs to develop record documents that comply with this requirement. Reimbursement shall be made at the Architect/Engineer's hourly rates in effect at the time of work.
- D. Record actual routing of all conduits sized 2" or larger.
- E. The above record of changes shall be made available for the Architect and Engineer's examination during any regular work time.
- F. Upon completion of the job, and before final payment is made, This Contractor shall give the marked-up drawings to the Architect/Engineer.

3.9 ADJUST AND CLEAN

- A. Contractor shall thoroughly clean all equipment and systems prior to the Owner's final acceptance of the project.
- B. Contractor shall clean all foreign paint, grease, oil, dirt, labels, stickers, and other foreign material from equipment.
- C. Contractor shall remove all rubbish, debris, etc., accumulated during the Contractor's operations from the premises.

END OF SECTION

STATEMENT INDICATING READINESS FOR FINAL JOBSITE OBSERVATION

To assist the contractor in a timely close-out of the project, it is crucial that the final jobsite observation is not conducted prior to the project being ready. The contractor is required to review the completion status of the project at the time the observation is scheduled. This review, and the subsequent submittal of this form to the Architect/Engineer, shall indicate the contractor's agreement that the area of the project being requested for final observation is ready as defined below. The following list represents the degree of completeness required prior to requesting a final observation:

1. All cabling pathways (cable tray, ladder rack, conduit sleeves, etc.) are installed and all cabling has been pulled through them.
2. All mechanical firestop products are installed and all other penetrations have been sealed.
3. All telecommunications jacks are installed in the faceplates.
4. All telecommunications cabling is pulled and at least 75% of all jacks have been terminated at the jack and at the telecom room.
5. Telecommunications testing is in progress and at least 25% of testing has been completed.
6. Telecommunications labeling has been provided on at least 25% of each type of component requiring a label.
7. All telecommunications related grounding is complete.
8. All Audio/Visual components, cabling and control systems are installed, programmed and operational.
9. All overhead or integrated paging systems, including speakers, back boxes, cabling, and power supplies, and all headend equipment is installed, programmed and operational.
10. All access control system equipment, including card readers, conduits, cabling, electronic locks, controllers and all headend equipment, is installed, programmed and operational.

The project will be ready for final jobsite observation prior to the requested date of the observation according to the above list of requirements.

Prime Contractor: _____ By: _____

Requested Observation Date _____ Today's Date: _____

Contractor shall sign this readiness statement and transmit to Architect/Engineer at least 10 days prior to the requested date of observation.

It is understood that if the Architect/Engineer finds that the project is not complete as defined above and that the final jobsite observation cannot be completed on the requested date, the Architect/Engineer will return to the site at a later date. All additional visits to the site for the purposes of completing the final observation will be billed T&M to the Contractor at our standard hourly rates, including travel expenses or the contractor's retainage may be deducted for the same amount.

Telecommunications – Proof of Certification

There are specific Contractor qualification requirements for this project as defined in Section 27 05 00, which may include Manufacturer Certification and RCDD or CNIDP credentials. This Proof of Certification document, and the supporting documentation require herein, is required to be submitted at the time of bid to show compliance with the requirements of 27 05 00.

Statement of Compliance:

The named Contractor's base bid is a structured cabling solution from the connectivity manufacturer _____. Named Contractor is trained and certified, under the named manufacturer's formal certification program to provide and install all materials and work required by this project. Further, said Contractor is authorized, by the named manufacturer, to offer all product, labor and system assurance warranties required for this project by these contract documents.

The certification of this named manufacturer is valid, current and in effect as of the bid day of this project, the _____ day of _____, 20____.

The named Contractor is not employing any other sub-contractor on the telecommunications portion of this project that does not also meet this certification requirement.

Contractor Company Name: _____

Authorized Representative: (print) _____

Date: _____ Manufacturer Certification Number (if any): _____

If this project requires RCDD certification, complete the following:

RCDD or CNIDP Name: _____ RCDD #: _____ Expiration: _____

Submit the following with the bid:

- This form.
- Proof of Manufacturer Certification indicated above.
- Proof of RCDD or CNIDP status.

SECTION 27 05 26

COMMUNICATIONS BONDING

1. PART GENERAL

1.1 SECTION INCLUDES

- A. Bonding Conductors
- B. Bonding Connectors
- C. Grounding Busbar (TMGB and TGB)
- D. Rack-mount Telecommunications Grounding Busbar

1.2 RELATED WORK

- A. Section 26 05 33 – Conduit and Boxes
- B. Section 26 05 13 – Wire and Cable
- C. Section 26 05 26 – Grounding and Bonding
- D. Section 26 41 00 – Lightning Protection Systems
- E. Section 27 05 00 – Basic Communications Systems Requirements
- F. Section 27 05 03 – Through Penetration Firestopping
- G. Section 27 11 00 – Communication Equipment Rooms
- H. Section 27 05 28 – Interior Communication Pathways
- I. Section 27 05 53 – Identification and Administration

1.3 QUALITY ASSURANCE

- A. Refer to Section 27 05 00 for relevant standards.
- B. Communications bonding system component, device, equipment, and material manufacturer(s) shall have a minimum of five (5) years documented experience in the manufacture of communications bonding products.
- C. The entire installation shall comply with all applicable electrical codes, safety codes, and standards. All applicable components, devices, equipment, and material shall be listed by Underwriters' Laboratories, Inc.

1.4 REFERENCES

- A. ANSI/IEEE 1100 – Recommended Practice for Power and Grounding Sensitive Electronic Equipment in Industrial and Commercial Power Systems
- B. ANSI/TIA/EIA 568-C – Commercial Building Telecommunications Cabling Standard
- C. ANSI/TIA/EIA 569-A – Commercial Building Standard for Telecommunications Pathways and Spaces
- D. ANSI/TIA/EIA 606 – Administration Standard for the Telecommunications Infrastructure of Commercial Buildings
- E. ANSI/TIA/EIA 758 – Customer Owned Outside Plant
- F. ANSI-J-STD-607-A – Commercial Building Grounding (Earthing) and Bonding Requirements for Telecommunications
- G. IEEE 81 – IEEE Guide for Measuring Earth Resistivity, Ground Impedance, and Earth Surface Potentials of a Ground System Part 1: Normal Measurements
- H. IEEE 837 – IEEE Standard for Qualifying Permanent Connections Used in Substation Grounding
- I. NFPA 70 – National Electrical Code
- J. NFPA 780 – Standard for the Installation of Lightning Protection Systems
- K. UL 96 – Lightning Protection Components
- L. UL 96A – Installation Requirements for Lightning Protection Systems
- M. UL 467 – Grounding and Bonding Equipment

1.5 SUBMITTALS

- A. Submit product data and shop drawings under provisions of Section 27 05 00 and Division 1.

- B. Provide manufacturer's technical product specification sheet for each individual component type. Submitted data shall show the following:
 - 1. Compliance with each requirement of these documents. The submittal shall acknowledge each requirement of this section, item-by-item, including construction, materials, ratings, and all other parameters identified in Part 2 - Products.
 - 2. Manufacturer's installation instructions indicating application conditions and limitations of use stipulated by product testing agency. Include instructions for storage, handling, protection, examination, preparation, installation, and starting of product.
- C. Provide CAD-generated, project-specific system shop drawings as follows:
 - 1. Provide a system block diagram indicating system configuration, system components, interconnection between components, and conductor routing. The diagram shall clearly indicate all wiring and connections required in the system. When multiple devices or pieces of equipment are required in the exact same configuration (e.g., multiple identical equipment racks or sections of ladder tray), the diagram may show one device and refer to the others as "typical" of the device shown. The diagram shall list room numbers where system equipment will be located.
 - 2. Installation details for all system components.
- D. Provide system checkout test procedure to be performed at acceptance.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Deliver products to the site under the provisions of Section 27 05 00.
- B. Store and protect products under the provisions of Section 27 05 00.
- C. Contractor shall exercise care to prevent corrosion of any products prior to installation. Corroded products shall not be acceptable for use on this project.

1.7 SYSTEM DESCRIPTION

- A. This section describes the requirements for the furnishing, installation, adjusting, and testing of a complete turnkey communications bonding system, including connection to the electrical ground grid.
- B. Performance Statement: This specification section and the accompanying drawings are performance based, describing the minimum material quality, required features, operational requirements, and performance of the system. These documents do not convey every wire that must be installed, every equipment connection that must be made, or every feature and function that must be configured. Based on the equipment constraints described and the performance required of the system as presented in these documents, the Contractor is solely responsible for determining all components, devices, equipment, wiring, connections, and terminations required for a complete and operational system that provides the required performance.
- C. This document describes the major components of the system. All additional hardware, subassemblies, supporting equipment, and other miscellaneous equipment required for complete, proper system installation and operation shall be provided by the Contractor.
- D. Basic System Requirements:
 - 1. A complete communications bonding infrastructure is required for this project. Refer to the drawings and the requirements of ANSI-J-STD-607-A and NFPA 70 for complete information.

2. The bonding system shall include, but not be limited to, the following major components:
 - a. Bonding Conductor for Telecommunications (BCT)
 - b. Telecommunications Main Grounding Busbar (TMGB)
 - c. Telecommunications Bonding Backbone (TBB)
 - d. Telecommunications Grounding Busbar(s) (TGB)
 - e. Rack mount Telecommunications Grounding Busbar(s)
 - f. Bonding Conductor(s) (BC)
 - g. Bonding Connectors
 - h. Bonding system labeling and administration as defined in Section 27 05 53.

1.8 PROJECT RECORD DOCUMENTS

- A. Submit documents under the provisions of Section 27 05 00.
- B. Provide final system block diagram showing any deviations from approved shop drawing submittal.
- C. Provide floor plans that document the following:
 1. Actual locations of system components, devices, and equipment.
 2. Actual conductor routing.
 3. Actual system component, device, equipment, and conductor labels.
- D. Provide statement that system checkout test, as outlined in the approved shop drawing submittal, is complete and test results were satisfactory.
- E. Complete all operation and maintenance manuals as described below.

1.9 OPERATION AND MAINTENANCE DATA

- A. Submit under provisions of Section 27 05 00.
- B. Submitted data shall include:
 1. Approved shop drawings.
 2. Descriptions of recommended system maintenance procedures, including:
 - a. Inspection
 - b. Periodic preventive maintenance
 - c. Fault diagnosis
 - d. Repair or replacement of defective components

2. PART PRODUCTS

2.1 BONDING CONDUCTORS

- A. Bare Copper:
 1. Annealed uncoated stranded conductor.
 2. Minimum size 6 AWG.
- B. Insulated Copper:
 1. Annealed uncoated stranded conductor.

2. Insulation:
 - a. PVC insulation with nylon outer jacket.
 - b. Rated ≥ 600 volts.
 - c. Green.

3. Minimum size 6 AWG.

C. All bonding conductors shall be listed and recognized by a nationally recognized testing laboratory as being suitable for the intended purpose and for installation in the space in which they are installed.

D. Bonding Conductor Sizing

1. All Communications bonding system conductors shall be sized by length as follows:

Length Linear ft (m)	Size (AWG)
Less than 13 (4)	6
14 - 20 (4 - 6)	4
21 - 26 (6 - 8)	3
27 - 33 (8 - 10)	2
34 - 41 (10 - 13)	1
42 - 52 (13 - 16)	1/0
53 - 66 (16 - 20)	2/0
Greater than 66 (20)	3/0

2. The BCT shall be the same size as the TBB or larger.

2.2 BONDING CONNECTORS

A. Acceptable Types:

1. Two-hole compression lug
2. Exothermic weld
3. Irreversible compression

B. Connectors shall be provided in kit form and selected per manufacturer's written instructions.

C. Connectors shall comply with IEEE 837 and UL 467 and be listed for use for specific types, sizes, and combinations of conductors and connected items.

2.3 GROUNDING BUSBAR (TMGB AND TGB)

A. Features:

1. Wall-mount configuration.
2. Listed and recognized by a nationally recognized testing laboratory as being suitable for intended purpose.
3. Hole patterns compliant with BICSI recommendations and ANSI-J-STD-607-A standards.
4. Predrilled holes.
5. Integral insulators.
6. Stainless steel offset mounting brackets.

B. Specifications:

1. Material: Electrolytic tough pitch copper bar with tin plating.

2. Minimum Dimensions: 1/4" thick x 4" high x 12" long.
 - a. Increase dimensions and/or quantity furnished and installed as required to accommodate all terminations required by the project, plus 20% spare capacity.
3. Hole pattern shall include:
 - a. A minimum of 15 sets of 5/16" holes, 5/8" on center, to accommodate "A" spaced 2-hole compression lugs.
 - b. A minimum of three (3) sets of 7/16" holes, 1" on center, to accommodate "C" spaced 2-hole compression lugs.

2.4 RACK-MOUNT TELECOMMUNICATIONS GROUNDING BUSBAR

A. Features:

1. Listed and recognized by a nationally recognized testing laboratory as being suitable for intended purpose.
2. Predrilled holes.
3. Mounts in a standard 19" equipment rack.

B. Specifications:

1. Material: Electrolytic tough pitch copper bar with tin plating.
2. Minimum Dimensions: 3/16" thick x 3/4" high x 19" long.
 - a. Increase dimensions and/or quantity furnished and installed as required to accommodate all terminations required by the project, plus 20% spare capacity.
3. Hole pattern shall include:
 - a. A minimum of eight (8) 6-32 tapped lug mounting holes on 1" centers.
 - b. A minimum of two (2) pairs of 5/16" diameter holes spaced 3/4" apart.

3. PART EXECUTION

3.1 INSTALLATION

A. General Bonding Requirements:

1. The communications bonding system shall be a complete system. Contractor shall furnish and install all necessary miscellaneous components, devices, equipment, material, and hardware, including, but not limited to, lock washers, paint-piercing washers, hex nuts, compression lugs, insulators, mounting screws, lugs, etc., to provide a complete system.
2. A licensed electrician shall perform all bonding.
3. Comply with the manufacturer's instructions and recommendations for installation of all products.

B. Main Cross Connect and Service Entrance Room Bonding Requirements:

1. Locate the TMGB in the service entrance room unless otherwise noted on the drawings.

2. The location of the TMGB shall be the shortest practical distance from the telecommunications primary lightning protection devices.
 3. Bond the telecommunications primary protectors to the TMGB. Maintain a minimum 1 foot (300 mm) separation of the bonding conductor from all DC power cables, switchboard cable, and high frequency cable.
- C. Telecommunications Main Ground Bar (TMGB) Requirements:
1. Install TMGB such that it is insulated from its support with a minimum 2" standoff.
 2. Bond the TMGB to the electrical service ground via the BCT.
 - a. A minimum of 1 foot (300 mm) separation shall be maintained between the BCT and any DC power cables, switchboard cable, or high frequency cables.
 3. TMGB shall be bonded to all electrical panels located in the same room or space as the TMGB or in an immediately adjacent space within 20 linear feet of the TMGB. TMGB shall be bonded to all electrical panels providing electrical power to communications equipment located in the same room or space as the TMGB.
 4. TMGB shall be bonded to accessible metallic building structure located within the same room or space as the TMGB.
 5. All metallic continuous cable pathways, including, but not limited to, cable trays, basket trays, ladder racks, raceways, conduits, conduit sleeves, and fire-rated cable pathway devices, located within the same room or space as the TMGB, shall be bonded to the TMGB.
 6. All metallic communications equipment, including, but not limited to, cable pair protectors, surge suppressors, cross-connect frames, patch panels, equipment cabinets, etc., located within the same room or space as the TMGB, shall be bonded to the TMGB.
- D. Telecommunications Ground Bar (TGB) Requirements:
1. Provide a TGB in each telecommunications equipment room.
 2. Install TGB such that it is insulated from its support with a minimum 2" standoff.
 3. Bond each TGB to the TMGB via the TBB.
 - a. A minimum of 1 foot (300 mm) separation shall be maintained between the TBB and any DC power cables, switchboard cable, or high frequency cables.
 - b. The TBB may be routed from TGB to TGB or as a radial feed to each TGB as the layout requires.
 4. When there are multiple telecommunications equipment rooms on each floor in buildings containing more than five stories, the TGBs on the same floor shall be bonded together horizontally using a grounding equalizer (GE) on the first, last, and every third intermediate floor. GE conductors shall be the same size as the TBB.
 5. If more than one (1) TGB is provided within the same room or space, they shall all be bonded together via a BC the same size as the TBB.
 6. TGBs shall be bonded to accessible metallic building structure located within the same room or space as the TGBs.
 7. TGBs shall be bonded to all electrical panels located in the same room or space as the TGB or in an immediately adjacent space within 20 linear feet of the TGB. TGBs shall be bonded to all electrical panels providing electrical power to communications equipment located in the same room or space as the TGB.

8. All metallic continuous cable pathways, including, but not limited to, cable trays, basket trays, ladder racks, raceways, conduits, conduit sleeves, and fire-rated cable pathway devices, located within the same room or space as the TGB, shall be bonded to the TGB.
9. All metallic communications equipment, including, but not limited to, cable pair protectors, surge suppressors, cross-connect frames, patch panels, equipment cabinets, etc., located within the same room or space as the TGB, shall be bonded to the TGB.

E. Rack-mount Telecommunications Ground Bar Requirements (RTGB):

1. Provide a rack-mount telecommunications ground bar in each equipment rack and equipment rack enclosure.
2. Install RTGB such that it is electrically bonded to the rack. Where necessary, remove paint and/or use paint-piercing washers to provide proper electrical bond between RTGB and equipment rack.
3. Bond each RTGB to the TGB via a BC.
4. If more than one (1) RTGB is provided within the same room or space, they shall all be bonded together via a BC.
5. All contractor-furnished and/or contractor-installed metallic communications equipment, including, but not limited to patch panels, fiber optic distribution enclosures, splice enclosures, active electronics, uninterruptible power supplies, etc., mounted within the same equipment rack as the RTGB, shall be bonded to the RTGB. Where necessary, remove paint and/or use paint-piercing washers to provide proper electrical bond between equipment rack and installed metallic communications equipment. Active electronics and uninterruptible power supplies shall be bonded to the RTGB via a dedicated BC for each device.

F. Metallic Interior Communication Pathway Bonding Requirements:

1. All metallic interior continuous communication cable pathways, including, but not limited to, conduit, conduit sleeves, fire-rated cable pathway devices, cable tray, basket tray, and ladder rack, shall be bonded to the communications bonding system.

G. Bonding Conductor Requirements:

1. Bonding conductors shall be green or marked with a distinctive green color.
2. Bonding conductors shall be routed parallel and perpendicular to building structure along shortest and straightest paths possible. Number of bends and changes in direction should be minimized. Install and secure conductors in a manner that protects the conductors from impact and from physical or mechanical strain or damage.
3. Bonding conductors shall not be installed in metallic conduit.
4. All conductors, including, but not limited, to the BCT, TBB, GE(s), and BC(s), shall be installed splice-free. If the Contractor believes that site conditions do not allow a splice-free installation, the Contractor may request permission from the Architect/Engineer to splice a specific communications bonding system conductor.
 - a. Where documented permission to splice a conductor is granted:
 - 1) The number of splices shall be limited to as few as possible.
 - 2) Splices shall be made using exothermic welding or irreversible compression-type connections only. Splice hardware shall be listed for grounding and bonding. Solder is not an acceptable means of splicing conductors.

- 3) Splices shall be made in telecommunications spaces in accessible locations to facilitate future inspection and maintenance.
 - 4) Splices shall be adequately supported and protected from impact and from physical or mechanical strain or damage.
 5. All bonding conductors shall be labeled in accordance with the requirements of Section 27 05 53. In addition to the requirements of Section 27 05 53:
 - a. Labels shall be nonmetallic.
 - b. Labels shall be printer-generated.
 - c. Labels shall be located on conductors as close as is practical to their point of termination in a readable position.
 - d. Additionally, conductors shall be labeled as follows:
 - 1) "IF THIS CONNECTOR OR CABLE IS LOOSE OR MUST BE REMOVED, PLEASE CALL THE BUILDING TELECOMMUNICATIONS MANAGER."
 6. Interior water piping is not acceptable for use as a communications bonding system bonding conductor.
 7. Metallic cable shields are not acceptable for use as communications bonding system bonding conductors.
- H. Bonding Connection Requirements:
1. Make all connections in accessible locations to facilitate future inspection and maintenance.
 2. Communications bonding system connections shall be made using exothermic welding, two-hole compression lugs, or other irreversible compression-type connections. The use of 1-hole lugs is prohibited, except for connections to a rack-mount telecommunications ground bar. Connection hardware shall be listed for grounding and bonding. Sheet metal screws shall not be used to make communications bonding system connections.
 3. Thoroughly clean conductors before installing lugs and connectors.
 4. Install and tighten all connectors in accordance with manufacturer's instructions, using the appropriate purpose-designed tool(s) recommended by the manufacturer for that purpose. Exercise care not to tighten connectors beyond manufacturer's recommendations.
 5. Where necessary, remove paint and/or use paint-piercing washers to provide proper electrical bond at all connections.
 6. All bonding connections shall be coated in anti-oxidant joint compound that is purpose-designed and purpose-manufactured for that use. Anti-oxidant joint compound shall be applied in accordance with manufacturer's recommendations and instructions.
 7. All installed connectors on conductors installed in damp locations shall be sealed with dielectric grease and then covered with heat shrink tubing to protect against moisture ingress. Applied heat shrink tubing shall overlap conductor's outer jacket a minimum of four (4) inches past connector and be installed in accordance with manufacturer's recommendations and instructions.

3.2 FIELD QUALITY CONTROL

- A. Field testing shall be performed under provisions of Section 27 05 00.

- B. Where these specifications require a product or assembly without the use of a brand or trade name, provide a product from a reputable manufacturer that meets the requirements of the specifications.
- C. Periodic observations will be performed during construction to verify compliance with the requirements of the specifications. These services do not relieve the Contractor of responsibility for compliance with the contract documents.

3.3 ADJUSTING

- A. Adjust work under provisions of Section 27 05 00.
- B. Contractor shall make any and all adjustments to the communications bonding system necessary to ensure that the installed system meets all requirements listed herein. Modifications necessary to comply with listed requirements or to provide specified performance shall be completed by the Contractor at no additional cost to the Owner.

3.4 TESTING

- A. Test installed system under provisions of Section 27 17 10.
- B. Measure and document resistance to ground at TMGB, each TGB, each RTGB, and each electrical distribution panel bonded to the TMGB or a TGB.
 - 1. Measurements shall be made not less than two full days after the last trace of precipitation, and without the soil being moistened by any means other than natural drainage or seepage, and without chemical treatment or other artificial means of reducing natural ground resistance. Perform tests by the fall-of-potential method according to IEEE 81.
 - 2. Measured resistance to ground at TMGB, each TGB, and each RTGB must not exceed 5 ohms.
 - 3. Under no circumstances shall any point in the communications bonding system have a lower resistance to ground than that of nearby electrical distribution system components that it is bonded to.
- C. Include measurement documentation in test data submitted at completion of project under provisions of Section 27 17 10.

3.5 SYSTEM TRAINING

- A. All labor and materials required for on-site system training shall be provided. Training shall be conducted at the project site using the project equipment.
 - 1. Provide two week's advanced notice of training to the Owner and Architect/Engineer.
 - 2. The Architect/Engineer shall be presented with the option to attend the training.
 - 3. Provide a training outline agenda describing the subject matter and the recommended audience for each topic.
- B. At a minimum, the following training shall be conducted:
 - 1. A course detailing the system functions and operations that a technical user will encounter. Provide training on all aspects of using the system, including making new bonding connections to the TMGB, TGB, or RTGB. Provide training on all recommended inspection, maintenance, and repair procedures for the system.

C. Minimum on-site training times shall be:

1. Technical user: Four 4 hours.

END OF SECTION

SECTION 27 05 28

INTERIOR COMMUNICATION PATHWAYS

1. PART GENERAL

1.1 SECTION INCLUDES

- A. The work covered under this section consists of the furnishing of all necessary labor, supervision, materials, equipment, tests and services to install complete wire mesh support systems, conduits, sleeves, innerduct, etc. for an interior cabling plant as shown on the drawings.

1.2 RELATED WORK

- A. Section 26 05 33 - Conduit and Boxes
- B. Section 27 05 00 - Basic Communications Systems Requirements
- C. Section 27 05 26 - Communications Bonding

1.3 QUALITY ASSURANCE

- A. Refer to Section 27 05 00 for requirements.

1.4 REFERENCES

- A. ANSI/NFPA 70 - National Electrical Code
- B. NEMA VE 2-2000 - Cable Tray Installation Guidelines

1.5 SUBMITTALS

- A. Under the provisions of Section 27 05 00 and Division 1, prior to the start of work the Contractor shall submit:
 - 1. Manufacturer's data covering all products proposed, including construction, materials, ratings and all other parameters identified in Part 2 - Products, below.
 - 2. Manufacturer's installation instructions.
- B. Coordination Drawings:
 - 1. Include cable tray and conduit sleeve layout in composite electronic coordination files. Refer to Section 27 05 00 for coordination drawing requirements.

1.6 DRAWINGS

- A. The drawings, which constitute a part of these specifications, indicate the general route of the wire mesh support systems, conduit, sleeves, etc. Data presented on these drawings is as accurate as preliminary surveys and planning can determine until final equipment selection is made. Accuracy is not guaranteed and field verification of all dimensions, routing, etc., is required.

2. PART PRODUCTS

2.1 CONDUIT

- A. Refer to Section 26 05 33 for conduit requirements for this project.

2.2 CABLE HANGERS AND SUPPORTS

- A. Provide a non-continuous cable support system suitable for use with open cable.

B. Cable Hooks:

1. Construction: Flat bottom design with a minimum cable bearing surface of 1-5/8". Hooks shall have 90-degree radius edges.
2. All cable hook mounting hardware shall be recessed to prevent damage to cable during installation. Installed cabling shall be secured using a cable latch retainer that shall be removable and reusable.
3. Finish: Pre-galvanized steel, ASTM A653 suitable for general duty.

3. PART EXECUTION

3.1 CABLE HOOK SUPPORT SYSTEM

- A. In areas where cabling is not supported by cable tray, ladder rack, enclosed wireway or installed in conduit, such cabling shall be supported by an approved cable hook support system.
- B. Refer to manufacturer's requirements for allowable fill capacity for selected cable hook. In no case shall a 40% fill capacity be exceeded.
- C. Cable hooks shall be securely mounted per manufacturer's instructions. In no case shall the side-to-side travel of any cable hook exceed 6".
- D. Cable hooks shall be selected based on the contractor's cable routing. Hooks shall be capable of supporting a minimum of 30 pounds with a safety factor of 3.
- E. Support spans shall be based on the manufacturer's load ratings. In no case shall a 5-foot span be exceeded.
- F. The resting and supporting of cabling on structural members shall not meet the requirements for cabling support specified herein.
- G. The use of tie-wraps or hook and loop type fasteners is specifically prohibited as a substitute for cable hooks specified herein.

3.2 CONDUIT AND CABLE ROUTING

- A. Refer to specification section 26 05 03 for additional requirements.
- B. All conduits shall be reamed and shall be installed with a nylon bushing.
- C. Maintain appropriate conduit bend radius at all times. For conduits with an internal diameter of 2" or less, maintain a bend radius of at least 6 times the internal diameter. For conduits with an internal diameter greater than 2", maintain a bend radius of at least 10 times the internal diameter.
- D. No conduit or sleeve containing more than two (2) cables shall exceed 40% fill ratio, regardless of length.
- E. Any conduit exceeding 90' in length or containing more than two (2) 90-degree bends shall contain a pull box sized per ANSI/TIA/EIA 569 requirements.
 1. A separate pull box is required for each 90' (or greater) length section.
 2. A separate pull box is required after any two (2) consecutive 90-degree bends.
 3. Pull box shall be located in an area that maintains accessibility of box, including the ability to remove box lid without removal or relocation of any other materials.

- F. Any conduit with bends totaling 90 degrees or more shall have the fill capacity derated by 15% for each 90 degrees of cumulative bend.
- G. Cables installed in any conduits that do not meet the above requirements shall be replaced at the Contractor's expense, after the conduit condition has been remedied.

3.3 ATTACHMENT TO METAL DECKING

- A. Where supports for cable trays and cable hook systems attach to metal roof decking, excluding concrete on metal decking, do not exceed 25 lbs. per hanger and a minimum spacing of 2'-0" on center. This 25-lb. load and 2'-0" spacing include adjacent electrical and mechanical items hanging from deck. If the hanger restrictions cannot be achieved, supplemental framing off steel framing will need to be added.

END OF SECTION

SECTION 27 05 43

EXTERIOR COMMUNICATION PATHWAYS

1. PART GENERAL

1.1 SECTION INCLUDES

- A. This section describes the products and execution requirements relating to furnishing and installing exterior racks, ladders, conduits, sleeves, innerduct, etc. for an exterior cabling plant.

1.2 QUALITY ASSURANCE

- A. Refer to Section 27 05 00 for relevant standards.
- B. Precast Manufacturer (if applicable): Company specializing in precast concrete structures with three (3) years documented experience.

1.3 REFERENCES

- A. Section 27 05 00 – Basic Communications Systems Requirements.
- B. AASHTO HS-20 - Standard Specification for Highway Bridges.
- C. ANSI/ASTM A153 - Zinc Coating (Hot-Dip) on Iron and Steel Hardware.
- D. ANSI/ASTM A569 - Steel, Sheet and Strip, Carbon (0.15 Maximum Percent), Hot-Rolled, Commercial Quality.
- E. ASTM A48 - Gray Iron Castings.
- F. ASTM A123 - Zinc (Hot-Galvanized) Coatings on Products Fabricated from Rolled, Pressed, and Forged Steel Shapes, Plates, Bars, and Strips.

1.4 SUBMITTALS

- A. Under the provisions of Section 27 05 00 and Division 1, prior to the start of work the Contractor shall submit:
 - 1. Manufacturer's data covering all products proposed, including construction, materials, ratings and all other parameters identified in Part 2 - Products, below.
 - 2. Manufacturer's installation instructions.
- B. Manhole submittal (if applicable): Indicate material specifications, dimensions, capacities, size and location of openings, reinforcing details, and accessory locations.
 - 1. Provide product data for manhole accessories.
- C. Submit shop drawings and product data under provisions of Section 27 05 00.
- D. Submit manufacturer's installation instructions under provisions of Section 27 05 00.
- E. Coordination Drawings:
 - 1. Include manholes, hand holes, and conduits 1.5" and larger in coordination files. Include all in--floor and underfloor conduit in coordination files. Refer to Section 27 05 00 for coordination drawing requirements.

1.5 REGULATORY REQUIREMENTS

- A. Equipment and material shall be UL (Underwriters Laboratory) listed and labeled.

2. PART PRODUCTS

2.1 OUTSIDE PLANT CONDUIT

A. Rigid Non-Metallic Conduit (RNC) and Fittings:

1. UL listed, NEMA TC2 and TC6 Schedule 40 or 80 rigid polyvinyl chloride (PVC) approved for direct burial without concrete encasement.
2. Fittings: NEMA TC3 and TC9, sleeve type suitable for and manufactured especially for use with the conduit by the conduit manufacturer.
3. Plastic cement for joining conduit and fittings shall be provided as recommended by the manufacturer.
4. Acceptable Manufacturers:
 - a. Carlon (Lamson & Sessions) Type 40, Cantex, J.M. Mfg., or pre-approved equal.

B. Fittings:

1. Sweeps: Factory manufactured RMC wrapped with 4 mil vinyl tape with a bend radius as follows:
 - a. Conduit internal diameter of 2" or less is 6 times the internal conduit diameter.
 - b. Conduit internal diameter of more than 2" is 10 times the internal conduit diameter.
2. End Caps (Plugs): Pre-manufactured and watertight. Tape is not an acceptable end cap or cover.

2.2 HAND-HOLES

A. Type:

1. Polymer concrete

B. Dimensions:

1. As indicated on the drawings.

C. Requirements:

1. Includes polymer concrete cover.

D. Acceptable Manufacturers

1. Quazite
2. Old Castle Precast Christy®
3. New Basis.

2.3 TEXTILE INNERDUCT

- A. Contractor shall provide and install innerduct in each conduit identified to have copper and fiber optic cable installed.
- B. Innerduct shall have an 18 gauge solid copper core tracer wire installed into each cell to allow for detection by industry standard toning equipment.
- C. Each innerduct cell shall have a pull tape installed.

- D. Acceptable Manufacturers:
 - 1. Maxcell or pre-approved equal.

2.4 UNDERGROUND WARNING TAPE

- A. Detectable three-layer laminate, consisting of a printed pigmented polyolefin film, a solid aluminum-foil core, and a clear protective film that allows inspection of the continuity of the conductive core, bright-colored, compounded for direct-burial service.
- B. Overall Thickness: 5 mils (0.125 mm).
- C. Foil Core Thickness: 0.35 mil (0.00889 mm).
- D. Orange colored tape 3-wide with 1-inch high black letters permanently imprinted with "CAUTION – BURIED COMMUNICATIONS LINE BELOW". Printing on tape shall be permanent and shall not be damaged by burial operations.
- E. Tape material and ink shall be chemically inert, and not subject to degrading when exposed to acids, alkalis, and other destructive substances commonly found in soils.
- F. Comply with ANSI Z535.1 through ANSI Z535.5.

3. PART EXECUTION

3.1 INSTALLATION - PRECAST CONCRETE MANHOLES

- A. Excavate, install base material, and compact base material in accordance with manufacturer's instructions.
- B. Install and seal precast sections in accordance with manufacturer's instructions.
- C. Use precast neck and shaft sections to bring manhole entrance to proper elevation.
- D. Install manholes plumb.
- E. Set the top of each manhole to finished elevation or as indicated on the drawings.

3.2 INSTALLATION - DUCTBANK

- A. Make duct bank installations and penetrations through foundation walls watertight.
- B. Top of duct banks shall be a minimum of 24 inches below grade, unless otherwise indicated on drawings.
- C. Assemble duct banks using non-magnetic saddles, spacers and separators. Position separators to provide 3-inch minimum separation between the outer surfaces of the ducts.
- D. Transition from non-metallic to galvanized rigid steel conduit where duct banks enter buildings, manholes, and handholes.
- E. Where ducts enter structures such as manholes, handholes, pullboxes and buildings, terminate the ducts in suitable end bells.
- F. Slope duct runs for drainage toward manholes and away from buildings with a slope of approximately 3-inches per 100 feet.

- G. After completion of the duct bank and prior to pulling cable, pull a mandrel, not less than 12 inches long and with a cross section approximately 1/4 inch less than the inside cross section of the duct, through each duct. Then pull a rag swab or sponge through to make certain that no particles of earth, sand, or gravel have been left in the duct.
- H. Plug and seal empty spare ducts entering buildings and structures. Seal watertight all ducts in use entering buildings and structures.

3.3 INSTALLATION – TEXTILE INNERDUCT

- A. Provide two (2) 3-cell innerducts per 4" conduit or as recommended by the manufacturer.
- B. Install innerduct per manufacturer's guidelines.
- C. Cut and tie off innerduct and pull tape inside each communications vault or Entrance Room.

3.4 EXCAVATION, FILL, BACKFILL, COMPACTION

- A. General:
 - 1. The Contractor shall do all necessary excavating, securing, filling, backfilling, compacting, and restoration in connection with their work.
- B. Excavation:
 - 1. Excavations for trenches shall be excavated to proper dimensions to permit installation and inspection of work.
 - 2. Where excavations are carried in error below indicated levels, thoroughly compacted sand-gravel fill, shall be placed in such excess excavations.
 - 3. Excavations shall be protected against frost action and freezing.
 - 4. Care shall be exercised in excavating so as to not damage surrounding structures, equipment, and buried utilities. In no case shall any major structural footing or foundation be undermined.
 - 5. Excavation shall be performed in all ground characteristics, including rock, if encountered. Each bidder shall visit the premises and determine, by actual observations, borings, or other means, the nature of the soil conditions. The cost of all such inspections, borings, etc., shall be borne by the bidder.
 - 6. In the case where the trench is excavated in rock, a compacted bed with a depth of 3" (minimum) of sand and gravel shall be used to support the conduit unless masonry cradles or encasements are used.
 - 7. Where satisfactory bearing soil is not found at the indicated levels, the Architect/Engineer or their representative shall be notified immediately and no further work shall be done until further instructions are given.
 - 8. Mechanical excavation of the trench to line and grade of the conduit, unless otherwise indicated on the drawings.
- C. Dewatering:
 - 1. The Contractor shall be responsible for the furnishing, installation, operation and removal of all dewatering pumps and lines necessary to keep the excavation free of water at all times.

D. Underground Obstructions:

1. Prior to the commencement of any excavation or digging, the Contractor shall verify all underground utilities with the regional utility locator. Provide prior notice to the locator before excavations. Contact information for most regional utility locaters can be found by calling 811. The Contractor is responsible for obtaining all utility locates for all trades on the project to determine obstructions indicated. The Contractor shall use great care in installing in the vicinity of underground obstruction.

E. Fill and Backfilling:

1. No rubbish or waste material shall be permitted in excavations for trench fill and backfill.
2. The Contractor shall provide the necessary sand for backfilling.
3. Dispose of the excess excavated earth as directed.
4. Soils for backfill shall be suitable for required stability and compaction, clean and free from perishable materials, frozen earth, debris or earth with an exceptionally high void content, and free from stones greater than 4 inches in diameter. Under no circumstances shall water be permitted to rise in unbackfilled trenches after installation has been placed.
5. All trenches shall be backfilled immediately after installation of conduit, unless other protection is directed.
6. All conduit shall be laid on a compacted bed of sand at least 3" deep. Backfill around the conduit with sand, spread in 6" layers, then compact each layer.
7. Use sand for backfill up to grade for all conduit located under building slabs or paved areas. All other conduit shall have sand backfill to 6" above the top of the conduit.
8. The backfilling above the sand shall be placed in uniform layers not exceeding 6" in depth. Each layer shall be placed, then carefully and uniformly tamped, so as to eliminate the possibility of lateral or vertical displacement.
9. Install a warning tape approximately 12 inches below finished grade over all underground duct banks. The identifying warning tape shall be as specified above.
10. Where the fill and backfilling will ultimately be under a building, floor or paving, each layer of fill shall be compacted to 95% of the maximum density as determined by AASHTO Designation T-99 or ASTM Designation D-698. Moisture content of soil at time of compaction shall not exceed plus or minus 2% of optimum moisture content as determined by AASHTO T-99 or ASTM D-698 test.
11. After backfilling of trenches, no superficial loads shall be placed on the exposed surface of the backfill until a period of 48 hours has elapsed.

3.5 RESTORATION REQUIREMENTS

- A. Where soil and sod has been removed, it shall be replaced as soon as possible after backfilling is completed. All areas disturbed by work shall be restored to their original condition. The restoration shall include any necessary topsoiling, fertilizing, liming, seeding, or mulching,

END OF SECTION

SECTION 27 05 53

IDENTIFICATION AND ADMINISTRATION

1. PART GENERAL

1.1 SECTION INCLUDES

- A. This section describes the identification and administration requirements relating to the structured cabling system and its termination components and related subsystems.
- B. Identification and labeling.

1.2 RELATED WORK

- A. Section 27 05 00 – Basic Communications Systems Requirements

1.3 QUALITY ASSURANCE

- A. Refer to Section 27 05 00 for relevant standards.
- B. Perform all work in accordance with State or California standard.

1.4 SUBMITTALS

- A. Under the provisions of Section 27 05 00 and Division 1, prior to the start of work the Contractor shall submit:
 - 1. Documentation of labeling scheme.

2. PART PRODUCTS

2.1 LABELING

- A. Adhesive labels shall meet the requirements of UL 969 (Ref D-16) for legibility, defacement and adhesion. Exposure requirements of UL 969 for indoor and outdoor (as applicable) use shall be met.
- B. Insert labels shall meet the requirements of UL 969 for legibility, defacement and general exposure.
- C. Labeling shall be consistent for all common elements in the project. This consistency shall include label size, color, typeface and attachment method.
- D. Tag all CAT 3, CAT 6A, and optical fiber cables at both the Communications Equipment Room and the information outlets using the following alphanumeric labeling system:
 - 1. (Telecom Room Number) – (Patch Panel Letter) – (Patch Panel Port Number).
 - 2. "Telecom Room Number" shall be as indicated on the drawings.
 - 3. "Patch Panel Letter" shall start with 'A' for the top modular patch panel, increasing sequentially from top to bottom across the equipment rack.
 - 4. "Patch Panel Port Number" shall start with '1' for the upper left port in each modular patch panel, increasing sequentially from left to right and top to bottom across the modular patch panel face.
 - 5. Example #1: MC/1-A3 indicates the third modular patch panel port in modular patch panel 'A' in Main Equipment Room (MC/1).

6. Example #2: HC/2-C39 indicates the thirty-ninth modular patch panel port in modular patch panel C in Horizontal Cross-Connect room (HC/2).

2.2 DOCUMENTATION/AS-BUILTS/RECORDS

A. General:

1. Upon completion of the installation, the Contractor shall submit as-builts per the requirements of Section 27 05 00 and Division 1. Documentation shall include the items detailed in the subsections below.
2. All documentation, including hard copy and electronic forms shall become the property of the Owner.

B. Record Drawings:

1. The drawings are to include cable routes and outlet locations. Outlet locations shall be identified by their sequential number as defined elsewhere in this document. Numbering, icons and drawing conventions used shall be consistent throughout all documentation provided.

3. PART EXECUTION

3.1 IDENTIFICATION AND LABELING

A. Cable Labeling: Backbone and horizontal cables shall be labeled at each end.

1. Provide additional cable labeling at each manhole and pull box.
2. Cables that are routed through multiple pathway segments shall contain reference to all pathway segments in the pathway linkage field.
3. Cables that differ only by performance class shall have a suitable marking or label to indicate the higher performance class. For example, station cabling utilizing the blue color, may include blue with a white stripe to indicate the higher performance class station cabling.

B. Information Outlet Labeling: Tag all voice and data jacks as defined herein.

C. Termination Hardware Labeling:

1. An identifier shall be provided at each termination hardware location or its label.

D. Grounding/Bonding Labeling:

1. The TMGB shall be labeled "TMGB." There shall be only one TMGB in the facility.
2. Label all TBB conductors connecting to the TMGB with a unique label, located at both ends of the TBB.
3. Each TGB shall be labeled with a unique label.
4. All TBB conductors connecting to the TGB shall be labeled uniquely at each end of the cable.

END OF SECTION

SECTION 27 11 00

COMMUNICATION EQUIPMENT ROOMS (CER)

1. PART GENERAL

1.1 SECTION INCLUDES

- A. This section describes the products and execution requirements related to furnishing and installing equipment for communication equipment rooms.

1.2 RELATED WORK

- A. Section 27 05 00 - Basic Communications Systems Requirements
- B. Section 27 05 26 - Communications Bonding
- C. Section 27 05 28 - Interior Communication Pathways
- D. Section 27 15 00 - Horizontal Cabling Requirements

1.3 QUALITY ASSURANCE

- A. Refer to Section 27 05 00 for applicable standards.

1.4 SUBMITTALS

- A. Under the provisions of Section 27 05 00 and Division 1, prior to the start of work the Contractor shall submit:
 - 1. Manufacturer's data covering all products including construction, materials, ratings and all other parameters identified in Part 2 - Products, below.
 - 2. Manufacturer's installation instructions.
- B. Coordination Drawings:
 - 1. Include ladder racking, equipment racks, cable tray and conduit sleeve layout in composite electronic coordination files. Refer to Section 27 05 00 for coordination drawing requirements.

2. PART PRODUCTS

2.1 EQUIPMENT GROUNDING

- A. Refer to specification section 27 05 26 for grounding requirements.
- B. All equipment required to be grounded shall be provided with a grounding lug suitable for termination of the specified size electrode conductor.

2.2 EQUIPMENT RACKS AND CABINETS

- A. Where identified on the drawings in Communication Equipment Rooms, equipment racks and/or equipment cabinets shall be furnished and installed by the Contractor to house cable termination components (e.g., copper, optical fiber, coax) and network electronics.

B. The equipment rack shall conform to the following requirements:

1. Standard TIA/EIA 19" Floor Rack:

- a. Equipment rack shall be 84" in height, self-supporting and provide a useable mounting height of 45 rack units (RU) (1 RU = 1 $\frac{3}{4}$ ").
- b. Channel uprights shall be spaced to accommodate industry standard 19" mounting.
- c. Equipment rack shall be double side drilled and tapped to accept 12-24 screws. Uprights shall also be drilled on back to accept cable brackets, clamps, power strip(s), etc. Hole pattern on rack front shall be per TIA/EIA specifications (5/8"-5/8"-1/2"). Hole pattern on the rear shall be at 3" intervals to accept cable brackets.
- d. Equipment racks shall be provided with a supply of spare screws (minimum of 24).
- e. Equipment racks shall be provided with a ground bar and #6 AWG ground lug.
- f. Provide all mounting hardware and accessories as required for a complete installation.

2. Swing Gate TIA/EIA 19" Wall Rack:

- a. Equipment rack shall be 35" in height and provide a useable mounting height of 19 RU. Rack shall be a minimum of 25" deep.
- b. Wall-mounted equipment racks shall be provided with a swing-gate assembly to allow rear access of rack-mounted equipment.
- c. Equipment rack shall support up to 150 lbs. when securely mounted to a wall or backboard.
- d. Provide all mounting hardware and accessories as required for a complete installation.

3. Standard TIA/EIA 19" Floor Cabinet:

- a. The equipment cabinets shall be constructed of painted steel or aluminum and offer a usable mounting height of 45 RU. Rack shall be a minimum of 31 inches deep.
- b. The equipment cabinet shall be configured to allow for adjustment of the channel uprights (front to rear) in 1-inch increments and be spaced to accommodate industry standard 19-inch mounting. Cabinet shall be tapped to accept 12-24 screws.
- c. The equipment cabinet shall be vented to allow for airflow through the cabinet.

4. Standard TIA/EIA 19" Wall Cabinet:

- a. The equipment cabinets shall be constructed of painted steel or aluminum and offer a usable mounting height of 15 RU. Racks shall be a minimum of 21 inches deep. Access to the rear of the cabinet-mounted equipment shall be by a hinged arrangement.
- b. The equipment cabinet shall be equipped with a lockable steel front door and furnished with two (2) keys that shall be usable on all cabinets furnished under this Contract.

- c. The equipment cabinet shall be configured to allow for adjustment of the channel uprights (front to rear) in 1-inch increments and be spaced to accommodate industry standard 19-inch mounting. The cabinet shall be tapped to accept 12-24 screws.
- d. The equipment cabinet shall be vented to allow for airflow through the cabinet.

2.3 CABLE MANAGEMENT – VERTICAL AND HORIZONTAL

A. Equipment Racks:

- 1. Equipment racks shall be equipped with vertical and horizontal cable management hardware in the form of rings and guides. Racks shall incorporate vertical and horizontal covers, to allow an orderly, hidden, routing of copper, optical fiber, and coax jumpers from the modular patch panels and/or 110-type termination blocks to the customer provided network electronics. Vertical and horizontal cable management hardware shall be as follows:
 - a. Horizontal cable management hardware shall be 16 gauge cold rolled steel construction with six (6) pass-thru holes and seven (7) front-mounted 3.5" steel rod D-rings. Provide with cover designed to conceal and protect cable.
 - b. At a minimum, horizontal cable management hardware shall be positioned above and below (a) each grouping of two rows of jacks on modular patch panels, and (b) above and below each optical fiber patch panel and (c) each grouping of two rows of F-type connectors on coax patch panels.
 - c. Vertical cable management hardware shall provide for cable routing on front and rear of each rack and be 14" deep x 6" wide (minimum). Where multiple equipment racks are to be installed, this hardware shall be mounted between the uprights of adjacent equipment racks. Equipment rack uprights and the spacers shall be secured together per manufacturer's recommendations. Provide with cover designed to conceal and protect cable.
- 2. Each equipment rack shall be supplied with a minimum of 12 releasable (e.g., "hook and loop") cable support ties.
- 3. Where cable termination hardware is wall-mounted, the Contractor shall be responsible for establishing a cable pathway for jumpers routed from the equipment rack(s) to the wall. This shall be in the form of slotted ducts or troughs. Routing of jumpers via the overhead cable tray or ladder rack system is NOT acceptable. The proposed method shall be included in the submittals required by this document and shall be approved by the Architect/Engineer prior to installation.

B. Equipment Cabinets

- 1. Equipment cabinets shall be equipped with vertical and horizontal cable management hardware, in the form of rings and guides, to allow an orderly routing of optical fiber and copper jumpers from the modular patch panel and/or 110-type termination blocks to the customer provided network electronics. At a minimum, one such horizontal cable management panel shall be provided with each equipment cabinet. Horizontal cable management panels shall be 3.5" in height and have a minimum of five (5) jumper distribution rings.

C. 110-type Termination Blocks:

- 1. Horizontal troughs incorporating plastic distribution rings shall be provided by the Contractor to accommodate routing of jumpers. Horizontal troughs shall be positioned at the top of each column of 110-type termination blocks and between each 100-pair 110-type termination block.

2. Vertical troughs incorporating metal distribution rings shall be provided for vertical routing of jumper and/or cross-connect wire.

2.4 PATCH PANELS

- A. Where identified on the drawings in Communication Equipment Rooms, modular patch panels shall be furnished and installed by the Contractor for termination of copper cable.
- B. Copper cabling shall be terminated in Communication Equipment Rooms on modular patch panels consisting of a modular connector system incorporating modular jacks meeting the specifications for the jacks detailed in Section 27 15 00.
- C. The largest single modular patch panel configuration shall not exceed 48-Ports. Modular patch panels shall be fully populated (all ports occupied by jacks) and be provided in increments of no less than 12 jacks. High-density modular patch panels will not be accepted.
- D. The modular patch panel blocks shall have the ability to seat and cut eight (8) conductors (4 pairs) at a time and shall have the ability of terminating 22- through 26-gauge plastic insulated, solid and stranded copper conductors. Modular patch panel blocks shall be designed to maintain the cables' pair twists as closely as possible to the point of mechanical termination.
- E. Modular patch panels shall incorporate cable support and/or strain relief mechanisms to secure the horizontal cables at the termination block and to ensure that all manufacturers minimum bend radius specifications are adhered to.

2.5 OPTICAL FIBER PANELS

- A. All terminated optical fibers shall be mated to simplex LC -type couplings mounted on enclosed fiber distribution cabinets. Couplings shall be mounted on a panel that, in turn, snaps into the enclosure. The proposed enclosure shall be designed to accommodate a changing variety of connector types including SC, ST, Fixed Shroud Duplex (e.g., "FDDI Connector"), Biconic, FC, and MT-RJ by changing panels on which connector couplings are mounted. Refer to Section 27 15 00 for coupling requirements.
- B. The fiber distribution cabinet shall be sized to accommodate the total fiber count to be installed at each location as defined in the specifications and drawings, including those not terminated (if applicable). Connector panels and connector couplings (sleeves, bulkheads, etc.) adequate to accommodate the number of fibers to be terminated shall be furnished and installed by the Contractor.
- C. The fiber distribution cabinet shall be an enclosed assembly affording protection to the cable subassemblies and to the terminated ends. The enclosures shall incorporate a hinged or retractable front cover designed to conceal and protect the optical fiber couplings, connectors, and cable.
- D. Access to the inside of the fiber distribution cabinet's enclosure during installation shall be from the front and/or rear. Panels that require any disassembly of the fiber distribution cabinet to gain entry will not be accepted.
- E. The fiber distribution cabinet's enclosure shall provide for strain relief of incoming optical fiber cables and shall incorporate radius control mechanisms to limit bending of the optical fiber to the manufacturer's recommended minimums or 1/2", whichever is larger.
- F. All fiber distribution cabinets shall provide protection to both the "facilities" and "user" side of the coupling. The fiber distribution cabinet's enclosure shall be configured to require front access only when patching. The incoming optical fiber cables (e.g., backbone, riser, horizontal, etc.) shall not be accessible from the patching area of the panel. The fiber distribution cabinet's enclosure shall provide a physical barrier to access such optical fiber cables.

- G. Fiber distribution cabinets for horizontal cabling: Where optical fiber horizontal cabling is to be terminated, the enclosure shall be compliant to all the above requirements plus the enclosure shall incorporate a storage mechanism designed to allow simplified identification, access to and termination of individual optical fibers. This may be in the form of a storage cassette, tray or other appropriate mechanism.

2.6 OPTICAL FIBER CONNECTORS/COUPLERS/ADAPTERS

A. Optical Fiber Connectors (LC-type) (Singlemode):

1. LC-type Optical Fiber Connectors: Shall be used to terminate optical fiber in communication equipment rooms.
2. LC-type optical fiber connector plugs shall be snap-type with an integrated pull-proof design.
3. LC-type optical fiber connector plugs shall incorporate a zirconium ceramic ferrule and shall utilize a factory pre-polish end face to ensure fiber-to-fiber physical contact for low loss and reflections.
4. LC-type optical fiber connector plugs shall accept 1.6mm – 2.0mm and 3.0mm outside diameter fiber.
5. The average insertion loss is 0.3db for multimode and single mode connectors.
6. LC-type optical fiber connector plugs shall meet the following performance criteria:

<u>Test Procedure</u>	<u>Maximum Attenuation Change</u>
Cable Retention (FOTP-6)	0.2 dB
Durability (FOTP-21)	0.2 dB
Impact (FOTP-2)	0.2 dB
Thermal Shock (FOTP-3)	0.2 dB
Humidity (FOTP-5)	0.2 dB

7. Additional Performance Requirements:
 - a. Length: 2.23 inches
 - b. Operating Temperature: -40 to 85 degrees C
8. Basis of Design:
 - a. Hubbell FCLC Series

B. Optical Fiber Couplings (LC type) (Singlemode):

1. LC -type optical fiber couplings shall be used to terminate optical fiber backbone cable on fiber distribution cabinet panels in communication equipment rooms. Horizontal optical fiber cables shall also be terminated using optical fiber couplings at their designated work area locations on information outlet faceplates for "fiber to the desk."
2. LC -type optical fiber couplings shall be snap-type with locking washer and nut.
3. LC -type optical fiber couplings shall incorporate domed zirconia ferrule and shall utilize a PC polish to ensure fiber-to-fiber physical contact for low loss and reflections.
4. LC -type optical fiber couplings shall accept 125-micron outside diameter multimode fiber.
5. The attenuation per mated pair shall not exceed 0.7 dB (individual) and 0.5 dB (average). Connectors shall sustain a minimum of 200 mating cycles per TIA/EIA-455-21 without violating specifications.

6. SC-type optical fiber couplings shall meet the following performance criteria:

<u>Test Procedure</u>	<u>Maximum Attenuation Change</u>
Cable Retention (FOTP-6)	0.2 dB
Durability (FOTP-21)	0.2 dB
Impact (FOTP-2)	0.2 dB
Thermal Shock (FOTP-3)	0.2 dB
Humidity (FOTP-5)	0.2 dB

7. Additional Performance Requirements:

- a. Length: 2 inches (5.08cm)
- b. Operating Temperature: -40 to 85 degrees C

8. Basis of Design:

- a. Panduit

2.7 TERMINATION BLOCKS

- A. Where identified on the drawings in Communication Equipment Rooms, 110-type termination blocks shall be furnished and installed by the Contractor for termination of copper cable.
- B. Each horizontal row of the 110-type termination block must be capable of terminating one (1) 25-pair binder group (backbone cables).
- C. The Mechanical Termination Shall:
 1. Have the ability of terminating 22 - 26 AWG plastic insulated, solid and stranded copper conductors.
 2. Provide a direct connection between the cable and jumper wires.
 3. Have less than 0.2 dB of attenuation from 1-16 MHz.
 4. Have less than 100 mW of DC resistance.
 5. Have less than 5 mw of resistance imbalance.
 6. Have minimal signal impairments at all frequencies up to 16 MHz.
- D. The 110-type termination block shall identify pair position by a color designation - Blue, Orange, Green, Brown and Slate (backbone only).
- E. The 110-type termination block shall be designed to maintain the cables' pair twists as closely as possible to the point of mechanical termination.

2.8 LADDER RACK

- A. Provide complete ladder rack system including metallic ladder rack, splice connectors, fastening hardware and other miscellaneous materials as required for a complete installation per manufacturer's recommendations.
- B. Steel C-Channel Stringer Style Ladder Rack:
 1. Rolled steel siderail stringer, 2" stringer height, 9" spaced welded rungs.
 2. Steel shall meet the requirements of ASTM A1011 SS Grade 33.
 3. Loading limits shall be 292 lbs/ft for 4 ft spans.

- C. Ladder rack finish shall be flat black powder coat.

2.9 D-RINGS

- A. Rounded edge D-rings for support of cabling in vertical and horizontal configurations.
- B. EIA 310D compliant, manufactured from materials meeting UL94-V0 specifications.
- C. Provide ¼" screw holes for wall mounting.

2.10 COPPER PATCH CORDS

- A. Modular Patch Panel:
 - 1. Provide Category 6A copper patch cords for 50% of all assigned ports on the modular patch panel. Of these cords, 60% shall be 3' in length and 40% shall be 5' in length. These patch cords shall be the cross-connect between the network electronics and the horizontal RJ-45 modular patch panel. Copper patch cords shall be equipped with a 4-pair RJ-45 connector on each end.
 - 2. Refer to Section 27 15 00 for cable and connector performance requirements.
 - 3. Patch cords shall not be made-up in the field.
 - 4. Basis of Design (Refer to 27 17 20 for Acceptable Manufacturers):
 - a. Panduit

2.11 FIBER PATCH CORDS

- A. Optical Fiber Patch Cords (Singlemode):
 - 1. The optical fiber patch cord shall be 8.3/3 μm singlemode (SM) optical fiber, utilizing tight buffer construction. The optical fiber patch cords shall be a minimum of 5 feet (1.5m) in length.
 - 2. Provide 8.3/3 μm singlemode (SM) optical fiber utilizing tight buffer construction for 50% of all assigned ports on the fiber distribution cabinet. These patch cords shall be the cross-connect between the backbone fiber distribution cabinet and the Owner's network electronics (hub/switch). Optical fiber patch cords shall be equipped with a ceramic tipped LC-type connector on each end and shall be a minimum of 5 feet (1.5m) in length. Connector body shall be of materials similar to that used in the proposed couplings. Provide required lengths as determined on the plans.
 - 3. Channels shall be of equal length.
 - 4. Refer to Section 27 15 00 for cable and connector performance requirements.
 - 5. Basis of Design (Refer to 27 17 20 for Acceptable Manufacturers):
 - a. Panduit

2.12 LIGHTNING PROTECTION

- A. Contractor shall provide multipair protector panel(s), including mounting and termination hardware. The multipair protector panel(s) shall be UL listed.

- B. For small pair count applications (less than or equal to 200-pairs), the multipair protector panel shall consist of a mounting panel for a series of solid-state protector units, 710-type connector for input, and 110-type termination blocks for output. Insertion of the protector units into the mounting panel will complete the circuit. The multipair protector panel(s) shall be available in 25-, 50-, 100-, and 200-pair counts.
- C. For large pair count applications (greater than 200 pairs) or when the multipair protector panel is separated from the cross-connect field, the multipair protector panel shall consist of a metal housing containing mountings for a series of solid-state protector units. The protector units shall include a 25-foot, 26 AWG stub cable that serves as a fusible link, a 24 AWG terminating cable, and two connectors for external ground connections. The protection devices shall be available in 50- and 100-pair counts.
- D. Solid State Protection Units:
 - 1. DC Breakdown Voltage (at 2 kV/sec): 220-300V.
 - 2. Surger Breakdown Voltage (at 100 V/μsec): 220-300V.
 - 3. Insulation Resistance: >100 M Ω typical.
 - 4. DC Holdover Current: 260 mA/52V, 200 mA/135V, 140 mA/150V.
 - 5. Capacitance: Less than <100 pF.
 - 6. Rated Impulse Discharge: 200A.
 - 7. On-state Voltage (at 100A): Less than 10V.
 - 8. Response Time: Less than 100 nsec.
 - 9. Line Series Resistance: <4 Ω
 - 10. Sneak Current Operation (heat coils): 540 mA = <210 sec; 1A = <15 sec

2.13 DEMARCATION REQUIREMENTS

- A. Contractor shall coordinate all requirements for the demarcation point with the owner's selected service provider.
- B. The Contractor shall not proceed with any installation without written communication with the Architect/Engineer should the service provider's requirements differ from the work shown on the contract documents.
- C. Refer to the drawings for further requirements.

3. PART EXECUTION

3.1 EQUIPMENT RACKS

- A. Equipment racks shall be furnished and installed as shown on the drawings.
- B. The Contractor shall bolt the rack to the floor as recommended by the manufacturer. Multiple racks shall be joined and the ground made common on each. The rack shall be stabilized by extending a brace to the wall. Alternately, overhead ladder rack by which the cabling accesses the equipment rack(s) may provide this function.
- C. A space between the rack upright and the wall (approximately 4") should be provided to allow for cabling in that area. The rear of the rack should be approximately 40" from the wall to allow for access by maintenance personnel. In all cases, a minimum of 40" workspace in front of the rack is also required. Locations where these guidelines cannot be followed should be brought to the attention of the Architect/Engineer for resolution prior to installation.
- D. All hardware and equipment is to be mounted between 18" and 79" above floor level. This is to afford easy access and, in the case of the lower limit, prevent damage to the components. Positioning of hardware should be reviewed and approved by the Architect/Engineer and Site Coordinator(s) prior to installation.

- E. Equipment racks shall be equipped with cable management hardware as to allow an orderly and secure routing of optical fiber and/or copper cabling to the optical fiber distribution cabinets and/or modular patch panels. At minimum, one such horizontal jumper management panel shall be placed below each optical fiber distribution cabinet installed by the Contractor. Additional Jumper Management panels may be required pending installation of other cable types on the equipment rack.
- F. Each rack shall be grounded to the Telecommunications Ground Bar (GND) using a #6 AWG (or larger) insulated stranded copper conductor (GREEN jacket) directly or via an adjacent grounded equipment rack. Refer to grounding requirements below.

3.2 LADDER RACK

- A. Provide support for ladder rack on 4 ft centers.
- B. Maintain a 1.5 safety factor on all load limits specified herein.
- C. Ladder rack support shall be by 5/8" diameter threaded rod when ceiling mounted. Ladder rack requiring wall mounting shall utilize accessories supplied by the ladder rack manufacturer specifically for the purpose of wall mounting ladder rack.

3.3 D-RINGS

- A. Provide D-rings for cable routing and management in all areas where open cabling is routed along the wall in an Equipment Room.
- B. Locate D-rings on 24" centers vertically and horizontally.
- C. Securely attach D-rings to the wall as required by the manufacturer.

3.4 GROUNDING

- A. Provide a complete grounding system in accordance with the requirements of Section 27 05 26.

3.5 CROSS CONNECT INSTALLATION

- A. Bend radius of cable shall not exceed 4 times the outside cable diameter or manufacturer's recommendation, whichever is less.
- B. Cables shall be neatly bundled and dressed to their respective panels and/or blocks. Each shall be fed by an individual bundle separated and dressed to the point of cable entrance into the rack and/or frame.
- C. The cable jacket shall be maintained as close as possible to the termination point.
- D. Each cable shall be clearly labeled on the cable jacket behind the patch panel at a location that is visible without removing the bundle support.

3.6 OPTICAL FIBER TERMINATION

- A. All fiber slack shall be neatly coiled within fiber splice enclosures or splice trays. No slack loops shall be allowed external to the enclosure.
- B. Each cable shall be individually attached to the respective fiber enclosure by mechanical means. The cable strength member shall be securely attached to the cable strain relief bracket in the enclosure.
- C. Each cable shall be clearly labeled at the entrance to all enclosures.
- D. A maximum of 12 strands shall be spliced in any tray.

3.7 CONDUITS AND CABLE ROUTING

- A. Refer to Section 26 05 33 for additional requirements.
- B. Where conduits enter a telecommunications room, conduits shall be terminated on the wall where shown on the contract documents. Conduits entering the room from the floor shall extend 3" above the floor slab.
- C. Where cabling rises vertically in a telecommunications rooms, provide vertical cable management to support the cabling from floor to ceiling level.
- D. All conduits shall be reamed and shall be installed with a nylon bushing.
- E. Maintain appropriate conduit bend radius at all times. For conduits with an internal diameter of 2" or less, maintain a bend radius of at least 6 times the internal diameter. For conduits with an internal diameter greater than 2", maintain a bend radius of at least 10 times the internal diameter.

END OF SECTION

SECTION 27 13 00

BACKBONE CABLING REQUIREMENTS

1. PART GENERAL

1.1 SECTION INCLUDES

- A. This section describes the products and execution requirements relating to furnishing and installing backbone communications cabling and termination components and related subsystems as part of a cabling plant. The cabling plant consists of both optical fiber and/or copper cabling.

1.2 RELATED WORK

- A. Section 27 05 00 – Basic Technology Systems Requirements.
- B. Section 27 15 00 - Horizontal Cabling Requirements.
- C. Section 27 17 20 - Support and Warranty.

1.3 QUALITY ASSURANCE

- A. Refer to Section 27 05 00 for relevant standards.

1.4 SUBMITTALS

- A. Under the provisions of Section 27 05 00 and Division 1, prior to the start of work the Contractor shall submit:
 - 1. Manufacturer's data covering all products proposed, including construction, materials, ratings and all other parameters identified in Part 2 - Products, below.
 - 2. Manufacturer's installation instructions.

2. PART PRODUCTS

- 2.1 The basis of design is listed herein. Refer to Section 27 17 20 for additional acceptable manufacturers.

2.2 OPTICAL FIBER BACKBONE – INSIDE PLANT (RISER)

- A. Singlemode (SM):
 - 1. This optical fiber backbone cable shall be suitable for installation in building riser systems, in conduit, in cable tray and/or in innerduct.
 - 2. Optical fiber cable materials shall be all dielectric (no conductive material).
 - 3. Optical fiber cable shall carry an OFNR (optical fiber non-conductive riser) or OFNP (optical fiber non-conductive plenum) rating. Refer to Section 27 05 00 for project requirements.
 - 4. Optical fiber cable shall be interlocking armored cable.
 - 5. Outer Sheath: The outer sheath shall be marked with the manufacturer's name, date of manufacture, fiber type, flame rating, UL symbol, and sequential length markings every two feet.
 - 6. Temperature Range:
 - a. Storage: -40°C to +70°C (no irreversible change in attenuation).
 - b. Operating: -40°C to +70°C.

7. Humidity Range: 0% to 100%.
8. Maximum Tensile Strength (≥ 12 fibers):
 - a. During Installation: 1332 Newton (300 lb. force) (no irreversible change in attenuation).
 - b. Long-Term: 600 N (135 lb. force).
9. Maximum Tensile Strength (≤ 6 fibers):
 - a. During Installation: 1000 Newton (225 lb. force) (no irreversible change in attenuation).
 - b. Long-Term: 100 N (67 lb. force).
10. Bending Radius:
 - a. During Installation: 20 times cable diameter.
 - b. No Load: 10 times cable diameter.
- B. Optical fiber cables suitable for installation in multiple environments (e.g., underground duct and building risers) may be used at the Contractor's option. Such optical fiber cables shall meet all specifications noted above for cables designated for each environment through which the optical fiber cable shall pass.
- C. Basis of Design (Singlemode):
 1. Panduit (FSPP9) interlocking plenum

2.3 COPPER BACKBONE – INSIDE PLANT

- A. CAT 3 Backbone Cable:
 1. The CAT 3 backbone cable shall link Communication Equipment Rooms serving the building. These CAT 3 backbone cables shall be terminated on 110-type termination blocks.
 2. CAT 3 backbone cable shall incorporate 24 AWG solid annealed copper conductors insulated with a polyvinyl chloride (PVC) CMR or thermoplastic CMP plenum rated skin. Refer to Section 27 05 00 for project requirements. Conductors shall be twisted to form pairs and be fully color-coded.
 3. Conductors shall be identified by the insulation color of each conductor. The color code shall follow the industry standard composed of 10 distinctive colors to identify 25-pairs in accordance with ICEA publication S-80-576-1988. Marking of each mate of the primary conductor in a pair with the color of that primary conductor is optional.
 4. CAT 3 backbone cable shall meet the TIA/EIA Category 3 performance requirements.
 5. When CAT 3 backbone cables of larger than 25-pairs are required, the core shall be assembled into 25-pair sub-units, each color-coded in accordance with ICEA publication S-80-576-1988. CAT 3 backbone cables with over 600-pair shall have 25-pair binder groups combined into super units. These super units shall be wrapped with a solid color thread that follows the primary color scheme of white, red, black, yellow and violet. Binder color code integrity shall be maintained wherever cables are spliced.
 6. Basis of Design:
 - a. Belden. DIW25 CMR or DPLN25 CMP.

2.4 OPTICAL FIBER BACKBONE – OUTSIDE PLANT

A. Duct Bank (Singlemode):

1. This optical fiber cable shall be suitable for installation in underground duct and in innerduct.
2. Optical fiber cable materials shall be all dielectric (no conductive materials).
3. Optical fiber cable shall be filled with a water-blocking material.
4. Outer Sheath: Polyethylene (PE). The outer sheath shall be marked with the manufacturer's name, words identifying the cable type (e.g., "Optical Fiber Cable" or "Fiber Optic Cable"), year of manufacture, and sequential length markings. The actual length of the optical fiber cable shall be within -0/+1% of the length markings. The marking shall be in a contrasting color to the cable jacket.
5. Temperature Range:
 - a. Storage: -40°C to +70°C (no irreversible change in attenuation).
 - b. Operating: -40°C to +70°C.
6. Humidity Range: 0% to 100%.
7. Maximum Tensile Strength:
 - a. During Installation: 2700 Newton (600 lb. force) (no irreversible change in attenuation).
 - b. Long Term: 890 N (200 lb. force).
8. Bending Radius:
 - a. During Installation: 20 times cable diameter.
 - b. No Load: 10 times cable diameter.

B. Basis of Design (Singlemode):

1. Corning (XXX).

2.5 OPTICAL FIBER BACKBONE PERFORMANCE

A. Singlemode (SM):

1. Fiber Type: Singlemode; doped silica core surrounded by a concentric glass cladding.
2. Core Diameter: 8 to 9 μm . All optical fibers shall be of the same nominal core diameter and profile.
3. Cladding Diameter: $125 \pm 1.0\mu\text{m}$.
4. Cladding Non-circularity: $\leq 1\%$.
5. Core to Cladding Offset: $\leq 0.8 \mu\text{m}$.
6. Fiber Coating Diameter:
 - a. $245 \pm 15\mu\text{m}$ (primary coating).
 - b. 900-nm (nominal) secondary coating (tight buffer).
 - c. All coatings shall be mechanically strippable without damaging the optical fiber.
7. Cut-off Wavelength (cabled fiber; λ_{ccf}) $\leq 1260\text{-nm}$.

8. Mode Field Diameter: 8.3 to 9.8 μm at 1300-nm; $10.5 \pm 1.0 \mu\text{m}$ at 1550-nm.
9. Zero Dispersion Wavelength (λ_0): $1301.5 \text{ nm} \leq \lambda_0 \leq 1321.5 \text{ nm}$.
10. Zero Dispersion Slope (S_0): $\leq 0.092 \text{ ps/nm}^2\cdot\text{km}$.
11. Fiber Attenuation (maximum @ $23 \pm 5^\circ\text{C}$; Backbone):
 - a. @ 1300-nm: 2.0 dB/km
 - b. @ 1550-nm: 1.75 dB/km

When tested in accordance with FOTP-3, "Procedure to Measure Temperature Cycling Effects on Optical Fibers, Optical Cable, and Other Passive Fiber Optic Components," the average change in attenuation over the rated temperature range of the optical fiber cable shall not exceed 0.05 dB/km at 1550-nm. The magnitude of the maximum attenuation change of each individual optical fiber shall not be greater than 0.15 dB/km at 1550-nm.

12. Fiber Dispersion (maximum):
 - a. @ 1285 to 1330-nm: 3.2-ps/nm*km
 - b. @ 1550-nm: 18-ps/nm*km
13. No optical fiber shall show a point discontinuity greater than 0.1 dB at the specified wavelengths. Such a discontinuity or any discontinuity showing a reflection at that point shall be cause for rejection of that optical fiber by the Owner.

2.6 COPPER BACKBONE – OUTSIDE PLANT

A. CAT 3 Backbone Cable:

1. CAT 3 backbone cable shall incorporate 24 AWG solid, annealed, bare copper conductors. All conductors shall be continuous and splice free. Bridge taps shall not be allowed.
2. Conductors shall be insulated with a thermoplastic skin. Maximum diameter of the insulated conductor shall be 0.048 in (1.22 mm). Insulated conductors shall be stranded into pairs of varying lengths to minimize crosstalk.
3. Conductors shall be identified by the insulation color of each conductor. The color code shall follow the industry standard composed of 10 distinctive colors to identify 25-pairs in accordance with ICEA publication S-80-576-1988. Marking of each mate of the primary conductor in a pair with the color of that primary conductor is optional.
4. When CAT 3 backbone cables of larger than 25 pairs are required, the core shall be assembled into 25-pair sub-units, each color-coded in accordance with ICEA publication S-80-576-1988. CAT 3 backbone cables with over 600-pair shall have 25-pair binder groups combined into super units. These super units shall be wrapped with a solid color thread that follows the primary color scheme of white, red, black, yellow and violet. Binder color code integrity shall be maintained wherever CAT 3 backbone cables are spliced.
5. CAT 3 backbone cable shall meet the physical and electrical requirements of 100 Ohm "Backbone Cable" as defined by the ANSI/TIA/EIA-568 Standard for Commercial Building Wiring and shall conform to Category 3 performance specifications or better. Measurements should be in accordance with ASTM D 4566 (ref. B.17).
6. CAT 3 backbone cable shall be UL listed and be compliant with Article 800 (Communications Circuits) of the National Electrical Code (NEC) and be suitable for installation in underground duct or direct burial (REA PE-89).

7. A flooding compound shall be applied over the core and to all surfaces of the shield/armor to resist moisture entry and to inhibit corrosion.
8. The CAT 3 backbone cable core shall be filled with a waterproofing compound and wrapped with a non-hydroscopic core tape.
9. CAT 3 backbone cable shall contain an overall corrugated, coated aluminum shield, which is electrically continuous over its entire length.
10. CAT 3 backbone cable shall be finished with a black polyethylene jacket, which is sequentially printed with a footage marker at regular intervals.
11. Basis of Design:
 - a. Belden ANMW.

3. PART EXECUTION

3.1 CABLE INSTALLATION REQUIREMENTS

- A. Cable slack shall be provided in each backbone fiber optic cable. This slack is exclusive of the length of fiber that is required to accommodate termination requirements and is intended to provide for cable repair and/or equipment relocation. The cable slack shall be stored in a fashion as to protect it from damage and be secured in the termination enclosure or a separate enclosure designed for this purpose. Multiple cables may share a common enclosure.
- B. A minimum of 5 meters (approximately 15 feet) of slack cable (each cable if applicable) shall be coiled and secured at both ends located in the entrance room, Telecommunications Room or main equipment room, for backbone and intra-building cable.
- C. Where exposed, all backbone fiber optic cable shall be installed in protective inner duct. This includes areas where the cable is routed in cable tray and where making a transition between paths (e.g., between conduit and cable tray or into equipment racks). The inner duct should extend into the termination and/or storage enclosure(s) at system endpoints.

3.2 CROSS-CONNECTS

- A. The Owner will be responsible for all cross-connects between the data backbone cabling and network electronics and between the data network electronics and horizontal cabling.
- B. The Contractor shall be responsible for the cross-connect wiring between the horizontal and backbone voice cabling.
 1. All four (4) pairs of the horizontal cable shall be terminated on modular patch panels. Two (2) pairs of the horizontal cable shall be cross-connected to the backbone cable. Refer to the drawings for requirements of the 110 to RJ-45 cross connect cable.
 2. Fastening cables directly to support brackets with wire or plastic ties will not be accepted. All cabling shall be neatly laced, dressed and supported. Avaya 88A retainer clips (or equivalent) shall be used on each 110-type termination block to secure jumper wires on the wiring block(s).

- C. This Contractor shall not be responsible for cross-connects between the cabling terminations at the Entrance Room and the telephone utility network point-of-presence. It shall be the responsibility of the Contractor, to work with the Owner and provide the necessary assistance to allow Owner and/or telephone company personnel to make the necessary connections to establish service on the new cable system. These activities include, but are not limited to cross-connect documentation, general wiring overview and cable pair identification.

END OF SECTION

SECTION 27 15 00

HORIZONTAL CABLING REQUIREMENTS

1. PART GENERAL

1.1 SECTION INCLUDES

- A. This section describes the products and execution requirements relating to furnishing and installing horizontal communications cabling and termination components and related subsystems as part of a cabling plant. The cabling plant consists of copper cabling.

1.2 RELATED WORK

- A. Section 27 05 00 - Basic Communications Systems Requirements

1.3 QUALITY ASSURANCE

- A. Refer to Section 27 05 00 for relevant standards and plenum or non-plenum cable requirements.
- B. The channel shall be required to meet the performance requirements indicated herein. The manufacturer shall warranty the performance of their system to the required performance (and not just to the Standard, should the required performance exceed the Standard).
- C. Specific components of the channel shall be required, at a minimum, to meet the Standard component requirements for that particular component.
- D. The installing contractor must be certified by the manufacturer of the structured cabling system.

1.4 SUBMITTALS

- A. Under the provisions of Section 27 05 00 and Division 1, prior to the start of work the Contractor shall submit:
 - 1. Manufacturer's data covering all products proposed, including construction, materials, ratings and all other parameters identified in Part 2 - Products, below.
 - 2. Manufacturer's installation instructions.

2. PART PRODUCTS

2.1 HORIZONTAL CABLE

- A. CAT 6A Cable:
 - 1. The horizontal cable requirements must be met, as well as the following channel requirements.
 - 2. CAT 6A cable shall terminate on rack-mounted modular patch panels in their respective communication equipment room as indicated on the drawings.
 - 3. Cable shall exceed transmission requirements listed in ANSI/TIA/EIA-568-C.2. Performance tests shall be conducted using swept frequency testing through 500 MHz for the channel. All numbers given are for a 4-connection channel. Discrete frequency testing results at 500 MHz is not acceptable.

4. Performance tests shall be conducted using swept frequency testing through 500 MHz for the channel. All numbers given are for a 4-connection channel. Discrete frequency testing results at 500 MHz is not acceptable.
5. Performance data shall be provided by third-party independent testing laboratories only. Testing data shall be submitted on the third-party testing laboratory letterhead. Test data will only be accepted if it displays testing as a channel. Electrical characteristics of the performance of the cable itself will not satisfy this requirement.
6. The structured cabling and connectivity may be provided by the same company. For the purpose of this specification that shall mean that the cabling and connectivity must be marketed, branded, supported, warranted, and distributed by the same company. Specifically, ally or partnerships between cabling manufacturers and connectivity manufacturers do not meet this requirement unless otherwise listed in Section 27 17 20 as an acceptable manufacturer. Specifically, products made by others through an OEM relationship are acceptable if the products are marketed, branded, supported, warranted, and distributed by the same company.
7. The 4-connector channel performance margins in the table below shall be guaranteed margins above ANSI/TIA/EIA-568-C.2:

Electrical Value (1 - 500 MHz)	Minimum Margin
Insertion Loss:	3%
NEXT:	2 dB
PS NEXT:	3 dB
PSA NEXT:	3dB
PSA NEXT (Average):	
ACR-F:	2 dB
PS ACR-F:	3 dB
PSA ACR-F:	3 dB
PSA ACR-F (Average):	3 dB
Return Loss:	2 dB

8. The jacket color for CAT 6A cable shall be white for voice applications and blue for data applications.
9. Basis of Design:
 - a. Panduit Advanced MaTriX
 - b. Refer to Section 27 17 20 for additional acceptable manufacturers.

2.2 FACEPLATES/JACKS

A. Cat 6A Jacks:

1. CAT 6A horizontal cable shall each be terminated at its designated work area location on RJ-45 modular jacks. These modular jack assemblies shall snap into a modular mounting frame. The combined modular jack assembly is referred to as an information outlet.
2. The same orientation and positioning of modular jacks shall be utilized throughout the installation. Prior to installation, the Contractor shall submit the proposed configuration for each information outlet type for review by the Architect/Engineer.
3. Information outlet faceplates shall incorporate recessed designation strips at the top and bottom of the frame for identifying labels. Designation strips shall be fitted with clear plastic covers.

4. Where standalone CAT 6A only modular jacks are identified, the information outlet faceplate shall be configured as to allow for the addition of one (1) additional modular jack (CAT 3, CAT 5E, or CAT 6) to be installed to supplement each such modular jack as defined by this project. The installation of these supplemental modular jacks is NOT part of this project.
5. Any unused modular jack positions on an information outlet faceplate shall be fitted with a removable blank inserted into the opening.
6. The information outlet faceplate shall be constructed of high impact plastic (except where noted otherwise). The information outlet faceplate color shall:
 - a. Match the faceplate color used for other utilities in the building, or
 - b. When installed in surface raceway (if applicable), match the color of that raceway.
7. Different faceplate and frame designs for locations, which include optical fiber cabling relative to those, that terminate only copper cabling are acceptable. Information outlets that incorporate optical fiber shall be compliant with the above requirements plus:
 - a. Be a low-profile assembly.
 - b. Incorporate a mechanism for storage of cable and fiber slack needed for termination.
 - c. Position the optical fiber couplings to face downward or at a downward angle to prevent contamination.
 - d. Incorporate a shroud that protects the optical fiber couplings from impact damage.
8. All information outlets and the associated modular jacks shall be of the same manufacturer throughout the project.
9. The CAT 6A modular jacks shall be non-keyed 8-pin modular jacks.
10. The interface between the modular jack and the horizontal cable shall be an angled insulation displacement type contact and shall provide separation for ANEXT suppression. Termination components shall be designed to maintain the horizontal cable's pair twists as closely as possible to the point of mechanical termination.
11. CAT 6A modular jacks shall be pinned per TIA-568A TIA-568B.
12. CAT 6A termination hardware shall, as a minimum, meet all the mechanical and electrical performance requirements of the following standards:
 - a. ANSI/TIA/EIA-568-B.2-10
 - b. IEEE 802.af (PoE)
 - c. IEEE 802.an 10GBASE-T
 - d. ISO/IEC 60603-7
 - e. ISO 11801 Class E Compliant
 - f. FCC PART 68.5 SUBPART F
13. The color for CAT 6A jacks shall be white for voice applications and blue for data applications. Alternately, a color-coded bezel or icon may be used to identify the CAT 6A modular jack.

2.3 COPPER WORK AREA CORDS

A. RJ-45:

1. Provide the same quantity of Category 6A copper work area cords as copper patch panel cords specified in Section 27 11 00. Copper work area cords shall be equipped with an 8-pin modular RJ-45 connector on each end.
2. Work area cords shall be 10' in length.
3. Manufacturer of copper patch cable shall be the same as the manufacturer of the horizontal copper cable.

3. PART EXECUTION

3.1 CABLE INSTALLATION REQUIREMENTS

A. Horizontal Cabling:

1. The maximum horizontal cable drop length for Data UTP shall not exceed 295 feet (90 meters) in order to meet data communications performance specifications. This length is measured from the termination panel in the wiring closet to the outlet and must include any slack required for the installation and termination. The Contractor is responsible for installing horizontal cabling in a fashion so as to avoid unnecessarily long runs. Any area that cannot be reached within the above constraints should be identified and reported to the Architect/Engineer prior to installation. Changes to the contract documents shall be approved by the Architect/Engineer.
2. All cable shall be free of tension at both ends. In cases where the cable must bear some stress, Kellum grips may be used to spread the strain over a longer length of cable.
3. Manufacturer's minimum bend radius specifications shall be observed in all instances.
4. Horizontal cabling installed as open cabling shall be supported at a maximum of 5' between supports. Refer to the specifications for required cable supports.
5. Horizontal cabling installed as open cable or in cable tray shall be bundled at not less than 10' intervals with hook-and-loop tie wraps. The use of plastic cable ties is strictly prohibited.
6. The maximum conduit fill for horizontal cabling shall not exceed 40% regardless of conduit length.
7. Cable sheaths shall be protected from damage from sharp edges. Where a cable passes over a sharp edge, a bushing or grommet shall be used to protect the cable.
8. A coil of 3 feet in each cable shall be placed in the ceiling at the last support (e.g., J-hook, bridle ring, etc.) before the cables enter a fishable wall, conduit, surface raceway or box. At any location where cables are installed into movable partition walls or modular furniture via a service pole, approximately 15-feet of slack shall be left in each horizontal cable under 250 feet in length to allow for change in the office layout without re-cabling. These "service loops" shall be secured at the last cable support before the cable leaves the ceiling and shall be coiled from 100% to 200% of the cable recommended minimum bend radius.
9. To reduce or eliminate EMI, the following minimum separation distances from 480V power lines shall be adhered to:
 - a. Twelve (12) inches from power lines of <5-kVa.
 - b. Eighteen (18) inches from high-voltage lighting (including fluorescent).
 - c. Thirty-nine (39) inches from power lines of 5-kVa or greater.
 - d. Thirty-nine (39) inches from transformers and motors.

10. Information outlets shown on floor plans with the subscript "W" are intended to be used for wall mounted telephones. Back boxes for wall mounted telephones shall not be located within 12" vertically, or horizontally, from any light switches, power receptacles, nurse call devices, thermostats, or any other architectural element that would otherwise prevent the installation of a wall mounted telephone on the mating lugs.

B. Horizontal Cabling in Modular Furniture:

1. This Contractor shall be responsible for providing and installing cable completely to the information outlet in the furniture. This Contractor's responsibility does not end at the furniture feed point.
2. Where furniture panels are installed to include contact with a wall, cabling shall be fed to the furniture panels via conduit.
3. Where modular furniture is installed without wall contact, the Contractor shall install cabling through floor fittings as shown on the drawings.
4. Cabling shall be protected in the transition from the floor or wall fittings to the modular furniture via a length of flexible plastic conduit or other approved protective means. Conduit fittings shall be compatible with the Floor and Wall Fittings proposed. There shall be no exposed cable in the transition to the modular furniture. Fill ratio (cable area vs. conduit area) in each feed shall not exceed 40%.
5. For purposes of bidding, it is to be assumed that the cable pathway shall be limited to the bottom panel of the modular furniture only. Communications cables would be run through these channels to the jack location.
6. For purposes of bidding, it is to be assumed that it will be the responsibility of the Contractor to punch and reinstall the bottom molding panels on the modular furniture as required to accommodate the communications cabling and information outlets. The panels shall be marked prior to installation by the Owner to identify the desired location of the information outlets.
7. The information outlet shall be secured to the panel via mounting tabs, pop-rivets, screws or other approved method. Use of adhesive tape is not acceptable. The method of securing the information outlet to the panel shall not result in sharp protrusions (e.g., sheet metal screw tip) into the channel behind the panel.

C. Cable Terminations - Data UTP:

1. Modular patch panels shall be designed and installed in a fashion as to allow future horizontal cabling to be terminated on the panel without disruption to existing connections.
2. If the "last" patch (per rack) is greater than 50% utilized, one additional patch panel shall be provided for future use.
3. At information outlets and modular patch panels, the Contractor shall ensure that the twists in each cable pair are preserved to within 0.5-inch of the termination for data cables. The cable jacket shall be removed only to the extent required to make the termination.

END OF SECTION

SECTION 27 17 10

TESTING

1. PART GENERAL

1.1 SECTION INCLUDES

- A. This section describes the testing requirements relating to the structured cabling system and its termination components and related subsystems.

1.2 RELATED WORK

- A. Section 27 05 00 – Basic Communications Systems Requirements

1.3 QUALITY ASSURANCE

- A. Refer to Section 27 05 00 for relevant standards.

1.4 SUBMITTALS

- A. Under the provisions of Section 27 05 00 and Division 1, prior to the start of work, the Contractor shall submit:
 - 1. Complete information on testing procedure as described herein.
 - 2. Test plan summary for each cable type to be tested including equipment to be used, setup, test frequencies or wavelengths, results format, etc.

2. PART PRODUCTS

2.1 TESTING COPPER

- A. General Requirements:
 - 1. Perform acceptance tests as indicated below for each sub-system (e.g., backbone, horizontal, etc.) as it is completed.
 - 2. Supply all equipment and personnel necessary to conduct the acceptance tests. The method of testing shall be approved by the Architect/Engineer.
 - 3. Visually inspect all cabling and termination points to ensure that they are complete and conform to the wiring pattern defined herein. Provide the Architect/Engineer with a written certification that this inspection has been made.
 - 4. Conduct acceptance testing according to a schedule coordinated with the Owner/Architect/Engineer. Representatives of the Owner may be in attendance to witness the test procedures. Provide a minimum of one (1) week's advance notice to the Architect/Engineer to allow for such participation. The notification shall include a written description of the proposed conduct of the tests, including copies of blank test result sheets to be used.

5. Tests related to connected equipment of others shall only be done with the permission and presence of the Contractor involved. The Contractor shall ascertain that testing only is required to prove the wiring connections are correct.
6. Provide test results and describe the conduct of the tests including the date of the tests, the equipment used, and the procedures followed. At the request of the Architect/Engineer, provide copies of the original test results in their native format.
7. All cabling shall be 100% fault-free unless noted otherwise. If any cable is found to be outside the specification defined herein, that cable and the associated termination(s) shall be replaced at the expense of the Contractor. The applicable tests shall then be repeated.
8. Should it be found by the Architect/Engineer that the materials or any portion thereof furnished and installed under this Contract fail to comply with the specifications and drawings with respect or regard to the quality, amount, or value of materials, appliances, or labor used in the work, it shall be rejected and replaced by the Contractor and all work disturbed by changes necessitated in consequence of said defects or imperfections shall be made good at the Contractor's expense.
 - a. CAT 3 Cable:
 - 1) Indoor/Backbone Cable:
 - a) Backbone CAT 3 copper cable shall be free of shorts within the pairs and be verified for continuity, pair validity and polarity, and conductor position on the termination blocks (e.g., 110). Any mis-positioned pairs must be identified and corrected. The percentage of "bad" pairs shall not exceed 3% in any backbone (riser or tie) cable based on total pair count. All bad pairs must be identified and documented.
 - b) Where horizontal cables are cross-connected by the Contractor to backbone cables at an intermediate or horizontal cross-connect, the Contractor will be responsible to test the entire system from each CAT 3 information outlet to the building's main cross-connect. If more than a 1% failure on the cross-connects occur, the Contractor will be required to provide mapping of the system utilizing the procedure outlined below for CAT 5E copper cabling.
 - c) All horizontal cable shall be free of shorts within the pairs and be verified for continuity, pair validity and polarity, and conductor position on the modular jack (e.g., wire map). Any defective, split, or mis-positioned pairs must be identified and corrected.
 - b. CAT 6A Cable:
 - 1) Testing shall be from the modular jack at the information outlet to the modular patch panel in the communication equipment room.
 - 2) Horizontal cable shall be free of shorts within the pairs and be verified for continuity, pair validity and polarity, and conductor position on the modular jack (e.g., wire map). Any defective, split, or mis-positioned pairs must be identified and corrected.

- 3) CAT 6A horizontal cable shall be tested to 500 MHz as defined by TIA/EIA-568-C.2. Measurements shall be of the "Basic Link," including cabling and modular jacks at the information outlet and modular patch panel. Parameters to be tested must include:
- a) Wire Map
 - b) Length
 - c) NEXT Loss (Pair-to-Pair)
 - d) NEXT (Power Sum)
 - e) ELFEXT (Pair-to-Pair)
 - f) ELFEXT (Power Sum)
 - g) Return Loss
 - h) Attenuation
 - i) Propagation Delay
 - j) Delay Skew
- 4) The maximum length of horizontal cable shall not exceed 295 feet (90m), which allows 33 feet (10 m) for technology equipment and modular patch cords.
- 5) To establish testing baselines, cable samples of known length and of the cable type and lot installed shall be tested. The cable may be terminated with an eight-position CAT 6A modular connector (8-pin) to facilitate testing. Nominal Velocity of Propagation (NVP) and nominal attenuation values shall be calculated based on this test and be used during the testing of the installed cable plant. This requirement can be waived if NVP and nominal attenuation data is available from the cable manufacturer for the exact cable type under test.
- 6) CAT 6A horizontal cable testing shall be performed using a test instrument designed for testing to 500 MHz or higher. Test records shall verify "PASS" on each cable and display the specified parameters, comparing test values with standards based "templates" integral to the unit. Test records that report a PASS*, FAIL*, or FAIL result for any of the parameters will not be accepted.
- 7) In the event results of the tests are not satisfactory, the Contractor shall make adjustments, replacements, and changes as necessary and shall then repeat the test or tests that disclosed faulty or defective material, equipment, or installation methods, and shall make additional tests as the Architect/Engineer deems necessary at no additional expense to the project or user agency.

2.2 TESTING FIBER

A. General Requirements:

1. Perform acceptance tests as indicated below for each optical fiber sub-system (e.g., backbone, horizontal, etc.) as it is completed.
2. Supply all equipment and personnel necessary to conduct the acceptance tests. The method of testing shall be approved by the Architect/Engineer.
3. Visually inspect all optical fiber cabling and termination points to ensure that they are complete and conform to the standards defined herein. Provide the Architect/Engineer with a written certification that this inspection has been made.
4. Conduct acceptance testing according to a schedule coordinated with the Owner/Architect/Engineer. Representatives of the Owner may be in attendance to witness the test procedures. Provide a minimum of one (1) week's advance notice to the Architect/Engineer to allow for such participation. The notification shall include a written description of the proposed conduct of the tests, including copies of blank test result sheets to be used.
5. Tests related to connected equipment of others shall only be done with the permission and presence of the Contractor involved. The Contractor shall ascertain that testing only is required to prove that the optical fiber connections are correct.
6. Provide test results and describe the conduct of the tests including the date of the tests, the equipment used and the procedures followed. At the request of the Architect/Engineer, provide copies of the original test results.
7. All optical fiber cabling shall be 100% fault-free unless noted otherwise. If any optical fiber cable is found to be outside the specification defined herein, that optical fiber cable and the associated connector(s) shall be replaced at the expense of the Contractor. The applicable tests shall then be repeated.
8. Should it be found by the Architect/Engineer that the materials or any portion thereof furnished and installed under this Contract fail to comply with the specifications and drawings with respect or regard to the quality, amount, or value of materials, appliances, or labor used in the work, it shall be rejected and replaced by the Contractor and all work disturbed by changes necessitated in consequence of said defects or imperfections shall be made good at the Contractor's expense.
9. The optical fibers utilized in the installed cable shall be traceable to the manufacturer. Upon request by the Owner, provide cable manufacturer's test report for each reel of cable provided. These test reports shall include manufacturer's on-reel attenuation test results at 850-nm and 1300-nm for each optical fiber of each reel prior to shipment from the manufacturer.
 - a. On-the-reel bandwidth performance as tested at the factory. Factory data shall be provided upon request.
 - b. The testing noted for optical fiber cabling utilizes an Optical Time Domain Reflectometer (OTDR). However, the Contractor may submit to the Architect/Engineer for pre-approval of alternate fiber optic testing equipment.
 - c. Tests Prior to Installation:
 - 1) The Contractor, at their discretion and at no cost to the Owner, may perform an attenuation test with an OTDR at 850-nm or 1300-nm on each optical fiber of each cable reel prior to installation. Supply this test data to the Architect/Engineer prior to installation.

d. Tests After Installation:

- 1) Upon completion of cable installation and termination, the optical fiber cabling shall be tested to include:

- a) Optical Attenuation ("Insertion Loss" Method):

- (1) Optical Attenuation shall be measured on all terminated optical fibers in one direction of transmission using the "Insertion Loss" method measurement in accordance with the TIA/EIA 526-14, Method B, and be inclusive of the optical connectors and couplings installed at the system endpoints. Access jumpers shall be used at both the transmit and receive ends to ensure that an accurate measurement of connector losses is made. Multimode optical fibers shall be tested at 850 ± 30 nm. Singlemode optical fibers (if Attenuation of optical fibers shall not exceed the values calculated as follows:

$$\text{Attenuation (max.)} = 2 * C + L * F + S \text{ dB}$$

Where C is the maximum allowable Connector Loss (in dB), L is the length of the run (in kilometers), and F is the maximum allowable optical fiber loss (in dB/km). S is the total splice loss (# of splices * maximum attenuation per splice).

- b) Verification of Link Integrity (OTDR):

- (1) All optical fibers shall be documented in one direction of transmission using an Optical Time Domain Reflectometer (OTDR). Multimode optical fibers shall be tested at 850-nm and 1300-nm (nominal). Singlemode optical fibers (if applicable) shall be tested at 1310-nm and 1550-nm (nominal). The OTDR(s) shall incorporate high-resolution optics optimized for viewing of short cable sections. Access jumpers of adequate length to allow viewing of the entire length of the cable, including the connectors at the launch and receive end, shall be used. Access jumpers used for testing shall match the type and core diameter of the fiber optic strand under test.
 - (2) Set OTDR's test variables to the manufacturer's published backscatter coefficient and velocity of propagation figure for the specific strand of fiber under test. OTDR's range should be set to approximately 1.5 times the length of the strand under test, pulse width should be optimized for the length of the fiber optic strand under test, and number of averages should be adjusted to approximately 120 seconds per wavelength.

- (3) OTDR traces revealing a point discontinuity greater than 0.2 dB in a multimode optical fiber or 0.1 dB in a singlemode optical fiber (if applicable) at any of the tested wavelengths or any discontinuity showing a reflection at that point shall be a valid basis for rejection of that optical fiber by the Owner. The installation of that optical fiber cable shall be reviewed in an effort to remove any external stress that may be causing the fault. If such efforts do not remove the fault, that optical fiber cable and the associated terminations shall be replaced at the expense of the Contractor.

2.3 DOCUMENTATION/AS-BUILTS/RECORDS

A. General:

1. Upon completion of the installation, submit as-builts per the requirements of Section 27 05 00 and Division 1. Documentation shall include the items detailed in the subsections below.
2. All documentation, including hard copy and electronic forms, shall become the property of the Owner.
3. The Architect/Engineer may request that a 10% random field retest be conducted on the cable system at no additional cost to verify documented findings. Tests shall be a repeat of those defined above. If findings contradict the documentation submitted by the Contractor, additional testing can be requested to the extent determined necessary by the Architect/Engineer, including a 100% retest. This retest shall be at no additional cost to the Owner.

B. Copper Media Test Data:

1. Test results shall include a record of test frequencies, cable type, conductor pair and cable (or Outlet) I.D., measurement direction, test equipment type, model and serial number, date, reference setup, and crew member name(s).
2. Printouts generated for each cable by the wire test instrument shall be submitted as part of the documentation package. The Contractor shall furnish this information in electronic form (USB thumb drive). The thumb drive shall contain the electronic equivalent of the test results as defined by the bid specification and be in the tester's native format as well as summaries of each test in pdf format. Provide a licensed copy of the software required to view and print the data that is provided in a proprietary format. Furnish one (1) copy of the data and display (if applicable) software.

C. Optical Fiber Media Test Data:

1. Test results shall include a record of test wavelengths, cable type, fiber and cable (or Outlet) I.D., measurement direction, test equipment type, model and serial number, date, reference setup, and crew member name(s).
2. OTDR traces of individual optical fiber "signatures" obtained as specified above shall be provided to the Architect/Engineer in electronic form for review. Trace files shall be so named as to identify each individual optical fiber by location in the cable system and optical fiber number or color. Where traces are provided in electronic form, provide along with the above documentation, one (1) licensed copy of software that will allow for the display of OTDR traces provided. The software shall run on a Microsoft Windows-based personal computer.

D. Record Drawings:

1. The drawings are to include cable routes and outlet locations. Outlet locations shall be identified by their sequential number as defined elsewhere in this document. Numbering, icons, and drawing conventions used shall be consistent throughout all documentation provided.

3. PART EXECUTION

NOT APPLICABLE

END OF SECTION

SECTION 27 17 20

SUPPORT AND WARRANTY

1. PART GENERAL

1.1 SECTION INCLUDES

- A. This section describes support and warranty requirements relating to the structured cabling system and related subsystems.

1.2 RELATED WORK

- A. Section 27 05 00 – Basic Technology Systems Requirements.

1.3 QUALITY ASSURANCE

- A. Refer to Section 27 05 00 for relevant standards.

2. PART PRODUCTS

2.1 MANUFACTURER REQUIREMENTS

- A. The Basis of Design for all structured cabling components is listed in the individual Division 27 sections. Alternative acceptable manufacturers will be accepted for this project.

- 1. Exceptions:

- a. CAT 3 copper (≥25-pair).
 - b. Optical fiber.

- B. Additional acceptable manufacturers for horizontal cabling:

- 1. Systimax
 - 2. Hubbell/Mohawk
 - 3. Siemon
 - 4. Belden

2.2 WARRANTY

- A. A One (1) year Product Installation Warranty shall be provided for the structured cabling system as described in the contract documents.
- B. The Product Installation Warranty shall cover the replacement or repair of the defective product(s) and labor for the replacement or repair of such defective product(s).

3. PART EXECUTION

NOT APPLICABLE

END OF SECTION

SECTION 27 41 00

PROFESSIONAL AUDIO/VIDEO SYSTEM

1. PART GENERAL

1.1 SECTION INCLUDES

- A. System Components
- B. Audio-Video Connectors and cabling
- C. Transmission Connectors and cabling
- D. Control Cabling
- E. Horizontal Copper and Fiber Cabling and Connectors
- F. Submittal requirements
- G. Coordination requirements

1.2 RELATED WORK

- A. Section 26 05 33 - Conduit
- B. Section 26 05 13 - Wire and Cable
- C. Section 27 05 00 - Basic Communications Requirements
- D. Section 27 05 26 - Communications Bonding
- E. Division 7 - Through Penetration Firestopping
- F. Section 27 11 00 - Communication Equipment Rooms
- G. Section 27 05 28 - Interior Communications Pathway
- H. Section 27 15 00 - Horizontal Cabling Requirements

1.3 QUALITY ASSURANCE

- A. Manufacturer: The manufacturer of equipment shall have a complete service organization for all products in the manufacturer's line.
- B. Integrator/Dealer: The Contractor must be a factory-authorized and certified integrator/dealer specializing in the selected manufacturer's products, with demonstrated prior experience with the selected manufacturer's system installation and programming.
- C. The following qualifications have been endorsed by the AudioVisual and Integrated Experience Association (AVIXA) which is formerly known as InfoComm International.
 - 1. The Contractor shall have a Certified Technology Specialist (CTS) on staff and supervising the project. This service shall not be subcontracted.
 - 2. The Contractor shall have a Certified Technology Specialist with a specialized Installation endorsement (CTS-I) on staff and supervising the project. This service shall not be subcontracted.
- D. The Contractor(s) shall provide a résumé of prior experience in similar types and scales of projects, and other projects that may have been completed with the client. The résumé shall include the project name, square footage, budget, system descriptions, and references with email addresses and phone numbers.
- E. Control System Dealer: The media control system shall be provided, terminated, installed, and programmed by a factory-authorized and certified dealer and integrator in good standing with the manufacturer. The dealer shall have direct purchasing and support authority. These services shall not be subcontracted.

- F. Control System Programmer: The media control system shall be programmed by a factory-trained and certified programmer.
 - 1. Should the installer of the system not employ a factory-trained and certified programmer, a representative from the equipment manufacturer or certified independent programmer shall be retained for programming services. The Contractor shall be responsible for payment of his/her services until the job is complete and signed off.
- G. Audio System Programmer: All digital sound processing equipment (DSP) used on the project shall be setup, programmed and calibrated by a factory-trained and certified technician.
- H. Video System Programmer: All video distribution and processing used on the project shall be setup, programmed and calibrated by a factory-trained and certified technician.
- I. The Contractor shall have acquired and maintained all certifications for a minimum of one (1) one month prior to the posted bid date of this project.
- J. Servicing Contractor: The installer must be factory certified to provide service on the installed manufacturer's equipment and must have local service representatives within a 100 mile radius of the project site.

1.4 REFERENCES

- A. ADA - Americans with Disabilities Act
- B. ADAAG - Americans with Disability Accessibility Guidelines
- C. ANSI - American National Standards Institute
- D. AVIXA – Audiovisual and Integrated Experience Association (Formerly InfoComm)
- E. ANSI/InfoComm A102.01:2017 - Audio Coverage Uniformity
- F. ANSI/InfoComm 2M-2010 - Standard Guide for Audiovisual Systems Design and Coordination Processes
- G. ANSI/InfoComm F501.01:2015 – Cable Labeling for Audiovisual Systems
- H. ANSI/InfoComm 10:2013 – Audiovisual Systems Performance Verification
- I. ANSI/InfoComm 3M-2011 – Projected Image System Contrast Ratio
- J. IBC - International Building Code
- K. IEC - International Electrotechnical Commission
- L. NFPA 70 - National Electrical Code (NEC)
- M. UL 813 - Commercial Audio Equipment
- N. UL 1419 – Professional Video and Audio Equipment
- O. UL 1480 - Speakers for Fire Alarm, Emergency, and Commercial and Professional Use
- P. UL 1492 – Audio/Video Products and Accessories

1.5 SUBMITTALS

- A. Submit shop drawings and product data under provisions of Section 27 05 00.
- B. Initial Submittals: To be submitted after the project is awarded but before equipment is purchased and installed.
 - 1. Contractor(s) résumé of qualifications.
 - 2. Product Data Submittal: Provide manufacturer's technical product specification sheet for each individual component type. Submitted data shall show the following:
 - a. Compliance with each requirement of these documents.
 - b. All component options and accessories specific to this project.
 - c. Electrical power consumption rating and voltage.
 - d. Wiring requirements.
 - e. Pre-terminated cable distances and requirements identified by each room where required.

3. Manufacturer Certifications:
 - a. All certifications shall be current and valid. Any certificate with expired dates will not be accepted.
 - b. Control system authorized dealer certification and dealer #.
 - c. Control system certified programmer certification(s).
 - d. Audio system DSP dealer certification and dealer #.
 - e. Audio system DSP programmer certification.
 - f. Professional audio components dealer certification(s) and dealer #.
 - g. Video system dealer certification(s) and dealer #.
 - h. All other applicable dealer, installation and programming certifications.
 4. If an alternate manufacturer(s) is submitted, the equivalent certifications to the basis of design manufacturer(s) shall be required and submitted.
 5. Audio and video testing and calibration equipment and software.
 6. All applicable Audiovisual and Integrated Experience Association (AVIXA) certifications. Qualifications from InfoComm that have not expired will be accepted.
 7. Available wireless microphone frequencies within a 50 mile range based on the submitted system(s) and coordinated with the quantity of channels.
 8. Alternate System Drawings: If an approved alternate manufacturer is submitted, the Contractor shall provide project-specific system CAD drawings as follows:
 - a. Provide a system block diagram noting system components and interconnection between components. The interconnection of components shall clearly indicate all wiring required in the system. When multiple pieces of equipment are required in the exact same configuration (e.g., multiple identical controllers), the diagram may show one device and refer to the others as "typical" of the device shown.
- C. Later Submittals: To be submitted after all initial submittals have been approved but before equipment is installed, configured, and programmed.
1. System Drawings: Project-specific system CAD drawings shall be provided as follows:
 - a. Provide a system block diagram noting system components and interconnection between components. The interconnection of components shall clearly indicate all wiring required in the system. When multiple pieces of equipment are required in the exact same configuration (e.g., multiple identical controllers), the diagram may show one device and refer to the others as "typical" of the device shown.
 - b. Submittals shall contain shop drawings indicating physical plan locations and placement of installed devices and accessories with associated scope or field conditions for review and coordination. Provide mounting details, suspensions, and rough-in notes with trade demarcations.
 - 1) Identify any non-standard back boxes or mounting assembly required by product or specifications and elaborate contractor means and methods for mounting.
 - 2) Provide rack drawing(s) showing the mounting of equipment in each rack or cabinet on the project.
 - c. Submit wiring and cable path requirements, including field wiring, path verification, signal separation and outside diameter of cables for conduit sizing and verification that can be used for field installation and electrical coordination

- d. Reproduction of contract documents is not acceptable for submittals. Wire CAD type drawings and cable tag lists or schedules, or typical manufacturer's abbreviated single lines alone are not complete
- D. The Contractor **shall** submit graphic or emulated representations of the control system touch panels for each unique space and layout prior to purchase, installation and programming for review and comment by the Architect/Engineer and Owner. These shall show and describe the intended programming/macro control features and functions of each button/icon for all pages.
- E. The Contractor shall submit graphic or emulated representations of the control system keypads for each unique space and layout prior to purchase, installation and programming for review and comment by the Architect/Engineer and Owner. These shall show and describe the intended programming/macro control features and functions of each button/knob.
- F. The Contractor shall submit the actual DSP audio processor files prior to purchase, installation, and programming for review and comment by the Architect/Engineer and Owner.
- G. The Contractor shall submit the actual DSP audio processor control software files prior to programming and project completion for review and comment by the Architect/Engineer and Owner.
- H. The Contractor shall submit the number of IP addresses, VLANS, and subnetworks that will be required from the Owner's Information Systems Department.
- I. Submit meeting agenda for planning/programming meetings as required in Part 3 of this specification.
- J. Provide system checkout and commissioning procedure to be performed at acceptance.
 - 1. The A/E provides electro-acoustic and technical testing including punch list on behalf of the owner for final performance verification and optimization of the systems. The AVC shall include a site test allowance in his bid, for A/E Commissioning and testing services.
 - 2. AVC shall provide two (2) week written advance notice to the Prime Contractor for the A/E and schedule a minimum of one "Quiet Day" on the CM project schedule chart for A/E electro-acoustic testing, when project nears substantial completion and loudspeakers are properly aimed.
 - 3. A "quiet day" means general contractor activity may proceed in certain areas, but A/E shall retain the ability to call off any noise or intrusive construction activity in the main seat area for noise control measurements and main loudspeaker testing as required.
 - 4. A test report and pre-commissioning check list shall be filed by A.V.C. prior to scheduling A/E performance verification.
- K. Submit detailed description of Owner training to be conducted at project end, including specific training times.
- L. Provide rack drawing(s) showing the mounting of equipment in each rack or cabinet on the project.
- M. Submit the engineered and coordinated rigging solution(s) for the following items:
 - 1. Surface-mounted and/or flown loudspeakers.
 - 2. Submit engineered PE stamped rated rigging solution(s) for performance loudspeakers, including but not limited to the following items:
 - a. Provide PE stamped shop drawings that detail suspension means and methods including rated loudspeaker rigging components, attachments, supplemental spans and independent safety cables. Note load for each location.
 - 1) Provide detail mounting at lighting poles and coordinate cable pathway through poles.

- b. Clearly note and confirm the XYZ “reference” point being used on floor plans (“0” point) for determining proper aim, horn rotation, location, heights and clearance of main speakers. Refer to Loudspeaker Aim Schedule and confirm XYZ location and aim angle for each loudspeaker device. Verify clear sightline from speaker to aim point. Notify A/E of any anticipated conflicts.
- N. If an alternate loudspeaker design is going to be utilized, the Contractor shall submit the following sets of calculations:
 - 1. EASE Calculations:
 - a. All calculations shall be completed at a minimum patch size resolution of 1.00ft at 1/3 octave, 35ms split time, and shown with Summed Interference and Map with Shadow turned on. The calculations shall be submitted electronically as EASE OpenGL (*.egl) files. The Contractor shall also provide a copy of the latest version of the EASE GLL viewer to view the electronic EASE files.
 - b. Provide coverage maps (print or pdf) for each main loudspeaker and combine composite of all main loudspeakers as Direct SPL at 500 Hz, 1000 Hz, 2000 Hz, 4000 Hz, 8000 Hz, and three octave mid-band sum centered at 2000 Hz.
 - c. Articulation Loss of Consonants (ALCons).
 - d. Calculated Speech Transmissible Index (STI) using the Modulation Transfer Index (MTI) with noise levels.
 - e. The Contractor shall use the latest version of EASE.
 - f. The Contractor shall refer to the architectural drawings and specifications for room geometry, room dimensions and surface finishes.
 - g. The Contractor shall use a listener sitting height of four (4) feet for rooms where the primary function will be sitting. The Contractor shall utilize a listener standing height of five feet three inches (5.25') for rooms where the primary function will be standing.
 - h. The Contractor shall use a standard indoor temperature of 68°F, 60% humidity and a standard pressure of 29.8 Hg, unless more specific data is available.
 - i. The Contractor shall submit packed electronic EASE files or an EASE generated list of materials and room data for review and approval by the Architect/Engineer.
- O. Quality Assurance:
 - 1. Provide system checkout and commissioning procedure to be performed at acceptance.
- P. Discontinued Products and New Model Releases:
 - 1. For each product, the Contractor shall submit (in addition to the specified product) a product cut sheet if the specified product has been replaced, improved upon, phased out or otherwise upgraded at the time of shop drawing submittal.
 - a. The intent of this requirement is for the Contractor to submit only direct replacements for the specified products. A direct replacement shall be defined as a product of newer release that has equal or greater capabilities, which is available for not more than a 10% premium over the specified product's bid unit cost.
 - b. It is not the intent of this requirement for the Contractor to submit new products or other product options that significantly differ in capability and/or cost from the specified product.

Q. Coordination Drawings:

1. Include all ceiling-mounted devices in composite electronic coordination files. Refer to Section 27 05 00 for coordination drawing requirements.
2. Provide speaker mounting details and coordinate with lighting pole supplier for speaker mounting and cabling requirements at football field light poles.

1.6 SYSTEM DESCRIPTION

- A. This specification section describes the furnishing, installation, commissioning and programming of audio/video components and systems.
- B. Performance Statement: This specification section and the accompanying Contract Documents are performance based, describing the minimum material quality, required features, and operational requirements of the system. These documents do not convey every wire that must be installed, every equipment connection that must be made and every feature and function that must be programmed and configured. Based on the equipment constraints described and the performance required of the system, as presented in these documents, the Vendor and the Contractor are solely responsible for determining all wiring, programming and miscellaneous equipment required for a complete and operational system.
- C. This document describes the major components of the system. All additional hardware, subassemblies, supporting equipment and other miscellaneous equipment required for proper system installation and operation shall be provided by the Contractor.
- D. This document describes the major programming features and functions of the system. All additional programming, configuration and integration required for proper system installation and operation shall be provided by the Contractor.
- E. When a specific manufacturer is not provided in this document for minor pieces of equipment, the Contractor shall provide only those materials considered to be of the same industry commercial and professional quality level as the major equipment manufacturers.
 1. Classroom systems: Displays shall be located at the front a back of the classrooms that will display the same source. Sources will include: HDMI wall plate input and Chrome cast wireless dongle. Ceiling speakers provide audio from the sources and the IR wireless mic. Audio ouput is available for a portable assisted listening system.
 2. Lab Classroom systems: Displays shall be located at the front of the classrooms. Sources will include: HDMI wall plate input and Chrome cast wireless dongle. Ceiling speakers provide audio from the sources and the IR wireless mic. Audio ouput is available for a portable assisted listening system.
 3. High School Football stadium outdoor includes integrated audio video system with large format loudspeaker arrays provide speech and media playback to home and visitor side of field. Audio input connectivity from field box and press box control booth, with portable sports announce desktop audio rack. Desktop rack include wireless microphones, input for push-to-talk announce microphone and consumer media playback inputs. Headend rack is located in telecommunication room.

1.7 PROJECT RECORD DOCUMENTS

- A. Submit documents under the provisions of Section 27 05 00.
- B. Provide all applicable certifications.
- C. Provide final system block diagram showing any deviations from shop drawing submittal.
- D. Provide statement that system checkout test, as outlined in the shop drawing submittal, is complete and satisfactory.

- E. Provide schedules documenting all terminal block wiring, including cable numbers.
- F. Warranty: Submit written warranty and complete all Owner registration forms.
- G. Complete all operation and maintenance manuals as described below.

1.8 OPERATION AND MAINTENANCE DATA

- A. Submit documents under the provisions of Section 27 05 00.
- B. Manuals: Final copies of the manuals shall be delivered after completing the installation. Each manual's contents shall be identified on the cover. The manual shall include names, addresses, and telephone numbers of the Contractor responsible for the installation and maintenance of the system and the factory representatives for each item of equipment for each system. The manuals shall have a table of contents and labeled sections. The final copies delivered after completion of the installation shall include all modifications made during installation, checkout, and acceptance. Manuals shall be submitted in electronic format. The manuals shall consist of the following:
 - 1. Functional Design Manual: The functional design manual shall identify the operational requirements for the system and explain the theory of operation, design philosophy, and specific functions. A description of hardware and software functions, interfaces, and requirements shall be included.
 - 2. Hardware Manual: The manual shall describe all equipment furnished including:
 - a. General description and specifications.
 - b. Installation and checkout procedures.
 - c. Equipment layout and electrical schematics to the component level.
 - d. System layout drawings and schematics.
 - e. Alignment and calibration procedures.
 - f. Manufacturers repair parts list indicating sources of supply.
 - 3. Software Manual: The software manual shall describe the functions of all software and shall include all other information necessary to enable proper loading, testing, and operation. The manual shall include:
 - a. Definition of terms and functions.
 - b. System use and application software.
 - c. Initializations, startup, and shutdown.
 - d. Reports generation.
 - e. Details on forms customization and field parameters.
 - 4. Operator's Manual: The operator's manual shall fully explain all procedures and instructions for the operation of the system including:
 - a. Computers and peripherals.
 - b. System startup and shutdown procedures.
 - c. Use of system, command, and applications software.
 - d. Recovery and restart procedures.
 - e. Use of report generator and generation of reports.
 - f. Data entry.
 - g. Operator commands.
 - h. Alarm messages and reprinting formats.
 - i. System permissions functions and requirements.
 - 5. Maintenance Manual: The maintenance manual shall include descriptions of maintenance for all equipment including inspection, periodic preventive maintenance, fault diagnosis, and repair or replacement of defective components.
- C. Audio Calibration Data: Provide documentation on all EQ settings, crossover points, limiter settings, gate settings and all other applicable settings.

- D. Extron DTP cable bandwidth and distance information readouts for each connection.

1.9 INTELLECTUAL PROPERTY OWNERSHIP:

- A. All supporting documentation, programming, uncompiled source code, graphic files, DSP code and diagrams, written and electronic files, including all latest versions of the documentation and software necessary to edit and adapt the system(s), shall be provided to the Owner for all spaces and all systems. The integrator and/or programmer shall also maintain a current copy to be provided at the Owner's request.
 - 1. The owner shall have the right to modify the intellectual property directly, or to have the intellectual property modified by any party of the Owner's choosing.

1.10 WARRANTY

- A. Unless otherwise noted, provide warranty for one (1) year after Date of Substantial Completion for all materials and labor.
- B. Onsite Work During Warranty Period: This work shall be included in the Contractor's bid and performed during regular working hours, Monday through Friday.
 - 1. Inspections: The Contractor shall perform two (2) two minor inspections at even intervals (or more often if required by the manufacturer), and two (2) two major inspections offset equally between the minor inspections.
 - 2. Minor Inspections: These inspections shall include:
 - a. Visual checks and operational tests of all equipment, field hardware, and electrical and mechanical controls.
 - b. Mechanical adjustments if required on any mechanical or electromechanical devices.
 - 3. Major Inspections: These inspections shall include all work described under paragraph Minor Inspections and the following work:
 - a. Clean all equipment, including filters, interior and exterior surfaces.
 - b. Perform diagnostics on all equipment.
 - c. Check, test, and calibrate (if required) any sensors or other equipment that contain settings.
 - d. Check zoom and focus of all projectors.
 - e. Run all system software diagnostics and correct all diagnosed problems.
- C. Operation: Upon the performance of any scheduled adjustments or repairs, Contractor shall verify operation of the systems.
- D. Emergency Service: The Owner will initiate service calls when the systems are not functioning properly. Qualified personnel shall be available to provide service within the distance defined within this specification section. The Owner shall be furnished with telephone number(s) where service personnel can be reached 24/7/365. Service personnel shall be at site within 24 hours after receiving a request for service.
- E. Records and Logs: The Contractor shall keep records and logs of each task completed under warranty. The log shall contain all initial settings at substantial completion. Complete logs shall be kept and shall be available for review on site, demonstrating that planned and systematic adjustments and repairs have been accomplished for the systems.

- F. Work Requests: The Contractor shall separately record each service call request on a service request form. The form shall include the model and serial number identifying the component involved, its location, date and time the call was received, specific nature of trouble, names of service personnel assigned to the task, instructions describing what must be done, the amount and nature of the materials used, the time and date work started, and the time and date of completion. The Contractor shall deliver a record of the work performed within five (5) business days after work is accomplished.
- G. System Modifications: The Contractor shall make any recommendations for system modification in writing to the Owner. No system modifications shall be made without prior approval of the Owner. Any modifications made to the system shall be incorporated into the operations and maintenance manuals, and other documentation affected. To the fullest extent possible, the Owner shall be provided with electronic restorable versions of all configurations prior to the modifications being made.
- H. Software: The Contractor shall provide all software and firmware updates during the period of the warranty and verify operation of the system upon installation. These updates shall be accomplished in a timely manner, fully coordinated with system operators, shall include training for the new changes/features, and shall be incorporated into the operations and maintenance manuals, and software documentation.
- I. Refer to the individual product sections for further warranty requirements of individual system components.

2. PART PRODUCTS

2.1 SYSTEM COMPONENTS

- A. Refer to the project drawings for basis of design system components. Equivalent products shall meet or exceed all requirements defined on the project drawings. The following product information represents the minimum additional requirements for equivalent products:
- B. Media Players:
 - 1. All media players, including Blu-ray players that are capable of outputting protected content including HDCP and DPCP, shall have a minimum of 16 keys available.
- C. Audio/Video Control Systems:
 - 1. Contractor shall furnish a programmable software-based audio/video control system. The system shall be field configurable and programmable by the factory and/or a factory-trained programmer.
 - 2. The control system shall be TCP/IP based allowing direct connection of the system processors to a 10/100BaseT compatible Ethernet network.
 - 3. Refer to project drawings for required central processors, touch panels, keypads and additional information.
- D. Microphone Systems:
 - 1. Wireless Microphones:
 - a. Wireless microphones shall not operate in the 698 to 806 MHz band (channels 52 to 69).
 - b. Features:
 - 1) Dual antenna reception with true diversity reception.

- c. Microphone systems that are common (shared) by multiple spaces or when the receivers are in a remote area shall include a compatible wireless antenna distribution system by the same manufacturer as the wireless microphone system.

E. Audio Amplifiers:

1. Power Amplifier(s), 25, 70.7 and 100 Volt:
 - a. Power: The following calculation shall be used to determine the minimum required output of the amplifier(s):
 - 1) Calculate the total power tap value of each transformer with insertion loss using the following equation:
 - a) $\text{Tap wattage} \times 10^{(x\text{dB}/10)}$ where x = the rated insertion loss at 1,000Hz.
 - 2) Calculate the total wattage loss based on cable distance, cable gauge and cable resistance.
 - 3) Add together all the speaker taps' total power values that will be on a single channel of the amplifier. Multiply that total by 1.2 which will allow for a 20% future expansion. Multiply that number by 1.25 to ensure the amplifier never exceeds 75% of its total output. Utilize the final number to determine the minimum amplifier power requirements.

F. Assisted Listening Systems (ALS):

1. All spaces with amplified audible communications require an ALS. The Contractor shall refer to the ADA and ADAAG guidelines, as well as IBC Section 1108.2.7 for ALS rules, regulations and guidelines. Refer to the table below for the required number of receivers to be provided for each space (*Source: IBC, Table 1108.2.7.1*). Alternatively, if the building is managed by a single entity and all systems are fully compatible and interoperable, the total number of seats for all areas can be used in accordance with the table below.

Capacity of Seating in Assemble Areas	Minimum Required Number of Receivers	Minimum Number of Receivers to be Hearing-aid (T-coil) Compatible
50 or less	2	2
51 to 200	2, plus 1 per 25 seats over 50 seats	2
201 to 500	2, plus 1 per 25 seats over 50 seats	1 per 4 receivers
501 to 1,000	20, plus 1 per 33 seats over 500 seats	1 per 4 receivers
1,101 to 2,000	35, plus 1 per 50 seats over 1,000 seats	1 per 4 receivers
Over 2,000	55, plus 1 per 100 seats over 2,000 seats	1 per 4 receivers

2. Receivers required to be hearing-aid compatible shall interface with telecoils in hearing aids through the provision of neckloops and shall be over-the-ear type headphones. Earbuds are not acceptable for this use.
3. Receivers shall include a 1/8" (3.2mm) standard mono output jack.
4. Refer to the Access Board Research "Large Area Assistive Listening Systems: Review and Recommendations" ALS report for additional recommendations.

G. Power Conditioning and Surge Protective Devices:

1. All equipment shall be plugged in through a power conditioning surge arrestor.
2. Provide a minimum of 50 dB noise attenuation.

3. Provide a minimum of 1,000 joules of surge protection.
 4. UL 1449 – Standard for Safety for Surge Protective Devices listed to 330 volt clamping voltage.
 5. Provide automatic voltage regulation from 97 VAC to 137 VAC at a minimum to maintain a stable 120 VAC where specified.
 6. Power sequencers shall be equipped with contact closures, bi-directional RS-232 or Ethernet control for remote turn on and off.
 7. Refer to the project drawings for additional information.
- H. Digital Video Signal Equalizers and Regenerators:
1. For any cable run that exceeds the manufacturer-recommended distances or fails to transmit video or audio due to cable length, the Contractor shall provide and install a signal equalizer at the far end (sink) with the following minimum features:
 - a. HDMI/DVI equalizers shall be HDCP compliant and support actively buffered DDC transmission.
 - b. Display port equalizers shall be HDCP and DPCP compliant, support actively buffered DDC transmission, and be DP++ compatible.
 - c. Provide automatic equalization.
 - d. Pass all embedded audio and metadata.
 - e. Have an auxiliary power input when adequate power is not available on the cable.
 - f. Provide output reclocking and jitter reduction for multi-rate SDI signals.
 2. For any cable run that fails to transmit video or audio due to a weak source signal, the Contractor shall provide and install a signal regenerator at the near end (source) with the following minimum features:
 - a. HDMI/DVI regenerators shall be HDCP compliant and support actively buffered DDC.
 - b. Display port regenerators shall be HDCP and DPCP compliant, support DDC transmission, and be DP++ compatible.
 - c. Provide automatic output reclocking and jitter reduction.
 - d. Pass all embedded audio and metadata.
 - e. Have an auxiliary power input when adequate power is not available on the cable.
- I. Extended Display Identification Data (EDID) Emulators:
1. If any source or Owner-furnished equipment (OFE) is not outputting video properly, the Contractor shall provide and install an EDID Emulator and set it to the highest common EDID table of the displays (sinks) being outputted to, with the following minimum features:
 - a. EDID capture mode from a display.
 - b. Have an auxiliary power input when adequate power is not available on the cable.

- J. Audio Unbalanced to Balanced Converters, Balanced to Unbalanced Converters, Combiners, Dividers, Isolation Transformers, and Line Drivers Minimum Requirements:
1. Unbalanced to Balanced Active Converter:
 - a. Provide signal isolation from the audio signals of differing channels.
 - b. Provide output trim gain and set to optimal output level while preventing over amplification and clipping of the signal.
 - c. Minimum frequency response of 20 Hz to 20 kHz ($\pm 0.5\text{dB}$).
 - d. Provide with appropriate power supply and mounting kit for rack or wall use.
 - e. Provide appropriate converter for mono to mono, mono to stereo, stereo to stereo, or stereo to mono to match the input of the equipment to which it is being connected.
 2. Balanced to Unbalanced Passive Converter:
 - a. Provide transformer isolation from the input to output.
 - b. Provide output trim attenuation and set to optimal output level while preventing over-amplification and clipping of the signal.
 - c. Minimum frequency response of 20 Hz to 20 kHz ($\pm 0.5\text{dB}$).
 - d. Provide with appropriate mounting kit for rack or wall use.
 - e. Provide appropriate converter for mono to mono, mono to stereo, stereo to stereo, or stereo to mono to match the input of the equipment to which it is being connected.
 3. Stereo to Mono and Mono to Stereo Passive Combiner/Divider:
 - a. Passive resistive network.
 - b. Provide RF filtering.
 - c. Provide a minimum of 3dB of isolation between channels.
 - d. Provide no greater than 3dB of Insertion Loss.
 - e. Minimum frequency response of 20 Hz to 20 kHz ($\pm 3\text{dB}$).
 - f. Provide with appropriate mounting kit for rack or wall use.
 - g. Provide appropriate passive combiner for low impedance or high impedance and balanced or unbalanced signals to maintain the original signal type.
 4. Passive Isolation Transformer:
 - a. Provide Galvanic Isolation.
 - b. Minimum frequency response of 20 Hz to 20 kHz ($\pm 3\text{dB}$).
 - c. Isolate the input shield from the output shield. Input shield is electrically isolated from the transformer chassis and provides a ground return. The output shield is connected to the transformer chassis.
 - d. Provide with appropriate mounting kit for rack or wall use.

- e. Provide appropriate isolation transformer for low impedance or high impedance, stereo or mono signals, and balanced or unbalanced signals to maintain the original signal type.

5. Active Signal Line Driver:

- a. Provide balanced or unbalanced inputs with balanced outputs.
- b. Provide input trim gain for a minimum of unity gain from -14dBu to +24dBu, set to optimal output level while preventing over-amplification and clipping of the signal.
- c. Provide a minimum balanced output of +4dBu nominal for a minimum output gain of +25dBu.
- d. Minimum frequency response of 20 Hz to 20 kHz ($\pm 0.5\text{dB}$).
- e. Provide with appropriate power supply and mounting kit for rack or wall use.
- f. Provide appropriate line driver for low impedance or high impedance and stereo or mono signals.

2.2 AUDIO CONNECTORS

A. Phono Jack:

- 1. Panel Mount: Professional grade, three conductor, stereo, 0.375" hole diameter mounting, self-locking, double-open circuit. Switchcraft, Neutrik or approved equal.
- 2. Cable Mount: Professional grade, three conductor, stereo, all-metal construction, integral cable clamp, nickel body, cable strain relief. Switchcraft, Neutrik or approved equal.

B. Phono Plug:

- 1. Professional grade, 1/4" stereo phone plug, strain relief, internal cable clamp, all metal body, tin-plated solder terminals. Switchcraft, Neutrik, Mogami or approved equal.

C. XLR Jack:

- 1. Panel Mount: Professional grade, crimped insert for vibration control, nickel shell, silver pins, pin quantity as required for application. Switchcraft, Neutrik or approved equal.

D. XLR Plug:

- 1. Professional grade, 360° strain relief, nickel shell, silver pins. Provide colored boot. Switchcraft, Neutrik, Mogami or approved equal.

E. Loudspeaker Connector:

- 1. Panel Mount: Twist-lock type, 4-conductor. Neutrik Speakon or approved equal.

2.3 AUDIO CABLING

- A. Provide with plenum-rated jacket where used in a plenum space without conduit. Refer to Section 27 05 00 for plenum or non-plenum cable rating requirements.

B. Microphone Level Audio Cabling:

- 1. For patch cables less than or equal to 25 feet:
 - a. 24 AWG 2-conductor, twisted, stranded (19x36) tinned bare copper.

- b. Single Layer Shield:
 - 1) Shield: 100% aluminum foil shield.
 - c. Nominal Capacitance: 30.0 pF/Ft.
 - 1) Belden
 - 2) West Penn
 - 3) Liberty
 - 2. For cable runs greater than or equal to 25 feet:
 - a. 22 AWG 2-conductor, twisted, stranded (16x34) tinned bare copper.
 - b. Dual Layer Shield:
 - 1) Shield: 85% total tinned copper braid shield.
 - c. Nominal Capacitance: 18.0 pF/Ft.
 - d. Acceptable Manufacturers:
 - 1) Belden
 - 2) West Penn
 - 3) Liberty
- C. Line Level Audio Cabling:
 - 1. For patch cables less than or equal to 25 feet:
 - a. 22 AWG 2-conductor, twisted, stranded (7x30) tinned bare copper.
 - b. Single Layer Shield:
 - 1) Shield: 100% aluminum foil shield.
 - c. Nominal Capacitance for non-plenum cable: 24.0pF/Ft.
 - d. Nominal Capacitance for plenum cable: 35.0 pF/Ft
 - e. Acceptable Manufacturers:
 - 1) Belden
 - 2) West Penn
 - 3) Liberty
 - 2. For cable runs greater than or equal to 25 feet:
 - a. 18 AWG 2-conductor, twisted, stranded (16x30) tinned bare copper.
 - b. Single Layer Shield:
 - 1) Shield: 100% aluminum foil shield.
 - c. Nominal Capacitance for non-plenum cable: 30.0 pF/Ft

d. Nominal Capacitance for plenum cable: 51.0 pF/Ft.

e. Acceptable Manufacturers:

- 1) Belden
- 2) West Penn
- 3) Liberty

D. Constant Voltage Speaker Cabling:

1. Class 2, stranded, twisted, shielded 2-conductor, 16-gauge wire for all 25/70.7/100-volt applications unless noted otherwise.
2. All shielded cables drain wire SHALL be grounded and continuous throughout the entire length of the system. The shield shall be grounded to the building ground system at the amplifier end of the cable only.
3. The Contractor shall size cabling as required for distance power and shall provide larger gauge cable as required.
4. As manufactured by Belden 5200FE (non-plenum) or Belden 6200FE (plenum), Liberty, Gepco, or approved equal.

E. High Performance Constant Voltage Speaker Cabling:

1. Class 2, stranded, twisted, shielded 2-conductor, 12-gauge wire for all 25/70.7/100-volt high wattage (50-watts per speaker or greater) applications unless noted otherwise.
2. All shielded cables drain wire SHALL be grounded and continuous throughout the entire length of the system. The shield shall be grounded to the building ground system at the amplifier end of the cable only.
3. The Contractor shall size cabling as required for distance power and shall provide larger gauge cable as required.
4. As manufactured by Belden 5000FE (non-plenum) or Belden 6000FE (plenum), Liberty, Gepco, or approved equal.

F. Low Capacitance Speaker/Subwoofer Cabling:

1. Class 2, high strand count (65x34), oxygen free copper, low capacitance (19.9 pF/Ft), twisted, 2-conductor, 16-gauge wire for all 2/4/8/16 ohm low impedance applications where amplifier output is 150 watts or less and/or the distance is less than 50', unless noted otherwise.
2. The Contractor shall size cabling as required for distance power and shall provide larger gauge cable as required.
3. Cable shall be installed in conduit within plenum areas.
4. As manufactured by Belden 1307A, Liberty, Gepco, or approved equal.

G. High Performance Low Capacitance Speaker/Subwoofer Cabling:

1. Class 2, high strand count (259x34), oxygen free copper, low capacitance (23.2 pF/Ft), twisted, 2-conductor, 10-gauge wire for all 4/8-ohm low impedance applications where amplifier output is 150 watts or greater and/or the distance is greater than 50', unless noted otherwise.
2. The Contractor shall size cabling as required for distance power and shall provide larger gauge cable as required.

3. Cable shall be installed in conduit within plenum areas.
4. As manufactured by Belden 1313A, Liberty, Gepco, or approved equal.

2.4 VIDEO CONNECTORS

A. RF Video F-Connector:

1. 75 ohm, broadcast quality, two-piece compression type. Return Loss: < -36 dB to 1 GHz, -25 dB to 2 GHz, -23 dB to 3 GHz. Twist-on and crimp connectors are not acceptable. Corning Gilbert, King, Amphenol or approved equal.

B. BNC Bulkhead:

1. Chassis Mount: 1/2" D jack, 75 ohm, feed-through jack-to-jack type.
2. Recessed: 1/2" D jack, 75 ohm, nickel face, feed-through jack-to-jack type.

C. BNC Connector:

1. 75 ohm, broadcast quality, two-piece compression type. Return Loss: < -36 dB to 1 GHz, -25 dB to 2 GHz, -23 dB to 3 GHz. Twist-on and crimp connectors are not acceptable. Corning Gilbert, King, Amphenol or approved equal.

D. VGA Assembly:

1. 75 ohm, metal shell, connections for coaxial RGBHV cables.

E. RJ-45 Un-shielded Connector:

1. 100 ohm, un-shielded, Category 5e rated, 8-pin, 8-conductor crimp type with strain relief boot. Match manufacturer or manufacturer partner of approved UTP cabling.

F. RJ-45 Un-shielded Jack:

1. 100 ohm, un-shielded, Category 5e rated, 8-pin, 8-conductor punch-down type. Provide with appropriate faceplate; coordinate color with Electrical Contractor. Match manufacturer or manufacturer partner of approved UTP cabling.

G. RJ-45 Shielded Connector:

1. 100 ohm, shielded, Category 6 or 6A rated, 8-pin, 8-conductor shielded crimp type with strain relief boot. Match manufacturer or manufacturer partner of approved ScTP or FTP cabling.

H. RJ-45 Shielded Jack:

1. 100 ohm, shielded, Category 6 or 6A rated, 8-pin, 8-conductor shielded punch-down type. Provide with appropriate faceplate; coordinate color with Electrical Contractor. Match manufacturer or manufacturer partner of approved ScTP or FTP cabling.

2.5 DIGITAL VIDEO CABLING

A. Provide with plenum-rated jacket where used in a plenum space without conduit.

B. High Definition Multi-Media Interface (HDMI) "High Speed" Cable:

1. For any cable run that exceeds the manufacturer-recommended distances or fails to transmit video or audio due to cable length, the Contractor shall provide and install an HDCP-compliant signal equalizer at the far end (sink).

2. For cable runs less than or equal to 25 feet:
 - a. Four (4) 28AWG solid bonded twisted pairs for clock and data, and seven (7) 28AWG solid conductors for control.
 - b. Two Layer Shield:
 - 1) Inner shield: non-bonded aluminum foil tape.
 - 2) Outer shield: 85% tinned copper braid shield.
 - c. Nominal attenuation of clock and data pairs (per 100 feet):
 - 1) at 100-MHz: 9.6 dB
 - 2) at 400-MHz: 19.3 dB
 - 3) at 825-MHz: 28.9 dB
 - 4) at 1200-MHz: 36.1 dB
 - d. Nominal capacitance between shielded pairs: 15.3 pF/ft nominal.
 - e. Nominal capacitance between control pairs: 16.5 pF/ft nominal.
 - f. Nominal return loss of shielded pairs: 15 dB, 1-1200 MHz.
 - g. Nominal shield DC resistance of individual shield: 24.4 ohms/1000 ft.
 - h. Nominal shield DC resistance of overall shield: 3.7 ohms/1000 ft.
 - i. The cable shall be HDMI 1.3a Category 1 certified to 25 feet, and HDMI 1.3a Category 2 certified to 15 feet.
 - j. Supports a maximum digital data rate of 10.2 Gbit/s.
 - k. Supports up to eight (8) channels of HD audio.
 - l. HDCP compliant.
 - m. Acceptable Manufacturers:
 - 1) Belden BJC Series-F2 as assembled by Blue Jeans Cable
 - 2) Atlona Technologies
 - 3) Extron
 - 4) Approved equal
3. For cable runs greater than 25 feet:
 - a. Four (4) 24AWG solid bonded twisted pairs for clock and data, and seven (7) 24AWG solid conductors for control.
 - b. Two Layer Shield:
 - 1) Inner shield: non-bonded aluminum foil tape.
 - 2) Outer shield: 82% tinned copper braid shield.
 - c. Nominal attenuation of clock and data pairs (per 100 feet):
 - 1) at 100-MHz: 6.0 dB
 - 2) at 400-MHz: 13.5 dB
 - 3) at 825-MHz: 19.8 dB
 - 4) at 1200-MHz: 24.1 dB
 - d. Nominal capacitance between shielded pairs: 15.3 pF/ft nominal.

- e. Nominal capacitance between control pairs: 16.5 pF/ft nominal.
- f. Nominal return loss of shielded pairs: 15 dB, 1-1200 MHz.
- g. Nominal shield DC resistance of individual shield: 15.0 ohms/1000 ft.
- h. Nominal shield DC resistance of overall shield: 1.75 ohms/1000 ft.
- i. The cable shall be HDMI 1.3a Category 1 certified to 45 feet, and HDMI 1.3a Category 2 certified to 25 feet.
- j. Supports a maximum digital data rate of 10.2 Gbit/s.
- k. Supports up to eight (8) channels of HD audio.
- l. HDCP compliant.
- m. Acceptable Manufacturers:
 - 1) Belden BJC Series-1 as assembled by Blue Jeans Cable
 - 2) Atlona Technologies
 - 3) Extron
 - 4) Approved equal

C. Extron DTP Shielded Twisted Pair:

- 1. For any cable run that exceeds the manufacturer-recommended distances, the Contractor shall provide and install an HDCP-compliant cable equalizing repeater.
- 2. Total cable distance shall not exceed 100M (328ft.).
- 3. 4-pair, 24 AWG S/FTP.
- 4. Aluminum shield (100% coverage) with tinned/copper braid (45% coverage).
- 5. Nominal Impedance = 100 ohms.
- 6. Acceptable Manufacturers:
 - a. XTP DTP 24(P) series

2.6 TRANSMISSION CONNECTORS

A. BNC Bulkhead:

- 1. Chassis Mount: 50 ohm, feed-through jack-to-jack type.
- 2. Recessed: 50 ohm, nickel face, feed-through jack-to-jack type.

B. BNC Connector:

- 1. 50 ohm, RF broadcast quality, two-piece compression or crimp type. Return Loss: < -36 dB to 1 GHz, -25 dB to 2 GHz, -23 dB to 3 GHz. Twist-on and connectors are not acceptable. Corning Gilbert, King, Amphenol or approved equal.

C. RJ-45 Shielded Connector:

- 1. 100 ohm, shielded, Category 6 rated, 8-pin, 8-conductor shielded crimp type with strain relief boot. Match manufacturer or manufacturer partner of approved UTP cabling.

D. RJ-45 Shielded Jack:

1. 100 ohm, shielded, Category 6 rated, 8-pin, 8-conductor shielded punch down type. Provide with appropriate faceplate; coordinate color with Electrical Contractor. Match manufacturer or manufacturer partner of approved UTP cabling.

2.7 TRANSMISSION CABLING

A. Provide with plenum-rated jacket where used in a plenum space without conduit.

B. For patch cables less than or equal to 25 feet:

1. RG-174, center conductor: 26 AWG stranded (7x34) copper-covered steel; 0.019" OD (nominal); polyethylene insulation.
2. Single Layer Shield:
 - a. Outer shield: 90% tinned copper braid shield.
3. Nominal Impedance: 50 ohms.
4. Nominal Capacitance: 30.8 pF/Ft.
5. Velocity of Propagation: 66%.
6. Maximum attenuation (per 100 feet):
 - a. at 1-MHz: 1.9 dB.
 - b. at 50-MHz: 5.8 dB.
 - c. at 400-MHz: 19.0 dB.
 - d. at 700-MHz: 27.0 dB.
 - e. at 1000-MHz: 34.0 dB.
7. Cable shall be installed in conduit within plenum areas.
8. Acceptable Manufacturers:
 - a. Belden 8216
 - b. CommScope
 - c. Liberty
 - d. Times Fiber

C. For horizontal cables less than or equal to 50 feet:

1. RG-58, center conductor: 20 AWG bare solid copper; 0.037" OD (nominal); polyethylene insulation for non-plenum and FEP Teflon dielectric for plenum.
2. Single Layer Shield:
 - a. Outer shield: 95% tinned copper braid shield.
3. Nominal Impedance: 50 ohms.
4. Nominal Capacitance for non-plenum cable: 28.5 pF/Ft
5. Nominal Capacitance for plenum cable: 26.4 pF/Ft.
6. Velocity of Propagation for non-plenum cable: 66%
7. Velocity of Propagation for plenum cable: 69.5%.

8. Maximum attenuation for non-plenum cable (per 100 feet):
 - a. at 1-MHz: 0.3 dB.
 - b. at 50-MHz: 2.5 dB.
 - c. at 400-MHz: 8.4 dB.
 - d. at 700-MHz: 11.7 dB.
 - e. at 1000-MHz: 14.5 dB.
 9. Maximum attenuation for plenum cable (per 100 feet):
 - a. at 1-MHz: 0.5 dB.
 - b. at 50-MHz: 3.0 dB.
 - c. at 400-MHz: 9.7 dB.
 - d. at 700-MHz: 13.7 dB.
 - e. at 1000-MHz: 17.3 dB.
 10. Acceptable Manufacturers:
 - a. Belden 8240 non-plenum or Belden 82240 plenum
 - b. CommScope
 - c. Liberty
 - d. Times Fiber
- D. For horizontal cables greater than or equal to 50 feet:
1. RG-8 Center conductor: 10 AWG bare solid copper; 0.108" OD (nominal); foam HDPE insulation for non-plenum and foam FEP dielectric for plenum.
 2. Two Layer Shield:
 - a. Inner shield: non-bonded aluminum foil tape.
 - b. Outer shield: 90% tinned copper braid shield.
 3. Nominal Impedance: 50 ohms.
 4. Nominal Capacitance for non-plenum cable: 24.8 pF/Ft
 5. Nominal Capacitance for plenum cable: 24.2 pF/Ft.
 6. Velocity of Propagation for non-plenum cable: 82%
 7. Velocity of Propagation for plenum cable: 84%.
 8. Maximum attenuation for non-plenum cable (per 100 feet):
 - a. at 1-MHz: 0.4 dB.
 - b. at 50-MHz: 1.0 dB.
 - c. at 400-MHz: 2.6 dB.
 - d. at 700-MHz: 3.6 dB.
 - e. at 1000-MHz: 4.4 dB.
 - f. at 4000-MHz: 9.9 dB.
 9. Maximum attenuation for plenum cable (per 100 feet):
 - a. at 1-MHz: 0.1 dB.
 - b. at 50-MHz: 1.1 dB.
 - c. at 400-MHz: 3.2 dB.
 - d. at 700-MHz: 4.5 dB.
 - e. at 1000-MHz: 5.9 dB.
 - f. at 4000-MHz: 14.1 dB.

10. Acceptable Manufacturers:
 - a. Belden 9914 non-plenum or Belden 7733A plenum
 - b. CommScope
 - c. Liberty
 - d. Times Fiber

2.8 CONTROL CABLING

- A. Provide with plenum-rated jacket where used in a plenum space without conduit.
- B. Other Control Circuits:
 1. #20 AWG, stranded, shielded cable, number of conductors as required for the applications. Provide with plenum-rated jacket where used in a plenum space without conduit. Provide PVC jacket where installed in conduit or non-plenum areas.
 2. Coordinate exact requirements with selected manufacturers prior to submitting bid.

2.9 HORIZONTAL COPPER DATA AND FIBER CABLING AND CONNECTORS

- A. Refer to Section 27 15 00 - Horizontal Cabling Requirements, for telecommunications cabling and connector requirements including fiber optics being utilized for A/V systems.
- B. Refer to Section 27 17 10 - Testing, for telecommunications cabling testing requirements including fiber optics being utilized for A/V systems.
- C. All category-rated copper data cabling and fiber optic cabling shall be installed, terminated, tested and certified by the Division 27 Telecommunications contractor certified by the selected manufacturers for the copper and fiber optic cabling plant. The Contractor shall submit all cabling and certifications to the Architect/Engineer for approval in the shop drawings.
- D. The A/V contractor shall coordinate purchase, installation, testing and certification with the telecommunications contractor for all required category-rated copper data cabling and fiber optic cabling required for A/V system operation prior to bid.

3. PART EXECUTION

3.1 EXAMINATION

- A. Verify that surfaces are ready to receive work.
- B. Verify field dimensions and coordinate physical size of all equipment with the architectural requirements of the spaces into which they are to be installed. Allow space for adequate ventilation and circulation of air.
- C. Verify that required utilities are available, in proper location, and ready for use.
- D. Beginning of installation means installer accepts existing conditions.

3.2 INSTALLATION

- A. Comply with the manufacturer's instructions and recommendations for installation of all products.
- B. Provide all system wiring between all components as directed by the manufacturer or required for proper system operation.
- C. Mount all touch screen and keypad devices where shown on plans in accordance with Americans with Disabilities Act (ADA) requirements for both side reach and front reach.

D. Cabling Requirements:

1. Non-plenum rated cabling may be used instead of plenum when installed with-in conduit in plenum rated areas.
2. All cabling shall be routed according to function. Cabling shall be grouped and bundled by groups, such as: microphone and line level audio, control, video and speaker. In no case shall cabling from different functional groups be intermixed. No cabling shall be routed parallel to 120 VAC or higher power circuits unless separated by a minimum of 6" and the 120 VAC or higher power is installed in conduit.
3. When cabling is installed in conduit, a separate conduit shall be provided for each cabling functional type.
4. Cable bundles shall be loosely bundled to allow the visual following of individual cables within the bundle and to permit the easy removal and addition of cables as necessary.
5. Horizontal cabling installed as open cable or in cable tray shall be bundled at not less than 10' intervals with hook-and-loop tie wraps. The use of plastic cable zip ties is strictly prohibited in any situation.
6. Cabling shall not be spliced under any circumstances.
7. Each cable shall be appropriately identified (as defined on the record documents) at each end's termination point using pressure sensitive label strips.
8. Audio Cabling:
 - a. All amplified audio cabling shall not be in the same enclosed pathway as any other type of cabling as required by the NEC. Refer to the NEC for definitions and additional requirements.
 - b. The polarity of all cabling shall remain consistent throughout the project, on all equipment. Red conductors shall be used for the positive "+" side, and black used for the negative "-" side.
 - c. Cable shield length shall be equal to the cable's conductor length.
 - d. All shielded cables drain wire SHALL be grounded and continuous throughout the entire length of the system, including splices where speakers are installed.
 - e. Balanced audio connections shall be used whenever the mating equipment allows.
 - f. Do not run unbalanced cables longer than 3m. For interconnecting of unbalanced equipment in lengths longer than 3m, the Contractor shall provide a line driver located at the source.
9. Video Cabling:
 - a. All video cabling, unless otherwise noted, shall be provided with BNC connectors of the two-piece compression type. Twist-on BNC connectors are not permitted.
 - b. Provide BNC 75-ohm terminators where required for all open BNC connectors.
 - c. All coaxial video cables used for S-video, component/RGB and RGBHV shall be the same length to minimize skew.

10. Twisted Pair Cabling for All Applications:

- a. The Contractor shall ensure that the twists in each cable pair are preserved to within 0.5 inch of the termination. The cable jacket shall be removed only to the extent required to make the termination.
- b. The Contractor shall ensure that the cable shields are continuous throughout, terminated, and grounded according to the manufacturer's recommendations.

E. Grounding Requirements:

1. Provide a minimum of #6 AWG conductor from the nearest electrical service ground bus or nearest telecommunications room ground bus bar to the A/V equipment racks and cabinets regardless of location. Size cable as required by the NEC.
2. Cables containing shields shall not have the shields grounded at conduits, boxes, racks, etc. Ground the shield only at the equipment end.
3. Audio cable shields for line-level signals shall be connected to the metal equipment chassis at both ends of the cable.
4. Audio cables connected to transformers shall have the cable shield connected to the transformer shield and transformer case ground.
5. The Contractor shall not connect cable shields together from differing cables.
6. XLR cable shields shall be connected to chassis ground.
7. Signal-grounded balanced shields are not acceptable and shall not be installed. All balanced shields shall be chassis grounded.

F. Rack and Cabinet Requirements:

1. Ground equipment racks/cabinets as noted within this specification section and Section 27 05 26 - Communications Grounding.
2. Provide one (1) RU of space between adjacent pieces of equipment with top and/or bottom vents, above the topmost piece of equipment, and below the bottommost piece of equipment. Provide a vented cover panel covering each rack space.
3. Terminate all speaker cabling on individual barrier strips for positive "+", negative "-", and shield. The shield barrier strip shall be grounded.
4. Provide a power conditioning surge arrestor in the rack for distribution of AC power from the wall receptacles indicated on the plans. The quantity of plugs shall be adequate so that no equipment in the rack shall require plugging into an AC source outside the rack.
5. Power sequencing shall be provided in the racks where shown on the drawings. All amplifiers located in the racks shall be sequenced "last on – first off". Power sequencers shall provide power conditioning and surge protection.

G. Video System Installation Requirements:

1. The Contractor shall perform calculations for the optimal distance from the screen to the projector lens based on actual field conditions and submit to the Architect/Engineer for review and approval.
2. If the projector and screen are in a fixed position, the Contractor shall provide the appropriate lens for the throw distance.
3. Video display image shall fill screen area with native aspect ratio

H. Audio System Installation Requirements:

1. Connections of balanced to unbalanced equipment shall only be done through an active converter at the unbalanced side.
2. Connections of unbalanced to balanced equipment shall only be done through an active converter at the unbalanced side.
3. Connections from stereo balanced or unbalanced equipment to mono equipment of the same signal type shall only be done through a passive combiner.
4. Connections from mono balanced or unbalanced equipment to stereo equipment of the same signal type shall only be done through a passive divider.
5. The Contractor shall provide an isolation transformer for any balanced or unbalanced audio line that exhibits a hum, noise from EMI or RFI, power line noise, or ground loops.
6. The Contractor shall provide an active audio line driver for all balanced and unbalanced signals that exceed the distance limitations of the cabling.

I. Control System Installation Requirements:

1. The Contractor shall perform calculations for the required wire AWG size based on distance for system power for touch panels, keypads and other devices being powered. A minimum of a 15% overhead is required.

3.3 VIDEO SYSTEM PERFORMANCE REQUIREMENTS

A. Extron DTP Digital Media:

1. Each digital media cable shall certify to a minimum of 6.68 Gpbs for applications at 1920x1080P/60 or above and for all 3D applications.

3.4 VIDEO SYSTEM TESTING AND CALIBRATION

A. All video equipment shall receive proper testing and configuration.

B. Color Space Optimization:

1. The Contractor shall set the color space of each source and display device to a uniform color space to optimize the switching speed and compatibility of a digital video system. Each device shall be set to an RGB or YCbCr color space depending on the systems primary function and compatibility of the devices.
2. If the primary function of the space is video and other digital media, the color space of each device shall be set to a YCbCr color space. If the primary function of the space is computer-based graphics and presentations, the color space of each device shall be set to an RGB color space.
3. Chroma subsampling shall be set to a consistent 4:4:4 or 4:2:2 across all devices. Set to 4:4:4 when all equipment is capable.
4. If all devices are not capable of displaying a certain color space, all devices shall be set to a common shared color space.

C. Extended Display Identification Data (EDID) Management:

1. The Contractor shall set the EDID management tables in capable equipment so all sources output the highest common EDID table of the displays (sinks).

2. For systems with capable matrix switches, the matrix shall dynamically adjust its EDID tables so any source will output the highest common EDID table of the displays (sinks) being outputted to.
 3. If any source or Owner-furnished equipment (OFE) is not outputting properly, the Contractor shall provide and install an EDID Emulator and set it to the highest common EDID table of the displays (sinks) being outputted to.
- D. Projector, monitors and receivers shall be tested and adjusted for proper signal sync, convergence, brightness, contrast, and color level. The Contractor shall adjust all other parameters necessary to achieve a proper video image.
 - E. All video source selections shall be tested and verified.
 - F. All projectors and displays shall have a minimum burn-in time of 96 hours prior to any adjustments are made and the completion of the project
 - G. All projectors and displays shall have their hue/tint and color/saturation calibrated with a video signal test generator and blue lens filter after a minimum warmup time of 20 minutes. Provide all calibrated settings results for each projector and display in the final documentation.
 - H. All projectors and displays shall have their brightness, contrast and sharpness calibrated with a video signal test generator after a minimum warmup time of 20 minutes. Provide all calibrated settings results for each projector and display in the final documentation.
 - I. All dynamic contrast functions shall be turned off.

3.5 AUDIO SYSTEM TESTING AND CALIBRATION:

- A. This Contractor shall field adjust any surface-mounted or flown loudspeaker orientation to achieve the necessary coverage pattern to the intended listening plane. Loudspeakers always face listeners and minimize coverage on walls. The contractor shall be familiar with the named and specified nominal coverage angle of all speakers above its crossover point or for speech range, (500-4,000 Hz).
- B. All speakers shall be tested for polarity prior to high work and a table of test results shall be included for A/E inspection. All loudspeakers shall be connected with uniform polarity, where a positive pressure pulse at the input corresponds to a positive driver excursion, and all drivers are uniform always moving in the same direction. Main speakers shall not be lifted or hoisted into high access areas without polarity testing.
- C. The Contractor shall make incremental adjustments on the equipment output and input tolerances to achieve matching signal levels while preserving +10 dB minimum headroom and also unity gain. Insert all broadband or high pass filters first for system protection after review of manufacturers specifications for power and bandpass.
- D. The Contractor shall utilize a Real Time Audio (RTA) spectrum analyzer with AES2 Broadband pink noise at a minimum of 1/3 octave, capable of providing detailed plots and reports.
 1. The Contractor shall have and own a calibrated Type 1 or Type 1.5 microphone for all measurements, that is recently calibrated within the last year.
 2. Calibration by ear, tablets and portable phones with integrated microphones are never acceptable. All software analysis tools require a calibrated interface and calibrated microphone. No Android devices are used for metering or calibration. IOS devices with calibrated software and interfaces may be used.
- E. Provide high quality media with full bandpass program material for critical listening. MP3 or streaming audio is not acceptable. Testing shall illustrate WAV file quality playback for impact and clarity.

- F. The Contractor shall provide graphic plots of the reference ambient noise for each space at the time of the calibration and submit with the calibration results. Test signal shall be 10dB minimum above ambient noise levels during testing.
- G. The Contractor shall use a listener sitting height of four (4) feet \pm 1" for rooms where the primary function will be sitting. The Contractor shall use a listener standing height of five feet three inches (5.25') \pm 1" for rooms where the primary function will be standing

3.6 AUDIO SYSTEM PERFORMANCE REQUIREMENTS

- A. The Contractor shall test and provide documents verifying all the following performance criteria. The Architect/Engineer shall be informed when the testing will take place and have the option to witness the testing and ask for additional testing for any reason.
- B. The Contractor shall develop an Audio Coverage Uniformity Measurement Location (ACUML) plan for each required space based on the project floor plans, and submit to the Architect/Engineer for review and approval prior to testing. The plan shall represent the majority of the listening area and perimeter seating in the direct field of main speakers.
- C. The tests shall be performed at the multiple locations defined on the ACUML plan representing the majority of the listening area(s). The Contractor shall indicate on the floor plan drawings where each test was performed, with the corresponding graphic plot, and submit with the final documentation for review and approval by the Architect/Engineer.
- D. The test shall be taken with AES2 Broadband pink noise at a minimum of 15 dB above the reference ambient noise level, taking caution to not overdrive and clip any component of the system beyond 0.5% Total Harmonic Distortion (THD), with a maximum system THD of 1.0%.
- E. The audio system(s) shall meet the following minimum requirements:
 - 1. Achieve a total average SPL of 95 dBA in the majority of seating area with additional headroom. Use dBC for levels above 95 dBA.
 - 2. The system's total SPL frequency response shall be within \pm 4 dB from 500 Hz to 8000 Hz. All efforts shall be made to equalize the system's frequency response possible throughout the system's entire 100 Hz16kHz spectrum.
 - 3. All vocal microphones shall have high and low pass filters set to minimize rumble, pop and hiss. The high pass filter cutoff frequency shall be set between 125 and 160 Hz, with a 12 dB per octave slope, minimum. The low pass filter cutoff frequency shall be set at 12,000 Hz, with a 6 dB per octave slope. Adjust frequency and slope as required to maximize performance for both male and female voices.
 - 4. The subwoofer/speaker low/high crossover points shall be a Butterworth (BW) filter set at 80 Hz with a 24 dB per octave slope. This crossover point shall be adjusted as needed to achieve a smooth frequency response. The subwoofer high-pass filter shall be set to manufacturer's recommended half-power point or 40 Hz, whichever is higher.
 - 5. Achieve a minimum RaSTI value of 0.63.

3.7 ASSISTED LISTENING SYSTEM (ALS) PERFORMANCE REQUIREMENTS

- A. The Contractor shall verify that the ALS system(s) meets the following minimum performance requirements at the earphone or headset:
 - 1. Reach a minimum total SPL of 110dB and no greater than 118dB, with a minimum of a 50dB dynamic range volume control.
 - 2. Achieve a minimum Speech Transmission Index (STI) value of 0.84.

3. Achieve a minimum signal-to-noise (S/N) ratio of 18dB. It is recommended to achieve a minimum signal-to-noise (S/N) ratio of 25dB to accommodate children.
 4. Ensure the peak clipping levels do not exceed 18dB down from the peak input signal level.
- B. FM-based systems shall operate within the FCC-reserved assisted listening frequencies of 72 to 76 MHz or the 216 to 217 MHz (preferred) range and comply with the FCC transmitter power requirements.

3.8 DSP-BASED AUDIO PROCESSOR PROGRAMMING

- A. Full system programming shall be provided for the system. Programming shall be performed by a factory trained and certified programmer or an employee of the equipment manufacturer.
- B. DSP pathfile with initial settings shall be provided by the contractor for reviewed by the architect/engineer before installation.
- C. The IP-based audio (IEEE AVB, Dante, etc.) and components shall be on a dedicated Virtual LAN (VLAN) for the A/V systems. These components shall be on a dedicated subnetwork of the VLAN. The Contractor shall coordinate these requirements with the Owner prior to installation.
- D. A parametric EQ shall be provided after each crossover point or as approved in the DSP pathfile during shop submittal review. These shall be utilized to set the speaker output as defined in the Audio System Calibration section within this specification. These equalizers should not be made available to the user to adjust.
- E. Levelers, compressor/limiters, duckers, gates and delays shall be preset during testing and commissioning and are not available for user adjustment following commissioning.
 1. Adjust delays for time of flight plus 8-10 ms, typical.
- F. Provide each microphone input with high-pass filter, 5-band parametric EQ, auto-leveler and volume module. Provide line level inputs with high-pass filter, 3-band parametric EQ, compressor/limiter and volume module.
- G. Acoustic Echo Cancelation (AEC) shall be provided for each conference microphone input..
- H. A broadband pink noise generator shall be provided with a selectable on/off control button within the DSP pathfile. The noise shall be routable through all processing EQs and speaker outputs during testing.
- I. Provide volume meters with labeling for each input and each output..
- J. Provide with user control software to be installed on Owner-provided and installed computer.
- K. The Contractor shall utilize the latest version of the programming software.
- L. The Contractor shall ensure that all components are updated to the latest firmware at the completion of the project.

3.9 DSP-BASED AUDIO PROCESSOR CONTROL SOFTWARE PROGRAMMING

- A. Full system software programming shall be provided for the system. Programming shall be performed by a factory-trained and certified programmer or an employee of the equipment manufacturer.
- B. The Contractor shall schedule a series of meetings with the Owner and Architect/Engineer to define and determine the exact page layout requirements prior to the final configuration of the audio system. An Owner sign-off of the final layouts shall be required.
- C. The Contractor shall use the latest version of the software.

- D. At a minimum, there shall be password-protected pages for zone combining, input/output volume control with meters, speaker output volume control with meters, signal routing, signal processing (EQ's, feedback suppression, etc.), and supervision/maintenance for all spaces and combined zones.

3.10 MULTIMEDIA CONTROL SYSTEM INTEGRATION AND PROGRAMMING

A. Programming and Integration for Control Systems:

1. Full system programming shall be provided for the system. Programming shall be performed by a factory trained and certified programmer or an employee of the equipment manufacturer.
2. The Contractor shall schedule a series of meetings with the Owner and Architect/Engineer to define and determine the exact integration requirements of the control system prior to the installation of the control system and components. An Owner sign-off of the final configuration shall be required.
3. This section only defines the minimum requirements. The programmer shall provide complete programming for a fully functional system.
4. The Contractor shall utilize the latest version of the programming software.
5. The Contractor shall ensure that all components are updated to the latest firmware at the completion of the project.
6. The IP-based control system and controlled components shall be on a dedicated Virtual LAN (VLAN) for the A/V systems. These components shall be on a dedicated subnetwork of the VLAN. The Contractor shall coordinate these requirements with the Owner prior to installation.
7. Integration and programming of the following pieces of equipment shall be provided, with the following minimum features and functions:
 - a. All equipment shall include on/off control, except for equipment that must remain active for system functionality.
 - b. Integration of HDCP (High-bandwidth Digital Content Protection) and DPCP (Display Port Content Protection) protected content and sources:
 - 1) No protected sources or content shall be allowed to be selected to route through non-protected devices and displays. A warning shall be displayed stating this information to the user.
 - c. Switcher/Transmitter Integration:
 - 1) The Contractor shall provide bi-directional RS-232 or Ethernet control system connections and programming with the following minimum functions:
 - a) Allow audio/video routing of individual video inputs to outputs.
 - b) HDCP (High-bandwidth Digital Content Protection) and DPCP (Display Port Content Protection) Protection:
 - (1) HDCP-compliant switchers shall allow HDCP source devices to only route to HDCP compliant devices.
 - (2) Room Combining/Uncombining features shall allow for complete audio and/or video devices to be connected to the system using simplified interface.

- d. DSP Audio Processor Integration:
- 1) The Contractor shall provide bi-directional RS-232 or Ethernet control system connections and programming with the following minimum functions:
 - a) On/off control of all microphones.
 - b) Volume and mute control of all microphones and input sources.
 - c) Volume and mute control of all outputs.
 - d) Independent volume and mute control of all assisted listening outputs.
 - e) On/off and reset control of feedback eliminators and suppressors.
 - f) Advanced routing of audio signals.
 - g) Audio conferencing dialer keypad with speed dials.
 - h) Audio conferencing CallerID display on touchpanel and/or workstation.
 - i) Acoustic Echo Cancellation (AEC) control.
- e. Display Integration:
- 1) The displays shall be integrated into the A/V control system via bi-directional RS-232 or Ethernet control. Provide with the following minimum functions:
 - a) On/off control.
 - b) Display status feedback.
 - c) Source switching control.
 - d) Audio volume control with mute.
 - e) Video mute.
 - f) Tuner channel control with direct channel access.
 - g) Station presets with station icons.
- f. Power Sequencer Integration:
- 1) The Contractor shall provide contact closure based control **[OR]** bi-directional RS-232 or Ethernet control system connections and programming with the following minimum functions:
 - a) Power on/off control.
 - b) On/off status via +12VDC output from the sequencer to the I/O input of the control system processor.
- g. Digital Audio Mixing Board Integration:
- 1) The Contractor shall provide bi-directional RS-232 or Ethernet control system connections and programming with the following minimum functions:
 - a) On/off control of device.
 - b) Master volume control.
 - c) Scene or preset recall.
 - d) This defines only the basic integration requirements. Coordinate with Owner on additional required functions.

3.11 SYSTEM COMMISSIONING

- A. The Contractor shall notify the Architect/Engineer and Owner prior to conducting final system commissioning.
- B. Contractor shall demonstrate system performance of all equipment and adjust settings as directed by the Architect/Engineer and/or Owner.
 - 1. All system settings, software options and other parameters shall be simulated and tested by the Contractor

3.12 FIELD QUALITY CONTROL

- A. Where these specifications require a product or assembly without the use of a brand or trade name, provide a product that meets the requirements of the specifications, as supplied and warranted by the system vendor. If the product or assembly is not available from the system vendor, provide product or assembly as recommended by the system vendor.
- B. Periodic observations will be performed during construction to verify compliance with the requirements of the specifications. These services do not relieve the Contractor of responsibility for compliance with the Contract Documents.

3.13 FIELD SERVICES

- A. The installer shall conduct a planning meeting with the Owner. The purpose of this meeting shall be to determine all equipment settings that are considered preferences (where proper system operation does not depend on the setting).
- B. The installer shall include labor for all planning and all programming activities required to implement the Owner's preferences for equipment settings.
- C. It shall be the responsibility of the Contractor/installer to provide a complete, functional system as described by the design documents. These responsibilities include:
 - 1. Complete hardware setup, installation and wiring and software configuration.
 - 2. Complete programming of software in accordance with the Owner's desires determined by the planning meeting.
 - 3. Complete system diagnostic verification.
 - 4. Complete system commissioning.

3.14 SYSTEM ACCEPTANCE

- A. The Contractor shall submit for review a formal acceptance and system checkout procedure. The system checkout procedures shall include all system components and software. The Contractor shall perform the tests and settings and document all results.

3.15 SYSTEM DOCUMENTATION

- A. Complete documentation shall be provided for the system. The documentation shall describe:
 - 1. All operational parameters of the system.
 - 2. Complete documentation of programming and features.
 - 3. Complete operating instructions for all hardware and software.
- B. The following sections shall be provided in the system documentation:
 - 1. User Manual: A step-by-step guide and instructions detailing all system user functions.

2. Technical Manual: A comprehensive document providing all system operations, troubleshooting flowcharts, functional system layout, wiring diagrams, block diagrams and schematic diagrams.
 3. Maintenance Manual: A comprehensive document on all aspects of physical maintenance of the systems, including cleaning of the displays, bulb changes, filter cleaning, filter changing and UPS maintenance.
- C. Intellectual Property Ownership:
1. All supporting documentation, programming, uncompiled source code, graphic files, DSP code and diagrams, written and electronic files, including all latest versions of the documentation and software necessary to edit and adapt the system(s), shall be provided to the Owner on a CD or DVD for all spaces and all systems. The integrator and/or programmer shall also maintain a current copy to be provided at the Owner's request.
 - a. A written release shall be given by the integrator and all other required parties for all programming done by the personnel or subcontractors for the project. This release will acknowledge the Owner's ownership and right to modify the intellectual property directly, or to have the intellectual property modified by any party of the Owner's choosing.

3.16 SYSTEM TRAINING

- A. All labor and materials required for on-site system training shall be provided. Training shall be conducted at the project site using the project equipment.
1. Provide two week's advanced notice of training to the Owner and Architect/Engineer.
 2. The Architect/Engineer shall be presented with the option to attend the training.
 3. Provide a training outline agenda describing the subject matter and the recommended audience for each topic.
- B. At a minimum, the following training shall be conducted:
1. User Manual: A course detailing the system functions and operations that a daily user will encounter.
 2. Technical User: Provide configuration training on all aspects of the system(s), including equipment and software.
 3. Maintenance User: Provide training on all aspects of physical maintenance of the systems, including cleaning of the displays, bulb changes, filter cleaning and filter changing.
- C. Minimum on-site training times per system shall be:
1. User Manual: One (1) day.
 2. Technical user: One (1) day.
 3. Maintenance user: Four (4) hours.

END OF SECTION

SECTION 27 51 13

PAGING SYSTEMS

1. PART GENERAL

1.1 SECTION INCLUDES

- A. Desktop Networked Paging Station
- B. Networked Audio Input Device
- C. Networked Message Server
- D. Networked Amplifier
- E. Networked End of Line Monitor
- F. Networked GPIO
- G. Ceiling Speaker
- H. Wall-Mounted Speaker
- I. Wall-Mounted Speaker, Weather Resistant
- J. Paging System Cable
- K. Audio Connectors
- L. Conduit
- M. Non-Continuous Cable Hangers and Supports
- N. Uninterruptible Power Supply

1.2 RELATED WORK

- A. Section 26 05 33 - Conduit and Boxes
- B. Section 26 05 35 - Surface Raceways
- C. Section 26 05 13 - Wire and Cable
- D. Section 27 05 00 - Basic Communications Systems Requirements
- E. Section 27 05 03 - Through Penetration Firestopping
- F. Section 27 05 26 - Communications Bonding
- G. Section 27 05 28 - Interior Communication Pathways
- H. Section 27 15 00 - Horizontal Cabling Requirements
- I. Section 27 05 53 - Identification and Administration

1.3 QUALITY ASSURANCE

- A. Manufacturer: The manufacturer shall have ten (10) years documented experience in the design and manufacture of paging system devices and equipment.
- B. Installer: The Contractor shall have a minimum of three (3) years documented experience in paging system installation and must be a factory-authorized service and support company specializing in the selected manufacturer's product, with demonstrated prior experience with the selected manufacturer's system installation and programming.
 - 1. The Contractor shall own and maintain all tools and equipment necessary for successful installation and testing of the system and have personnel adequately trained in the use of such tools and equipment.
- C. The following qualifications have been endorsed by the AudioVisual and Integrated Experience Association (AVIXA), which is formerly known as InfoComm International.
 - 1. The Contractor shall have a Certified Technology Specialist (CTS) on staff and supervising the project. This service shall not be subcontracted.
 - 2. The Contractor shall have a Certified Technology Specialist with a specialized installation endorsement (CTS-I) on staff and supervising the project. This service shall not be subcontracted.

- D. The Contractor(s) shall provide a résumé of prior experience in similar types and scales of projects, and other projects that may have been completed with the client. The résumé shall include the project name, square footage, budget, system descriptions, and references with email addresses and phone numbers.
- E. Audio System Programmer: All digital signal processing equipment (DSP) used on the project shall be setup, programmed, and calibrated by a factory-trained and certified technician.
- F. The Contractor shall have acquired and maintained all certifications for a minimum of one (1) month prior to the posted bid date of this project.
- G. Service: The manufacturer of the system must have local service representatives within 100 miles of the project site. The installer must be factory certified to provide service on the installed manufacturer's equipment and must have local service representatives within 100 miles of the project site.
- H. The entire installation shall comply with all applicable electrical and safety codes. All applicable devices, equipment, and cabling shall be listed by Underwriters' Laboratories, Inc.

1.4 REFERENCES

- A. ADA - Americans with Disabilities Act
- B. ADAAG - Americans with Disabilities Accessibility Guidelines
- C. NFPA 70 (NEC) – National Electrical Code
- D. UL 813 - Standards for Commercial Audio Systems
- E. UL 1480 - Speakers for Fire Alarm, Emergency, and Commercial and Professional Use
- F. ISO R 266-1997
- G. ANSI S1.6-1984

1.5 SUBMITTALS

- A. Submit product data under the provisions of Section 27 05 00.
- B. Provide materials documenting experience requirements of the manufacturer and installing contractor.
- C. Product Data Submittal: Provide manufacturer's technical product specification sheet for each individual component type. Submitted data shall show the following:
 - 1. Compliance with each requirement of these documents. The submittal shall acknowledge each requirement of this section, item by item.
 - 2. All component options and accessories specific to this project.
 - 3. Electrical power consumption rating and voltage.
 - 4. Heat generation for all power consuming devices.
 - 5. Wiring and connection requirements.
 - 6. Manufacturer's installation instructions, indicating application conditions and limitations of use as stipulated by product testing agency and instructions for storage, handling, protection, examination, preparation, installation, and initiating usage of product.

D. Certification Documentation Submittal

1. Provide documentation of all required certifications. All certifications shall be current and valid. Any certificate with expired dates will not be accepted. Submittal shall include documentation of the following:
 - a. Audiovisual and Integrated Experience Association (AVIXA) – Formerly InfoComm:
 - 1) Certified Technology Specialist (CTS)
 - 2) Certified Technology Specialist with a specialized Installation endorsement (CTS-I)
 - 3) Qualifications from InfoComm that have not expired will be accepted.
 - b. System Equipment Manufacturer(s) dealer certification(s) and dealer number(s).
 - c. System Equipment Manufacturer(s) programmer certification(s).
 - d. All other applicable dealer, installation, and programming certifications.
2. If an alternate manufacturer is submitted, the equivalent certifications to the basis of design manufacturer's shall be required and submitted.

E. System Drawings:

1. Project-specific system CAD-generated drawings shall be provided as follows:
 - a. Provide a system block diagram noting system components and interconnection between components. The interconnection of components shall clearly indicate all wiring required in the system. When multiple pieces of equipment are required in the exact same configuration (e.g., multiple identical speaker zones), the diagram may show one device and refer to the others as "typical" of the device shown.
 - b. Where applicable, an equipment rack plan shall be provided showing rack elevations and dimensions in plan and elevation view. The plan shall include equipment layout within the rack.

F. Provide voltage drop calculations for each speaker cable circuit or run, showing the drop for the specific circuit or run wattage and cable size used.

G. Coordination Drawings:

1. Include all ceiling-mounted devices in composite electronic coordination files. Refer to Section 27 05 00 for coordination drawing requirements.

H. Quality Assurance:

1. Provide list of test equipment proposed for use in testing the installed paging system.
2. Provide system checkout test procedure to be performed at acceptance, including demonstration of specified performance and all required system features and functions listed herein and as further detailed on the drawings.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Deliver products to the site under the provisions of Section 27 05 00.
- B. Store and protect products under the provisions of Section 27 05 00.

1.7 SYSTEM DESCRIPTION

- A. This specification section describes the furnishing, installation, commissioning and programming of a complete, turnkey multi-zone supervised paging system.

- B. Performance Statement: This specification section and the accompanying design documents are performance based, describing the minimum material quality, required features, and operational requirements of the system. These documents do not convey every wire that must be installed or every equipment connection that must be made. Based on the equipment constraints described and the performance required of the system as presented in these documents, the vendor and the Contractor are solely responsible for determining all wiring, programming, and miscellaneous equipment required for a complete and operational system.
- C. This Contractor shall furnish and install a paging system as hereinafter specified and further detailed on the drawings. System shall be completely wired and ready for use including, but not limited to, outlet boxes, conduit, wire, equipment, speakers, controls, and equipment cabinets.
- D. Basic System Requirements: The system shall be capable of providing the following minimum features in addition to those specified elsewhere in this specification and on the drawings:
 - 1. Multi-zone supervised paging system, capable of expanding the quantity of zones by the addition of modular components. Expansion of the quantity of zones by the replacement of equipment is not acceptable without a documented trade-in policy by the manufacturer.
 - 2. Live all-call voice messages via microphone.
 - 3. Live all-call voice messages via owner radios.
 - 4. Live and pre-recorded all-call voice message via message initiation station.
 - 5. Live and pre-recorded all-call voice messages via page port of Owner's telephone system.
 - 6. Live and pre-recorded voice announcements to a specific zone or group of zones via message initiation station universal telephone paging interface. Zone or group shall be user-selectable via touch-tone dialing at the initiation of a message.
 - 7. Scheduled tone signaling via line-level audio from tone generator, triggered from the paging systems synchronized clock.
 - 8. Digital feedback elimination for live voice messages.
 - 9. Field-configurable priority override hierarchy for signal source inputs.
 - 10. Individual volume control for each signal source input.
 - 11. Supervision of speaker cabling for electrical faults, including shorts, open circuits, and ground faults. Faults shall be indicated at a continually-attended location.
 - 12. Uninterruptible power supply to support continued system operation in the event of a loss of utility power.

1.8 PROJECT RECORD DOCUMENTS

- A. Submit documents under the provisions of Section 27 05 00.
- B. Provide floor plans identifying actual locations of all installed overhead paging system equipment and devices.
- C. Provide final system block diagram showing any deviations from shop drawing submittal. Block diagram shall include cable number documenting the numbers installed on both ends of the cable in the field.
- D. Provide documentation of all test results and statement that system checkout test, as outlined in shop drawing submittal, is complete and satisfactory.
- E. Warranty: Submit written warranty and complete all Owner registration forms.

- F. Complete all operation and maintenance manuals as described herein.

1.9 OPERATION AND MAINTENANCE DATA

- A. Submit data under provisions of Section 27 05 00.
- B. Operation and Maintenance data shall be submitted in hard copy and electronic .pdf format.
- C. Operation data shall include:
 - 1. Manufacturer's full operation instructions for each piece of equipment.
 - 2. Complete documentation of all settings and programming.
 - 3. Detailed, step-by-step instructions for system operation, including accessing, initiating, and performing all required system features and functions listed herein.
- D. Maintenance data shall include:
 - 1. Description of servicing procedures:
 - a. Documentation of all manufacturers' recommended preventive and remedial maintenance procedures to be performed by the Owner.
 - b. Troubleshooting flowcharts.
 - 2. Spare parts list.

1.10 WARRANTY

- A. Unless otherwise noted, provide warranty for a minimum of one (1) year after Substantial Completion, as defined by the Contract. Certain system components may require additional manufacturer's warranty as described herein.
- B. The warranty shall:
 - 1. Ensure that all approved devices, equipment, cabling, and other components specified in this section meet or exceed the specified requirements.
 - 2. Ensure against product defects.
 - 3. Cover the replacement or repair of the defective product(s) and labor for the replacement or repair of such defective product(s).
 - 4. Include emergency service and repair on-site, with response times of eight (8) hours from time of notification. The system shall be repaired and restored to operation within 24 hours of technician's arrival on site.
- C. Refer to the individual product sections for further warranty requirements of individual system components.

2. PART PRODUCTS

2.1 DESKTOP NETWORKED PAGING STATION

- A. Features:
 - 1. Free-standing desktop station
 - 2. Integral gooseneck microphone

3. Push-to-Talk button with status indication
4. On-board digital signal processing
5. Backlit LCD display
6. Two page navigation buttons
7. 10-button softkey page code keypad
8. Stores ten (10) 999 user-configurable page codes
9. Aux port for connecting other Vocia system accessories
10. CobraNet audio and control transmission
11. POE-powered

B. Specifications:

1. Microphone Element: Dynamic
2. Frequency Response: 100 Hz - 20 kHz, +/- 1 dB
3. Maximum Input: 125 dB SPL
4. Total Harmonic Distortion: $\leq 0.05\%$
5. Audio Converter Bit Depth: 24-bit
6. Audio Converter Frequency: 48 kHz
7. CobraNet Network Connection: RJ-45 jack

C. Basis of Design: Biamp DS-10

D. Provide complete with 10-foot Ethernet patch cable.

2.2 NETWORKED AUDIO INPUT DEVICE

A. Features:

1. Rack-mounted
2. Four (4) stereo line-level audio inputs
3. Two (2) microphone/line inputs with phantom power
4. Four (4) Biamp Vocia Paging Ports
5. Four (4) digital control inputs
6. Four (4) Form C control outputs
7. On-board digital signal processing
8. CobraNet audio and control transmission
9. Status LEDs
10. POE powered

B. Specifications:

1. Frequency Response: 20 Hz - 20 kHz, +/- 1 dB
2. Total Harmonic Distortion: $\leq 0.05\%$
3. Signal to Noise Ratio: $\geq 84\text{dB}$
4. Audio Converter Bit Depth: 24-bit
5. Audio Converter Frequency: 48 kHz
6. Digital Control Input Max Input Voltage: 12 V
7. Form C Control Output Max Operating Voltage: 125 VAC / 60 VDC
8. Form C Control Output Max Switching Capacity: 37 VA
9. Audio Connections: RCA and screw-terminal
10. Control Connections: Screw-terminal
11. CobraNet Network Connection: RJ-45 jack

C. Basis of Design: Biamp VI-6

D. Provide complete with all necessary audio, control, and Ethernet patch cables.

2.3 NETWORKED MESSAGE SERVER

A. Features:

1. Rack-mounted
2. Recorded message storage and playback
3. Event scheduling
4. VoIP paging interface
5. System configuration storage and service
6. CobraNet audio and control transmission

B. Specifications:

1. Ethernet Connection: RJ-45 jack
2. CobraNet Network Connection: RJ-45 jack

C. Basis of Design: Biamp MS-1e

D. Provide complete with Ethernet patch cables.

2.4 NETWORKED AMPLIFIER

A. Features:

1. Rack-mounted
2. Eight (8) channels
3. Eight (8) Page Active relays
4. Configurable for channel-to-channel and device-to-device failover
5. On-board digital signal processing
6. Local storage of emergency messages
7. Supports automatic level control accessory
8. Supports speaker line supervision accessory
9. CobraNet audio and control transmission
10. Status LEDs
11. EN 54-16 certified

B. Specifications:

1. Frequency Response: 40 Hz - 20 kHz, +/- 2 dB
2. Total Harmonic Distortion: $\leq 0.3\%$
3. Signal to Noise Ratio: ≥ 88 dB
4. Audio Converter Bit Depth: 24-bit
5. Audio Converter Frequency: 48 kHz
6. Supported Speaker Loads: 4/8 Ohm low impedance, 25/70/100 Volt constant voltage
7. Output Power: 150 watts per channel
8. Form C Page Active Relay Output Max Operating Voltage: 125 VAC / 60 VDC
9. Form C Page Active Relay Output Max Switching Capacity: 37 VA
10. Speaker Connections: Screw-terminal
11. Page Active Relay Connections: Screw-terminal
12. CobraNet Network Connections: RJ-45 jacks

C. Basis of Design: Biamp VA-8150CV

2.5 NETWORKED AMPLIFIER

A. Features:

1. Rack-mounted
2. Four (4) channels
3. Eight (8) Page Active relays
4. Configurable for channel-to-channel and device-to-device failover

5. On-board digital signal processing
6. Local storage of emergency messages
7. Supports automatic level control accessory
8. Supports speaker line supervision accessory
9. CobraNet audio and control transmission
10. Status LEDs
11. EN 54-16 certified

B. Specifications:

1. Frequency Response: 40 Hz - 20 kHz, +/- 2 dB
2. Total Harmonic Distortion: $\leq 0.3\%$
3. Signal to Noise Ratio: ≥ 88 dB
4. Audio Converter Bit Depth: 24-bit
5. Audio Converter Frequency: 48 kHz
6. Supported Speaker Loads: 4/8 Ohm low impedance, 25/70/100 Volt constant voltage
7. Output Power: 300 watts per channel
8. Form C Page Active Relay Output Max Operating Voltage: 125 VAC / 60 VDC
9. Form C Page Active Relay Output Max Switching Capacity: 37 VA
10. Speaker Connections: Screw-terminal
11. Page Active Relay Connections: Screw-terminal
12. CobraNet Network Connections: RJ-45 jacks

C. Basis of Design: Biamp VA-4300CV

2.6 NETWORKED AMPLIFIER

A. Features:

1. Rack-mounted
2. Two (2) / Four (4) channels
3. Eight (8) Page Active relays
4. Configurable for channel-to-channel and device-to-device failover
5. On-board digital signal processing
6. Local storage of emergency messages
7. Supports automatic level control accessory
8. Supports speaker line supervision accessory
9. CobraNet audio and control transmission
10. Status LEDs
11. EN 54-16 certified

B. Specifications:

1. Frequency Response: 40 Hz - 20 kHz, +/- 2 dB
2. Total Harmonic Distortion: $\leq 0.3\%$
3. Signal to Noise Ratio: ≥ 88 dB
4. Audio Converter Bit Depth: 24-bit
5. Audio Converter Frequency: 48 kHz
6. Supported Speaker Loads: 4/8 Ohm low impedance, 25/70/100 Volt constant voltage
7. Output Power: 30/60 watts per channel
8. Form C Page Active Relay Output Max Operating Voltage: 125 VAC / 60 VDC
9. Form C Page Active Relay Output Max Switching Capacity: 37 VA
10. Speaker Connections: Screw-terminal
11. Page Active Relay Connections: Screw-terminal
12. CobraNet Network Connections: RJ-45 jacks

C. Basis of Design: Biamp VA-2060/VA-4030

D. Provide complete with all necessary audio, control, and Ethernet patch cables.

2.7 NETWORKED END OF LINE MONITOR

A. Features:

1. Wall-mounted
2. Monitors speaker line
3. Compatible with low impedance and constant voltage speaker circuits
4. POE-powered
5. Status LED

B. Specifications:

1. Speaker Connections: Screw-terminal
2. Ethernet Connection: RJ-45 jack

C. Basis of Design: Biamp ELD-1

D. Provide complete with Ethernet patch cable.

2.8 NETWORKED GPIO

A. Features:

1. Wall-mounted
2. Accepts Triggering of recorded message page codes
3. Sixteen (16) general purpose logic inputs
4. Sixteen (16) general purpose outputs
5. POE-powered
6. Status LED

B. Specifications:

1. GPIO Connections: Screw-terminal
2. Ethernet Connection: RJ-45 jack

C. Basis of Design: Biamp GPIO-1

D. Provide complete with Ethernet patch cable.

2.9 CEILING SPEAKER

A. Features:

1. 8" paper cone speaker with 10-ounce magnet
2. Integral 70-volt transformer
3. Circular paintable steel grille
4. Recessed integral volume control

B. Specifications:

1. Transformer Taps: 4, 2, 1, 1/2, and 1/4 watt
2. Frequency Response: 70 Hz to 12 kHz
3. Sensitivity: ≥ 95 dB

C. Basis of Design: Bogen S86T725PG8WVK

D. Provide complete with manufacturer's circular paintable steel speaker enclosure and T-bar support tile bridge.

2.10 WALL-MOUNTED SPEAKER, WEATHER RESISTANT

A. Features:

1. $\geq 4"$ paper cone woofer
2. $\geq 1/2"$ dome tweeter
3. Integral 70-volt transformer
4. Weather-resistant molded black plastic enclosure with black metal mesh grille
5. Integral U-bracket mount

B. Specifications:

1. Power Handling: ≥ 15 watts, minimum of 5 transformer tap settings
2. Frequency Response: 105 Hz to 17 kHz
3. Sensitivity: ≥ 89 dB

C. Basis of Design: Bogen IH8A

D. Provide complete with necessary manufacturer's mounting accessories.

2.11 PAGING SYSTEM CABLE

A. Refer to Section 27 05 00 for plenum or non-plenum cable rating requirements.

B. Backbone Speaker Cable

1. Minimum 14/2 shielded with drain wire
 - a. Conductor Type: Bare copper, stranded
 - b. Voltage Capacity: 150 volts RMS
 - c. Current Capacity: 8 amps per conductor
 - d. Nominal Capacitance, Conductor to Conductor: ≤ 85 pF/ft.
 - e. Nominal Capacitance, Conductor to Shield: ≤ 153 pF/ft.
 - f. UL Temperature Rating: 75°C
2. Cable shall be NEC compliant and UL listed.
3. Basis of Design: Belden 5100FE (CM) or 6100FE (CMP)
4. Provide with larger-gauge conductors where necessary to maintain acceptable voltage drop as defined herein.

C. Speaker Cable

1. Minimum 18/2 shielded with drain wire
 - a. Conductor Type: Bare copper, stranded
 - b. Voltage Capacity: 300 volts RMS
 - c. Current Capacity: 5 amps per conductor
 - d. Nominal Capacitance, Conductor to Conductor: ≤ 70 pF/ft.
 - e. Nominal Capacitance, Conductor to Shield: ≤ 126 pF/ft.
 - f. UL Temperature Rating: 75°C
2. Cable shall be NEC compliant and UL listed.
3. Basis of Design: Belden 5300FE (CM) or 6300FE (CMP)
4. Provide with larger-gauge conductors where necessary to maintain acceptable voltage drop as defined herein.

D. Line-level Audio and Microphone Cable

1. 1-pair 22 AWG shielded with drain wire
 - a. Conductor Type: Bare copper, stranded
 - b. Voltage Capacity: 300 volts RMS
 - c. Current Capacity: 2.8 amps per conductor
 - d. Nominal Capacitance, Conductor to Conductor: ≤ 35 pF/ft.
 - e. Nominal Capacitance, Conductor to Shield: ≤ 67 pF/ft.
 - f. UL Temperature Rating: 60°C
2. Cable shall be NEC compliant and UL listed.
3. Basis of Design: Belden 8761 (CM) or 82761 (CMP)

E. Telephone Page Port Cable

1. Category 6A UTP cable.
 - a. Refer to Section 27 15 00 for requirements.

F. Ethernet Cable

1. Category 6A UTP cable.
 - a. Refer to Section 27 15 00 for requirements.

2.12 AUDIO CONNECTORS

A. 1/4" T/R/S Phono Female Jack:

1. Panel Mount:
 - a. Professional grade, three conductor, plated brass contacts, solder terminal connections, self-locking, ground conductor insulated from mounting panel.
2. Cable Mount:
 - a. Professional grade, three conductor, plated brass contacts, solder terminal connections, all-metal construction, integral cable clamp, cable strain relief.
3. Approved Manufacturers
 - a. Neutrik
 - b. Switchcraft
 - c. Amphenol

B. 1/4" T/R/S Phono Male Plug:

1. Cable Mount:
 - a. Professional grade, three conductor, plated brass contacts, solder terminal connections, all-metal construction, integral cable clamp, cable strain relief.
2. Approved Manufacturers:
 - a. Neutrik
 - b. Switchcraft
 - c. Amphenol

C. RCA Female Jack:

1. Panel Mount:

- a. Professional grade, two conductor, plated brass contacts, solder terminal connections, ground conductor insulated from mounting panel.

2. Cable Mount:

- a. Professional grade, two conductor, plated brass contacts, solder terminal connections, all-metal construction, integral cable clamp, cable strain relief.

3. Approved Manufacturers:

- a. Neutrik
- b. Switchcraft
- c. Amphenol

D. RCA Male Plug:

1. Cable Mount:

- a. Professional grade, two conductor, plated brass contacts, solder terminal connections, solid center pin, all-metal construction, integral cable clamp, cable strain relief.

2. Approved Manufacturers:

- a. Neutrik
- b. Switchcraft
- c. Amphenol

E. XLR Female Jack:

1. Panel Mount:

- a. Professional grade, three conductor, plated brass contacts, solder terminal connections, all-metal construction, latch lock, ground conductor insulated from mounting panel.

2. Cable Mount:

- a. Professional grade, three conductor, plated brass contacts, solder terminal connections, metal construction, latch lock, integral cable clamp, cable strain relief.

3. Approved Manufacturers:

- a. Neutrik
- b. Switchcraft
- c. Amphenol

F. XLR Male Plug:

1. Panel Mount:

- a. Professional grade, three conductor, plated brass contacts, solder terminal connections, solid pins, all-metal construction, latch lock, ground conductor insulated from mounting panel.

2. Cable Mount:
 - a. Professional grade, three conductor, plated brass contacts, solder terminal connections, solid pins, metal construction, latch lock, integral cable clamp, cable strain relief.
3. Approved Manufacturers:
 - a. Neutrik
 - b. Switchcraft
 - c. Amphenol

2.13 CONDUIT

- A. All conduit for paging system cabling shall be a minimum of 3/4" trade size.
- B. Flexible conduit shall be used only for "fixture whip" type applications at speakers in accessible ceilings, between a speaker and nearby junction box. Flexible conduit for this application shall be no longer than four (4) feet. Flexible conduit shall not be installed for any other paging system cabling.
- C. Refer to Specification Section 26 05 33 for additional requirements.

2.14 NON-CONTINUOUS CABLE HANGERS AND SUPPORTS

- A. Refer to Section 27 05 28 for requirements.

2.15 UNINTERRUPTIBLE POWER SUPPLY

- A. Features:
 1. Line-interactive design
 2. Sine wave output
 3. Integral surge protection
 4. Hot-swappable sealed lead-acid maintenance free batteries
 5. NEMA 5-15R output receptacles
 6. Rack mounted
- B. Specifications:
 1. Input Voltage: 120 volts AC
 2. Output Voltage: 120 volts AC
 3. Frequency Range: 46 to 65 Hz
 4. Operating Frequency: 60 Hz
 5. Transfer Time: ≥ 6 ms
 6. Audible Noise: ≥ 45 dB
- C. Acceptable Manufacturers:
 1. Emerson
 2. Eaton
 3. APC
- D. Provide uninterruptible power supply unit(s) of sufficient capacity and in sufficient quantity to provide a minimum of Four (4) hour of continued system operation in the event of a loss of utility power. For the purposes of calculating system power consumption to determine required UPS capacity, assume the system will be in use 30% of the specified UPS run time and at idle 70% of the specified UPS run time.

3. PART EXECUTION

3.1 INSTALLATION

- A. Comply with all manufacturer's instructions and recommendations for installation of all equipment, devices, and materials.
- B. Wiring:
 - 1. Refer to Sections 26 05 33 for conduit requirements and 26 05 13 for additional wiring requirements. Wiring shall be plenum rated.
 - 2. All cabling shall be run "free-air" in non-continuous cable supports or cable tray above accessible ceilings. Supports shall be spaced at a maximum 4-foot interval. If cable "sag" at mid-span exceeds 6 inches, another support shall be used.
 - 3. Cable shall not be laid directly on the ceiling grid or attached in any manner to the ceiling grid wires. Cables shall not be attached to or supported by existing cabling, plumbing or steam piping, ductwork, ceiling supports, electrical or communications conduit, or structural elements.
 - 4. Manufacturer's minimum bend radius specifications for cables shall be observed in all instances.
 - 5. All cable shall be installed at right angles and be kept clear of work by other trades. To reduce or eliminate EMI, the following minimum separation distances from $\leq 480V$ power lines shall be adhered to:
 - a. 12 inches from power lines of $<5\text{-kVa}$
 - b. 18 inches from high voltage lighting (including fluorescent)
 - c. 39 inches from power lines of 5-kVa or greater
 - d. 39 inches from transformers and motors
 - 6. It shall be noted that all cables shall be installed in continuous lengths from endpoint to endpoint. No splices shall be allowed unless noted otherwise.
 - 7. All cable shall be free of tension at both ends.
 - 8. Both ends of all cables shall be clearly labeled with an alphanumeric identifier. On speaker cables, the label shall indicate the speaker cable circuit zone or run and the telecommunications room in which the zone or run initiates; on line-level cables, the label shall indicate the signal and signal source. Record all speaker cable identifiers on record drawings.
 - 9. No acid core or other corrosive flux solder shall be used in this system.
 - 10. Speaker cable conductor sizes listed are minimum requirements. Actual wire size required shall be determined by the Contractor to maintain a maximum of 10% voltage drop or 0.5 dB insertion loss on any speaker zone. Actual speaker cabling installed shall meet or exceed minimum conductor sizes listed. Basis of design paging speaker cable listed herein is provided to list the minimum criteria and performance requirements for paging speaker cable.
 - 11. The polarity of all cabling shall remain consistent throughout the project, on all equipment.
 - 12. Do not run unbalanced audio signals over cables longer than 10 feet. Contractor shall provide a shielded transformer-based converter at signal source to convert the unbalanced signal to a balanced signal.
 - 13. The Contractor shall provide an isolation transformer for any balanced or unbalanced audio line that exhibits hum, EMI / RFI, power line noise, or ground loops.

14. Provide all system wiring between all components as shown on project documents, as directed by the manufacturer, and/or required for proper system operation and to provide specified system functionality.

C. Equipment:

1. All necessary devices, sub-components, accessories, and incidental materials required to provide a complete, turn-key paging system that provides specified performance and all required system features and functions listed herein and as further detailed on the drawings shall be provided and installed as part of a complete system.
2. All speakers shall be connected in proper polarity.
3. Install all head end equipment and devices in a manner that allows ample air flow for cooling.
4. Install and tighten all connectors in accordance with manufacturer's instructions, using the appropriate purpose-designed tools recommended by the manufacturer for that purpose. Use caution to avoid stripping or damaging connectors, terminals, or equipment by over-tightening termination fasteners.
5. The conductor color code used in terminating system cabling at system equipment and devices shall remain consistent from device to device for each unique device type throughout the project.

D. Grounding Requirements:

1. Furnish and install a minimum #6 AWG bonding conductor from each overhead paging system head end component to the nearest wall-mounted telecommunications grounding busbar. Actual bonding conductor size determined by its installed length. Refer to Section 27 05 26 for grounding and bonding conductor sizing criteria.
2. Audio cable shields for line level signals shall be connected to the metal equipment chassis at both ends of the cable. Audio cables connected to transformers shall have the cable shield connected to the transformer shield and transformer case ground.
3. Speaker cables containing shields shall not have the shields grounded at conduits, boxes, racks, etc. Ground speaker cable shields at signal origin telecommunications room end only.

3.2 FIELD QUALITY CONTROL

- A. Where these specifications require a product or assembly without the use of a brand or trade name, provide a product that meets the requirements of the specifications, as supplied and warranted by the system vendor. If the product or assembly is not available from the system vendor, provide product or assembly as recommended by the system vendor.
- B. Furnished products shall be listed and classified by UL as suitable for purpose specified and indicated.
- C. Periodic observations will be performed during construction to verify compliance with the requirements of the project documents. These services do not relieve the Contractor of responsibility for compliance with the project documents.

3.3 SYSTEM SETUP, PROGRAMMING, AND ADJUSTMENT

- A. The Contractor shall provide all system programming, startup, balancing, tuning, and adjustment required as part of this project. This shall include all calibration and adjustments of equipment controls, troubleshooting, and final adjustments that may be required.
- B. Complete all necessary programming to provide the indicated functionality.

- C. Program priority override hierarchy as follows:
 - 1. Voice paging microphone
 - 2. Voice Voip input
 - 3. Voice message input
 - 4. Schedule tones
 - 5. Night ring
 - 6. Background music
- D. Paging system shall be adjusted to provide 70 dBA of sound in classrooms and 80 hallways dBA of sound 10 dBA of sound above the ambient sound level in the space in which they are installed measured at one (1) meter from each speaker when voice pages are made. Sound shall be clear, even, and undistorted and free of any hum, noise, or sonic anomalies. Where speakers are controlled via local volume controls, adjustments shall be made with the volume control set at 70%.
- E. Paging system zone output equalization shall be adjusted to achieve +/- 3 dB over entire published effective frequency range of installed speakers, measured on axis at a distance of 1 meter from 10% of each speaker type installed +/- 4 dB over the 2,000 Hz octave band throughout all corridors, open treatment areas, and public spaces. All efforts shall be made to adjust the audible system output's average frequency response in all areas covered by each speaker zone to be as equal as possible when measured at ISO R 266-1997 / ANSI S1.6-1984 1/3 octave preferred frequencies from 20 Hz to 20 KHz.

3.4 TESTING

- A. The Contractor shall conduct all system testing as part of the requirements of this project. This shall include all calibration and adjustments of equipment controls, troubleshooting, and final adjustments or corrective action that may be required to provide a complete system that provides the specified performance and all required system features and functions listed herein and as further detailed on the drawings.
- B. At a minimum, the installer shall perform the following inspections and tests of the installed overhead paging system:
 - 1. Verify that all features and functionality are operating properly.
 - 2. Verify that the system receives signal from all sources and routes those signals as specified.
 - 3. Verify that priority override hierarchy functions properly and according to the hierarchy specified.
 - 4. Verify that system output meets specified sound level at each speaker.
 - 5. Verify that system output meets specified equalization requirements in all coverage areas.
 - 6. Verify that all controls are properly labeled and interconnecting wires and terminals are identified.
- C. Document all test results and submit as part of final system documentation package.

3.5 TRAINING

- A. All labor and materials required for on-site system training shall be provided. Training shall be conducted at the project site using the project equipment.
- B. Provide two week's advanced notice of training to the user.
- C. Provide a training outline agenda describing the subject matter and the recommended audience for each topic.

- D. At a minimum, the following training shall be conducted:
1. Users:
 - a. Provide training on the system functions and operations that a daily user will encounter, including navigation of the user interface to accomplish common operations.
 2. Maintenance Staff:
 - a. Provide training on the system functions and operations that a daily user will encounter, including navigation of the user interface to accomplish all common operations.
 - b. Provide training on all system components and the basic configuration of the system.
 - c. Identify and describe preventive and remedial maintenance procedures to be performed by the Owner.
 - d. Review troubleshooting flow charts and describe troubleshooting procedures for common issues.
- E. Minimum on-site training times shall be:
1. Users: Four (4) hours.
 2. Maintenance Staff: Four (4) hours.

END OF SECTION

SECTION 27 53 13

CENTRAL CLOCK SYSTEM

1. PART GENERAL

1.1 SECTION INCLUDES

- A. This section describes the products and execution requirements related to furnishing and installing a Central Clock System.

1.2 RELATED WORK

- A. Section 26 05 33 – Conduit and Boxes
- B. Section 26 05 13 – Wire and Cable
- C. Section 27 05 00 – Basic Communications Requirements

1.3 QUALITY ASSURANCE

- A. The system equipment manufacturer shall maintain a service organization within 60 miles of the project site consisting of direct full-time employees under the supervision of a qualified service manager, whose name shall be furnished to the Owner. A part-time serviceman or a Sales Office only shall not be considered a qualified service organization.
- B. The entire installation will comply with all applicable electrical and safety codes.
- C. The Contractor shall have a minimum of three (3) years documented experience in sound masking installation and commissioning. The Contractor shall own and maintain tools and equipment necessary for successful installation and testing of system and have personnel adequately trained in the use of such tools and equipment.
- D. Resume of qualification shall be submitted with the Contractor's proposal indicating the following:
 - 1. A list of recently completed projects of similar type and size with contact names and telephone numbers for each.
 - 2. List of test equipment proposed for use in verifying the installed integrity of sound masking systems.
 - 3. Technical resume of experience for the Contractor's project manager and on-site installation supervisor assigned to this project.

1.4 REFERENCES

- A. TIA/EIA 526-18 – Systematic Jitter Generation Measurement
- B. UL 863 – Time Indicating and Recording Appliances

1.5 SUBMITTALS

- A. Under the provisions of Section 27 05 00 and Division 1, prior to the start of work, the Contractor shall submit:
 - 1. Shop Drawings:
 - a. Provide a detailed drawing and system block diagram noting system components and interconnection between components. The inter-connection of components shall clearly indicate all wiring required in the system. When multiple pieces of equipment are required in the exact same configuration, the diagram may show one device and refer to the others as "typical" of the device shown.

2. Manufacturer's data covering all products proposed, indicating construction, materials, ratings and all other parameters identified in Part 2 - Products, below.
 3. Manufacturer's installation instructions.
- B. Contractor qualification documentation.
 - C. System commissioning procedure description.
- 1.6 DELIVERY, STORAGE, AND HANDLING
- A. Deliver products to and receive products at the site under provisions of Division 1, General Requirements.
 - B. Equipment must be stored according to manufacturer's recommendations.
 1. Equipment must be stored in a location protected from weather. If equipment is stored outside, it must be covered with opaque plastic or canvas, with provision for ventilation to prevent condensation and for protection from weather. If air temperature at equipment storage location will be below 40°F, the equipment shall be moved to a heated (50°F minimum) location.
- 1.7 SYSTEM DESCRIPTION
- A. Performance Statement: This specification section and the accompanying Central Clock specific design documents are performance based, describing the minimum material quality, required features, and operational requirements of the system. These documents do not convey every wire that must be installed and every equipment connection that must be made. Based on the equipment constraints described and the performance required of the system, as presented in these documents, the vendor and the Contractor are solely responsible for determining all wiring, programming and miscellaneous equipment required for a complete and operational system.
 - B. Furnish and install complete with all accessories, a Central Clock System. Furnish all materials, labor, tools, and system commissioning necessary to complete the installation of the clock system described in the Contract Documents.
 1. Complete central clock system including but not limited to: master clock, secondary clock, power, seven-day battery backup, controls, and all other equipment necessary to provide a complete and operating system.
 2. Commissioning of system includes settings.
 3. Documenting functionality, wiring, and settings.
- 1.8 WARRANTY
- A. Provide a one (1) year product and installation warranty for the Central Clock System.
 - B. The product warranty shall ensure against product defects and that all approved cabling and other components specified in this section meet or exceed the specified requirements.
 - C. The product warranty shall cover the replacement or repair of the defective product(s) and labor for the replacement or repair of such defective product(s).
- 1.9 PROJECT RECORD DOCUMENTS
- A. Submit documents under the provisions of Section 27 05 00.
 - B. Provide final system block diagram showing any deviations from shop drawing submittal.

- C. Provide statement that system checkout test, as outlined in shop drawing submittal, is complete and satisfactory.
- D. Provide schedules documenting:
 - 1. All terminal block wiring, including cable numbers.
 - 2. Clock numbers and location.
- E. Warranty: Submit written warranty and complete all Owner registration forms.
- F. Complete all operation and maintenance manuals as described below.

1.10 OPERATION AND MAINTENANCE DATA

- A. Submit documents under the provisions of Section 27 05 00.
- B. Operation Data: Provide full system operation instructions for each piece of equipment.
- C. Maintenance Data: Document any manufacturer's recommended preventative maintenance procedures to be performed by the Owner.

2. PART PRODUCTS

2.1 ACCEPTED SYSTEMS

- A. Primex
- B. Preapproved equals
 - 1. Chronos

2.2 SYSTEM EQUIPMENT

- A. The use of low voltage clocks is preferable. If +120 VAC clocks are used, refer to drawings for circuiting.
- B. Master Clock Controller:
 - 1. Microprocessor-based circuitry.
 - 2. "User-friendly" programming from keyboard.
 - 3. Non-volatile memory for protection of all programs.
 - 4. Up to 350 events may be scheduled for any combination of zones and schedules.
 - 5. Minimum of four zones and four schedules available.
 - 6. LED digital display of mode time, zones and schedules.
 - 7. 12- or 24-hour display on 12-hour operation.
 - 8. 1 to 59 second programmable signal duration zone.
 - 9. Latched zone operation for controlling lights or devices if desired.
 - 10. Output zone relays rated at 5 amps with built-in noise suppression.
 - 11. Correction of three (3) different clock systems simultaneously.
 - 12. Accumulation of down-time during power outage to reset slave clocks, minute impulse, synchronous and digitals, immediate correction shall begin after the power has been restored.
 - 13. Crystal control time base for assured accuracy.
 - 14. Five (5) year Lithium Battery Backup for master clock operation.
 - 15. Electronic keyboard lock-out.
 - 16. Speed Dial Keys.
 - 17. Auxiliary Data Jack.

C. Secondary Analog Clocks:

1. Flush mounted.
2. Full 12" face for exceptionally high readability.
3. 24 VAC synchronization correcting.
4. All metal case with convex glass crystal.
5. Finished in satin aluminum enamel.
6. Character height = 1-1/4".
7. Provide wire guards where noted on the drawings.
8. 12-hour display.
9. Red sweep secondhand.
10. Provide wall box.

3. PART EXECUTION

3.1 SYSTEM INSTALLATION REQUIREMENTS

A. General Requirements:

1. Contractor shall furnish and install all cables, connectors and equipment as shown on the drawings and as specified above.
2. It is the Contractor's responsibility to survey the site and include all necessary costs to perform the installation as specified.
3. The Contractor shall provide adequate labels so that the function of each cable can be determined by visual inspection.

3.2 INSTALLATION PROCEDURES

A. Cabling:

1. All cabling shall comply with Sections 26 05 33 and 26 05 13.
2. Cabling and control wiring shall be stranded copper.
 - a. Clock wiring shall be at least #18 AWG for +24V clocks and #12 AWG for +120V clocks.
 - b. If the requirements of Division 26 do not require low voltage cabling to be in conduit, provide plenum rated cable.

3.3 IDENTIFICATION AND LABELING

- A. Each cable terminated at the equipment shall be marked for identification purposes and this mark shall be shown on the record drawings.
- B. Labeling: The Contractor shall provide adequate labels so that the function of each cable can be determined by visual inspection.

3.4 SYSTEM TESTING

- A. Make sure ALL system components are working correctly.
- B. Make sure all labels reflect the correct operation.
- C. If the results of these tests require changes to the system, record the changes on the Contractor's record drawings.

3.5 SYSTEM TRAINING

- A. All labor and materials required for on-site system training by a certified representative of the system manufacturer shall be provided. Training shall be conducted at the project site using the project equipment.
- B. Provide two weeks advanced notice of training to the Owner.
- C. Provide a training outline agenda describing the subject matter and the recommended audience for each topic.
- D. At a minimum, the following training shall be conducted:
 - 1. Building System Engineer: A course detailing the system functions and operations. Provide configuration training on all aspects of the system.
- E. Minimum on-site training times shall be:
 - 1. Building System Engineer: Two (2) hours.

END OF SECTION

SECTION 28 05 00

BASIC ELECTRONIC SAFETY AND SECURITY SYSTEM REQUIREMENTS

1. PART GENERAL

1.1 SECTION INCLUDES

- A. Basic Safety and Security System Requirements (herein referred to Security) specifically applicable to Division 28 sections, in addition to Division 1 - General Requirements.
- B. All materials and installation methods shall conform to the applicable standards, guidelines and codes referenced herein and within each specification section.

1.2 REFERENCES

- A. OSHPD - Office of State Wide Health Planning and Development (California)
- B. CCR California Code of Regulation
- C. CBC California Building Code
- D. CFC California Fire Code
- E. CEC California Electric Code
- F. CMC California Mechanical Code
- G. CPC California Plumbing Code
- H. California Title 24 - Building Energy Efficiency Standards
- I. SCAQMD Southern California Air Quality Management Division

1.3 SCOPE OF WORK

- A. This Specification and the accompanying drawings govern the work involved in furnishing, installing, testing and placing into satisfactory operation the security systems as shown on the drawings and specified herein.
- B. Each Contractor shall provide all new materials as indicated in the schedules on the drawings, and/or in these specifications, and all items required to make their portion of the security systems a finished and working system.
- C. Description of systems include but are not limited to the following:
 - 1. Electronic access control system
 - 2. Electronic intrusion detection system
 - 3. Video surveillance
 - 4. Fire detection and alarm
 - 5. Low voltage security wiring (less than +120VAC) as specified and required for proper system control and communications.
 - 6. All associated electrical backboxes, conduit, miscellaneous cabling, and power supplies required for proper system installation and operation as defined in the "Suggested Matrix of Scope Responsibility".
 - 7. Firestopping of penetrations of fire-rated construction as described in Division 7.

1.4 DIVISION OF WORK BETWEEN ELECTRICAL AND SECURITY CONTRACTORS

- A. Division of work is the responsibility of the Prime Contractor. Any scope of work described in the contract document shall be sufficient for including said requirement in the project. The Prime Contractor shall be solely responsible for determining the appropriate subcontractor for the described scope. In no case shall the project be assessed an additional cost for scope that is described in the contract documents. The following division of responsibility is a guideline based on typical industry practice.
- B. Definitions:
1. "Electrical Contractor" as referred to herein refers to the Contractors listed in Division 26 of this Specification.
 2. "Electrical Contractor" shall also refer to the Contractor listed in Division 28 of this specification when the "Suggested Matrix of Scope Responsibility" indicates the work shall be provided by the EC. Refer to the Contract Documents for the "Suggested Matrix of Scope Responsibility".
 3. "Security Contractor" as referred to herein refers to the Contractors listed in Division 28 of this Specification.
 4. Low Voltage Security Wiring: The wiring (less than 120VAC) associated with the Security Systems, used for analog and/or digital signals between equipment.
- C. General:
1. The purpose of these Specifications is to outline typical Electrical and Security Contractor's work responsibilities as related to security systems including back boxes, conduit, power wiring and low voltage security wiring. The prime contractor is responsible for all divisions of work.
 2. The exact wiring requirements for much of the equipment cannot be determined until the systems have been purchased and submittals are approved. Therefore, only known wiring, conduits, raceways, and electrical power as related to such items, is shown on the Security Drawings. Other wiring, conduits, raceways, junction boxes, and electrical power not shown on the Security Drawings but required for the successful operation of the systems shall be the responsibility of the Security Contractor and included in the Contractor's bid.
 3. Where the Electrical Contractor is required to install conduit, conduit sleeves and/or power connections in support of Security systems, the final installation shall not begin until a coordination meeting between the Electrical Contractor and the Security Contractor has convened to determine the exact location and requirements of the installation.
 4. Where the Electrical Contractor is required to install cable tray that will contain Low Voltage Security Wiring, the installation shall not begin until the Security Contractor has completed a coordination review of the cable tray shop drawing.
 5. This Contractor shall establish Electrical and Security utility elevations prior to fabrication and installation. The Security Contractor shall cooperate with the Electrical Contractor and the determined elevations in accordance with the guidelines below. This Contractor shall coordinate utility elevations with other trades. When a conflict arises, priority shall be as follows:
 - a. Lighting Fixtures
 - b. Gravity Flow Piping, including Steam and Condensate
 - c. Sheet Metal
 - d. Electrical Busduct
 - e. Cable Trays, including 12" access space
 - f. Sprinkler Piping and other Piping

- g. Conduit and Wireway
- h. Open Cabling

D. Electrical Contractor's Responsibility:

1. Assumes all responsibility for all required conduit and power connections when shown on the "Suggested Matrix of Scope Responsibility" to be provided by the Electrical Contractor.
2. This Contractor is responsible for coordination of utilities with all other Contractors. If any field coordination conflicts are found, the Contractor shall coordinate with other Contractors to determine a viable layout.

E. Security Contractor's Responsibility:

1. Assumes all responsibility for the low voltage security wiring of all systems, including cable support where open cable is specified.
2. Assumes all responsibility for all required backboxes, conduit and power connections not specifically shown as being provided by the Electrical Contractor on the "Suggested Matrix of Scope Responsibility."
3. Responsible for providing the Electrical Contractor with the required grounding lugs or other hardware for each piece of security equipment which is required to be bonded to the telecommunications bonding system.
4. This Contractor is responsible for coordination of utilities with all other Contractors. If any field coordination conflicts are found, the Contractor shall coordinate with other contractors to determine a viable layout.

1.5 COORDINATION DRAWINGS

A. Definitions:

1. Coordination Drawings: A compilation of the pertinent layout and system drawings that show the sizes and locations, including elevations, of system components and required access areas to ensure that no two objects will occupy the same space.
 - a. Mechanical trades shall include, but are not limited to, mechanical equipment, ductwork, fire protection systems, plumbing piping, medical gas systems, hydronic piping, steam and steam condensate piping, and any item that may impact coordination with other disciplines.
 - b. Electrical trades shall include, but are not limited to, electrical equipment, conduit 1.5" and larger, conduit racks, cable trays, pull boxes, transformers, raceway, busway, lighting, ceiling-mounted devices, and any item that may impact coordination with other disciplines.
 - c. Technology trades shall include, but are not limited to, technology equipment, racks, conduit 1.5" and larger, conduit racks, cable trays, ladder rack, pull boxes, raceway, ceiling-mounted devices, and any item that may impact coordination with other disciplines.
 - d. Maintenance clearances and code-required dedicated space shall be included.
 - e. The coordination drawings shall include all underground, underfloor, in-floor, in chase, and vertical trade items.
2. The contractors shall use the coordination process to identify the proper sequence of installation of all utilities above ceilings and in other congested areas, to ensure an orderly and coordinated end result, and to provide adequate access for service and maintenance.

B. Participation:

1. The contractors and subcontractors responsible for work defined above shall participate in the coordination drawing process.
2. One contractor shall be designated as the Coordinating Contractor for purposes of preparing a complete set of composite electronic CAD coordination drawings that include all applicable trades, and for coordinating the activities related to this process. The Coordinating Contractor for this project shall be the Mechanical Contractor.
 - a. The Coordinating Contractor shall utilize personnel familiar with requirements of this project and skilled as draftspersons/CAD operators, competent to prepare the required coordination drawings.
3. Electronic CAD drawings shall be submitted to the Coordinating Contractor for addition of work by other trades. IMEG will provide electronic file copies of ventilation drawings for contractor's use if the contractor signs and returns an "Electronic File Transfer" waiver provided by IMEG. IMEG will not consider blatant reproductions of original file copies an acceptable alternative for coordination drawings.

C. Drawing Requirements:

1. The file format and file naming convention shall be coordinated with and agreed to by all contractors participating in the coordination process and the Owner.
 - a. Scale of drawings:
 - 1) General plans: 1/4 Inch = 1'-0" (minimum).
 - 2) Mechanical, electrical, communication rooms, and including the surrounding areas within 10 feet: 1/2 Inch = 1'-0" (minimum).
 - 3) Shafts and risers: 1/2 Inch = 1'-0" (minimum).
 - 4) Sections of shafts and mechanical and electrical equipment rooms: 1/4 Inch = 1'-0" (minimum).
 - 5) Sections of congested areas: 1/2 Inch = 1'-0" (minimum).
2. Ductwork layout drawings shall be the baseline system for other components. Ductwork layout drawings shall be modified to accommodate other components as the coordination process progresses.
3. There may be more drawings required for risers, top and bottom levels of mechanical rooms, and shafts.
4. The minimum quantity of drawings will be established at the first coordination meeting and sent to the A/E for review. Additional drawings may be required if other areas of congestion are discovered during the coordination process.

D. General:

1. Coordination drawing files shall be made available to the A/E and Owner's Representative. The A/E will only review identified conflicts and give an opinion, but will not perform as a coordinator.
2. A plotted set of coordination drawings shall be available at the project site.
3. Coordination drawings are not shop drawings and shall not be submitted as such.

4. The contract drawings are schematic in nature and do not show every fitting and appurtenance for each utility. Each contractor is expected to have included in his/her bid sufficient fittings, material, and labor to allow for adjustments in routing of utilities made necessary by the coordination process and to provide a complete and functional system.
5. The contractors will not be allowed additional costs or time extensions due to participation in the coordination process.
6. The contractors will not be allowed additional costs or time extensions for additional fittings, reroutings or changes of duct size, that are essentially equivalent sizes to those shown on the drawings and determined necessary through the coordination process.
7. The A/E reserves the right to determine space priority of equipment in the event of spatial conflicts or interference between equipment, piping, conduit, ducts, and equipment provided by the trades.
8. Changes to the contract documents that are necessary for systems installation and coordination shall be brought to the attention of the A/E.
9. Access panels shall preferably occur only in gypsum board walls or plaster ceilings where indicated on the drawings.
 - a. Access to mechanical, electrical, technology, and other items located above the ceiling shall be through accessible lay-in ceiling tile areas.
 - b. Potential layout changes shall be made to avoid additional access panels.
 - c. Additional access panels shall not be allowed without written approval from the A/E at the coordination drawing stage.
 - d. Providing additional access panels shall be considered after other alternatives are reviewed and discarded by the A/E and the Owner's Representative.
 - e. When additional access panels are required, they shall be provided without additional cost to the Owner.
10. Complete the coordination drawing process and obtain signoff of the drawings by all contractors prior to installing any of the components.
11. Conflicts that result after the coordination drawings are signed off shall be the responsibility of the contractor or subcontractor who did not properly identify their work requirements, or installed their work without proper coordination.
12. Updated coordination drawings that reflect as-built conditions may be used as record documents.

1.6 QUALITY ASSURANCE

A. Qualifications:

1. Only products of reputable manufacturers as determined by the Architect/Engineer will be acceptable.
2. Each Contractor and their subcontractors shall employ only workers who are skilled in their respective trades and fully trained. All workers involved in the installation, termination, testing, and placing into operation electronic security devices shall be individually trained by the manufacturer.
3. The Contractor shall be experienced in all aspects of this work and shall be required to demonstrate direct experience on recent systems of similar type and size.

4. The Contractor shall own and maintain tools and equipment necessary for successful installation and testing of electronic security devices and have personnel adequately trained in the use of such tools and equipment.
 5. A resume of qualification shall be submitted with the Contractor's bid indicating the following:
 - a. A list of recently completed projects of similar type and size with contact names and telephone numbers for each.
- B. Compliance with Codes, Laws, Ordinances:
1. Conform to all requirements of the State of California Codes, Laws, Ordinances and other regulations having jurisdiction.
 2. Conform to all published standards of Oxnard School District.
 3. In the event there are no local codes having jurisdiction over this job, the current issue of the National Electrical Code shall be followed.
 4. If there is a discrepancy between the codes and regulations having jurisdiction over this installation, and these specifications, Architect/Engineer shall determine the method or equipment used.
 5. If the Contractor notes, at the time of bidding, any parts of the drawings and specifications which are not in accordance with the applicable codes or regulations, he shall inform the Architect/Engineer in writing, requesting a clarification. If there is insufficient time to follow this procedure, he shall submit with the proposal, a separate price required to make the system shown on the drawings comply with the codes and regulations.
 6. Verify the installation environment prior to purchasing or installing any cable. Cable installed in a plenum environment shall be appropriately rated. Bring all discrepancies between the contract documents and installation conditions to the attention of the Architect/Engineer prior to purchase or installation.
 7. All changes to the system made after the letting of the contract, in order to comply with the applicable codes or the requirements of the Inspector, shall be made by the Contractor without cost to the Owner.
- C. Permits, Fees, Taxes, Inspections:
1. Procure all applicable permits and licenses.
 2. Abide by all applicable laws, regulations, ordinances, and other rules of the State or Political Subdivision wherein the work is done, or as required by any duly constituted public authority.
 3. Pay all applicable charges for such permits or licenses that may be required.
 4. Pay all applicable fees and taxes imposed by the State, Municipal and/or other regulatory bodies.
 5. Pay all charges arising out of required inspections due to codes, permits, licenses or as otherwise may be required by an authorized body.
 6. Pay all charges arising out of required contract document reviews associated with the project and as initiated by the Owner or authorized independent agency/consultant.

7. All equipment, and materials shall be as approved or listed by the following: (Unless approval or listing is not applicable to an item by all acceptable manufacturers.)
 - a. Factory Mutual
 - b. Underwriters' Laboratories, Inc.

D. Examination of Drawings:

1. The drawings for the Security Systems work are diagrammatic, intended to convey the scope of the work and to indicate the general arrangements and locations of equipment etc., and the approximate sizes of equipment.
2. Contractor shall determine the exact locations of equipment and the exact routing of cabling to best fit the layout of the job. Scaling of the drawings will not be sufficient or accurate for determining this layout. Where a specific route is required, such route will be indicated on the drawings.
3. Where job conditions require reasonable changes in indicated arrangements and locations, such changes shall be made by the Contractor at no additional cost to the Owner.
4. If an item is either shown on the drawings, called for in the specifications or required for proper operation of the system, it shall be considered sufficient for including same in this contract.
5. The determination of quantities of material and equipment required shall be made by the Contractor from the drawings. Schedules on the drawings and in the specifications are completed as an aid to the Contractor but where discrepancies arise, the greater number shall govern.
6. Where words "provide", "install", or "furnish" are used on the drawings or in the specifications, it shall be taken to mean, to furnish, install and terminate completely ready for operation, the items mentioned.

E. Electronic Media/Files:

1. Construction drawings for this project have been prepared utilizing Revit.
2. Contractors and Subcontractors may request electronic media files of the contract drawings and/or copies of the specifications. Specifications will be provided in PDF format.
3. Upon request for electronic media, the Contractor shall complete and return a signed "Electronic File Transmittal" form provided by IMEG.
4. If the information requested includes floor plans prepared by others, the Contractor will be responsible for obtaining approval from the appropriate Design Professional for use of that part of the document.
5. The electronic contract documents can be used for preparation of shop drawings and as-built drawings only. The information may not be used in whole or in part for any other project.
6. The drawings prepared by IMEG for bidding purposes may not be used directly for ductwork layout drawings or coordination drawings.
7. The use of these CAD documents by the Contractor does not relieve them from their responsibility for coordination of work with other trades and verification of space available for the installation.
8. The information is provided to expedite the project and assist the Contractor with no guarantee by IMEG as to the accuracy or correctness of the information provided. IMEG accepts no responsibility or liability for the Contractor's use of these documents.

F. Field Measurements:

1. Before ordering any materials, this Contractor shall verify all pertinent dimensions at the job site and be responsible for their accuracy.

1.7 SUBMITTALS

A. Submittals shall be required for the following items, and for additional items where required elsewhere in the specifications or on the drawings.

1. Submittals list:

Referenced Specification Section	Submittal Item
28 13 00	Electronic Access Control
28 16 00	Intrusion Detection System

B. General Submittal Procedures: In addition to the provisions of Division 1, the following are required:

1. Transmittal: Each transmittal shall include the following:

- a. Date
- b. Project title and number
- c. Contractor's name and address
- d. Division of work (e.g., plumbing, heating, ventilating, etc.)
- e. Description of items submitted and relevant specification number
- f. Notations of deviations from the contract documents
- g. Other pertinent data

2. Submittal Cover Sheet: Each submittal shall include a cover sheet containing:

- a. Date
- b. Project title and number
- c. Architect/Engineer
- d. Contractor and subcontractors' names and addresses
- e. Supplier and manufacturer's names and addresses
- f. Division of work (e.g., plumbing, heating, ventilating, etc.)
- g. Description of item submitted (using project nomenclature) and relevant specification number
- h. Notations of deviations from the contract documents
- i. Other pertinent data
- j. Provide space for Contractor's review stamps

3. Composition:

- a. Submittals shall be submitted using specification sections and the project nomenclature for each item.
- b. Individual submittal packages shall be prepared for items in each specification section. All items within a single specification section shall be packaged together where possible. An individual submittal may contain items from multiple specifications sections if the items are intimately linked (e.g., pumps and motors).
- c. All sets shall contain an index of the items enclosed with a general topic description on the cover.

4. Content: Submittals shall include all fabrication, erection, layout, and setting drawings; manufacturers' standard drawings; schedules; descriptive literature, catalogs and brochures; performance and test data; wiring and control diagrams; dimensions; shipping and operating weights; shipping splits; service clearances; and all other drawings and descriptive data of materials of construction as may be required to show that the materials, equipment or systems and the location thereof conform to the requirements of the contract documents.
5. Contractor's Approval Stamp:
 - a. The Contractor shall thoroughly review and approve all shop drawings before submitting them to the Architect/Engineer. The Contractor shall stamp, date and sign each submittal certifying it has been reviewed.
 - b. Unstamped submittals will be rejected.
 - c. The Contractor's review shall include, but not be limited to, verification of the following:
 - 1) Only approved manufacturers are used.
 - 2) Addenda items have been incorporated.
 - 3) Catalog numbers and options match those specified.
 - 4) Performance data matches that specified.
 - 5) Electrical characteristics and loads match those specified.
 - 6) Equipment connection locations, sizes, capacities, etc. have been coordinated with other affected trades.
 - 7) Dimensions and service clearances are suitable for the intended location.
 - 8) Equipment dimensions are coordinated with support steel, housekeeping pads, openings, etc.
 - 9) Constructability issues are resolved (e.g., weights and dimensions are suitable for getting the item into the building and into place, sinks fit into countertops, etc.).
 - d. The Contractor shall review, stamp and approve all subcontractors' submittals as described above.
 - e. **The Contractor's approval stamp is required on all submittals. Approval will indicate the Contractor's review of all material and a complete understanding of exactly what is to be furnished. Contractor shall clearly mark all deviations from the contract documents on all submittals. If deviations are not marked by the Contractor, then the item shall be required to meet all drawing and specification requirements.**
6. Submittal Identification and Markings:
 - a. The Contractor shall clearly mark each item with the same nomenclature applied on the drawings or in the specifications.
 - b. The Contractor shall clearly indicate the size, finish, material, etc.
 - c. Where more than one model is shown on a manufacturer's sheet, the Contractor shall clearly indicate exactly which item and which data is intended.
 - d. All marks and identifications on the submittals shall be unambiguous.
7. Schedule submittals to expedite the project. Coordinate submission of related items.
8. Identify variations from the contract documents and product or system limitations that may be detrimental to the successful performance of the completed work.
9. Reproduction of contract documents alone is not acceptable for submittals.

10. Incomplete submittals will be rejected without review. Partial submittals will only be reviewed with prior approval from the Architect/Engineer.
11. Submittals not required by the contract documents may be returned without review.
12. The Architect/Engineer's responsibility shall be to review one set of shop drawing submittals for each product. If the first submittal is incomplete or does not comply with the drawings and/or specifications, the Contractor shall be responsible to bear the cost for the Architect/Engineer to recheck and handle the additional shop drawing submittals.
13. Submittals shall be reviewed and approved by the Architect/Engineer **before** releasing any equipment for manufacture or shipment.
14. Contractor's responsibility for errors, omissions or deviation from the contract documents in submittals is not relieved by the Architect/Engineer's approval.

C. Electronic Submittal Procedures:

1. Distribution: Email submittals as attachments to all parties designated by the Architect/Engineer, unless a web-based submittal program is used.
2. Transmittals: Each submittal shall include an individual electronic letter of transmittal.
3. Format: Electronic submittals shall be in PDF format only. Scanned copies, in PDF format, of paper originals are acceptable. Submittals that are not legible will be rejected. Do not set any permission restrictions on files; protected, locked, or secured documents will be rejected.
4. File Names: Electronic submittal file names shall include the relevant specification section number followed by a description of the item submitted, as follows. Where possible, include the transmittal as the first page of the PDF instead of using multiple electronic files.
 - a. Submittal file name: 28 XX XX.description.YYYYMMDD
 - b. Transmittal file name: 28 XX XX.description.YYYYMMDD
5. File Size: Electronic file size shall be limited to a maximum of 4MB. Larger files shall be transmitted via a pre-approved method.

1.8 CHANGE ORDERS

- A. A detailed material and labor takeoff shall be prepared for each change order, along with labor rates and markup percentages. Change orders with inadequate breakdown will be rejected.
- B. Change order work shall not proceed until authorized.

1.9 EQUIPMENT SUPPLIERS' INSPECTION

- A. The following equipment shall not be placed in operation until a representative of the manufacturer has inspected the installation and certified that the equipment is properly installed and that the equipment is ready for operation:
 1. Firestopping, including mechanical firestop systems.

1.10 PRODUCT DELIVERY, STORAGE, HANDLING & MAINTENANCE

- A. Exercise care in transporting and handling to prevent damage to fixtures, equipment and materials.
- B. Store materials on the site to prevent damage.
- C. Keep fixtures, equipment and materials clean, dry and free from harmful conditions.

1.11 NETWORK / INTERNET CONNECTED EQUIPMENT

- A. These specifications may require certain equipment or systems to have network, Internet and/or remote access capability ("Network Capability"). Any requirement for Network Capability shall be interpreted only as a functional capability and is not to be construed as authority to connect or enable any Network Capability. Network Capability may only be connected or enabled with the express written consent of the Owner.

1.12 WARRANTY

- A. At a minimum, provide a one (1) year warranty for all equipment, materials, and workmanship. Individual specifications sections within Division 28 may require additional warranty requirements for specific equipment or systems.
- B. The warranty period for the entire installation described in this Division of the specifications shall commence on the date of substantial completion unless a whole or partial system or any separate piece of equipment or component is put into use for the benefit of any party other than the installing contractor with prior written authorization. In this instance, the warranty period shall commence on the date when such whole system, partial system or separate piece of equipment or component is placed in operation and accepted in writing by the Owner or their representative.
- C. Warranty requirements shall extend to correction, without cost to the final user, of all work and/or equipment found to be defective or nonconforming to the contract documents. The Contractor shall bear the cost of correcting all damage resulting from such defects or nonconformance with contract documents exclusive of repairs required as a result of improper maintenance or operation, or of normal wear as determined by the Architect/Engineer.

1.13 INSURANCE

- A. This Contractor shall maintain insurance coverage as set forth in Division 1 of these specifications.

1.14 MATERIAL SUBSTITUTION

- A. Where several manufacturers' names are given, the first named manufacturer constitutes the basis for job design and establishes the equipment quality required.
- B. Equivalent equipment manufactured by the other named manufacturers may be used. Contractor shall ensure that all items submitted by these other manufacturers meets all requirements of the drawings and specifications and fits in the allocated space. The Architect/Engineer shall make the final determination of whether a product is equivalent.
- C. Any material, article or equipment of other unnamed manufacturers which will adequately perform the services and duties imposed by the design and is of a quality equal to or better than the material, article or equipment identified by the drawings and specifications may be used if approval is secured in writing from the Architect/Engineer via addendum. The Contractor bears full responsibility for the unnamed manufacturers equipment adequately meeting the intent of design. The Architect/Engineer may reject manufacturer at time of shop drawing submittal. The Contractor assumes all costs incurred by other trades on the project as a result of changes necessary to accommodate the offered material, equipment or installation method.
- D. Should this Contractor be unable to secure approval from the Architect/Engineer for other unnamed manufacturers as outlined above, this Contractor may list voluntary add or deduct prices for alternate materials on the bid form. These items will not be used in determining the low bidder. Should a voluntary alternate material be accepted, This Contractor shall assume all costs that may be incurred as a result of using the offered material, article or equipment necessitating extra expense on This Contractor or on the part of other Contractors whose work is affected.

PRODUCTS

1.15 REFER TO INDIVIDUAL SECTIONS

2. PART EXECUTION

2.1 JOBSITE SAFETY

- A. Neither the professional activities of the Architect/Engineer, nor the presence of the Architect/Engineer or his or her employees and subconsultants at a construction site, shall relieve the Contractor and any other entity of their obligations, duties and responsibilities including, but not limited to, construction means, methods, sequence, techniques or procedures necessary for performing, superintending or coordinating all portions of the work of construction in accordance with the contract documents and any health or safety precautions required by any regulatory agencies. The Architect/Engineer and his or her personnel have no authority to exercise any control over any construction contractor or other entity or their employees in connection with their work or any health or safety precautions. The Contractor is solely responsible for jobsite safety. The Architect/Engineer and the Architect/Engineer's consultants shall be indemnified and shall be made additional insureds under the Contractor's general liability insurance policy.

2.2 GENERAL INSTALLATION REQUIREMENTS

- A. Installation of all conduit and cabling shall comply with Sections 26 05 33 and 26 05 13. Additional conduit requirements described within this Division shall be supplemental to the requirement described in Section 26 05 33. Should conflicts exist between the two Divisions the more stringent (more expensive material and labor) condition shall prevail until bidding addendum or construction clarification or RFI can be submitted and responded to. In no case shall the Contractor carry the least stringent condition in the pricing.
- B. It is the Contractor's responsibility to survey the site and include all necessary costs to perform the installation as specified.
- C. All cables and devices installed in damp or wet locations, including any underground or underslab location, shall be listed as suitable for use in such environments. Follow manufacturer's recommended installation practices for installing cables and devices in damp or wet locations. Any cable or device that fails as a result of being installed in a damp or wet location shall be replaced at the Contractor's expense.

2.3 FIELD QUALITY CONTROL

- A. General:
 - 1. Refer to specific Division 28 sections for further requirements.
 - 2. The Contractor shall conduct all tests required and applicable to the work both during and after construction of the work.
 - 3. The necessary instruments and materials required to conduct or make the tests shall be supplied by the Contractor who shall also supply competent personnel for making the tests who has been schooled in the proper testing techniques.
 - 4. In the event the results obtained in the tests are not satisfactory, This Contractor shall make such adjustments, replacements and changes as are necessary and shall then repeat the test or tests which disclose faulty or defective work or equipment, and shall make such additional tests as the Architect/Engineer or code enforcing agency deems necessary.

B. Protection of cable from foreign materials:

1. It is the Contractor's responsibility to provide adequate physical protection to prevent foreign material application or contact with any cable type. Foreign material is defined as any material that would negatively impact the validity of the manufacturer's performance warranty. This includes, but is not limited to, overspray of paint (accidental or otherwise), drywall compound, or any other surface chemical, liquid or compound that could come in contact with the cable, cable jacket or cable termination components.
2. Application of foreign materials of any kind on any cable, cable jacket or cable termination component will not be accepted. It shall be the Contractor's responsibility to replace any component containing overspray, in its entirety, at no additional cost to the project. Cleaning of the cables with harsh chemicals is not allowed. This requirement is regardless of the PASS/FAIL test results of the cable containing overspray. Should the manufacturer and warrantor of the structured cabling system desire to physically inspect the installed condition and certify the validity of the structured cabling system (via a signed and dated statement by an authorized representative of the structured cabling manufacturer), the Owner may, at their sole discretion, agree to accept said warranty in lieu of having the affected cables replaced. In the case of plenum cabling, in addition to the statement from the manufacturer, the Contractor shall also present to the Owner a letter from the local Authority Having Jurisdiction stating that they consider the plenum rating of the cable to be intact and acceptable.

2.4 PROJECT CLOSEOUT

A. Refer to the Division 1 Section: PROJECT CLOSEOUT for requirements. The following paragraphs supplement the requirements of Division 1.

B. Final Jobsite Observation:

1. The Architect/Engineer will not perform a final jobsite observation until the project is ready. This is not dictated by schedule, but rather by completeness of the project.
2. Refer to the end of Section 27 05 00 for a "STATEMENT INDICATING READINESS FOR FINAL JOBSITE OBSERVATION."
3. The Contractor shall sign this form and return it to the Architect/Engineer so that the final observation can commence.

C. Before final payment will be authorized, this Contractor must have completed the following:

1. Submitted operation and maintenance manuals to the Architect/Engineer for review.
2. Submitted bound copies of approved shop drawings.
3. Record documents including edited drawings and specifications accurately reflecting field conditions, **inclusive** of all project revisions, change orders, and modifications.
4. Submitted a report stating the instructions given to the Owner's representative complete with the number of hours spent in the instruction. The report shall bear the signature of an authorized agent of This Contractor and shall be signed by the Owner's representative as having received the instructions.
5. Submitted testing reports for all systems requiring final testing as described herein.
6. Submitted start-up reports on all equipment requiring a factory installation inspection and/or start.
7. Provide spare parts, maintenance, and extra materials in quantities specified in individual specification sections. Deliver to project site; submit receipt to Architect/Engineer prior to final payment being approved.

2.5 OPERATION AND MAINTENANCE MANUALS

A. General:

1. Provide an electronic copy of the O&M manuals as described below for Architect/Engineer's review and approval. The electronic copy shall be corrected as required to address the Architect/Engineer's comments. Once corrected, electronic copies and paper copies shall be distributed as directed by the Architect/Engineer.
2. Approved O&M manuals shall be completed and in the Owner's possession prior to Owner's acceptance and at least 10 days prior to instruction of operating personnel.

B. Electronic Submittal Procedures:

1. Distribution: Email the O&M manual as attachments to all parties designated by the Architect/Engineer.
2. Transmittals: Each submittal shall include an individual electronic letter of transmittal.
3. Format: Electronic submittals shall be in PDF format only. Scanned copies, in PDF format, of paper originals are acceptable. Submittals that are not legible will be rejected. Do not set any permission restrictions on files; protected, locked, or secured documents will be rejected.
4. File Names: Electronic submittal file names shall include the relevant specification section number followed by a description of the item submitted, as follows. Where possible, include the transmittal as the first page of the PDF instead of using multiple electronic files.
 - a. O&M file name: O&M.div28.contractor.YYYYMMDD
 - b. Transmittal file name: O&Mtransmittal.div28.contractor.YYYYMMDD
5. File Size: Electronic file size shall be limited to a maximum of 4MB. Larger files shall be divided into files that are clearly labeled as "1 of 2", "2 of 2", etc.
6. Provide the Owner with an approved copy of the O&M manual on compact discs (CD), digital video discs (DVD), or flash drives with a permanently affixed label, printed with the title "Operation and Maintenance Instructions", title of the project and subject matter of disc/flash drive when multiple disc/flash drives are required.
7. All text shall be searchable.
8. Bookmarks shall be used, dividing information first by specification section, then systems, major equipment and finally individual items. All bookmark titles shall include the nomenclature used in the construction documents and shall be an active link to the first page of the section being referenced.

C. Operation and Maintenance Instructions shall include:

1. Title Page: Include title page with project title, Architect, Engineer, Contractor, all subcontractors, and major equipment suppliers, with addresses, telephone numbers, website addresses, email addresses and point of contacts. Website URLs and email addresses shall be active links in the electronic submittal.
2. Table of Contents: Include a table of contents describing specification section, systems, major equipment, and individual items.
3. Copies of all final approved shop drawings and submittals. Include Architect's/Engineer's shop drawing review comments. Insert the individual shop drawing directly after the Operation and Maintenance information for the item(s) in the review form.
4. Copy of final approved test and balance reports.

5. Copies of all factory inspections and/or equipment startup reports.
6. Copies of warranties.
7. Schematic wiring diagrams of the equipment that have been updated for field conditions. Field wiring shall have label numbers to match drawings.
8. Dimensional drawings of equipment.
9. Capacities and utility consumption of equipment.
10. Detailed parts lists with lists of suppliers.
11. Operating procedures for each system.
12. Maintenance schedule and procedures. Include a chart listing maintenance requirements and frequency.
13. Repair procedures for major components.
14. List of lubricants in all equipment and recommended frequency of lubrication.
15. Instruction books, cards, and manuals furnished with the equipment.

2.6 INSTRUCTING THE OWNER'S REPRESENTATIVE

- A. Adequately instruct the Owner's designated representative or representatives in the maintenance, care, and operation of the complete systems installed under this contract.
- B. Provide verbal and written instructions to the Owner's representative or representatives by FACTORY PERSONNEL in the care, maintenance, and operation of the equipment and systems.
- C. The Owner has the option to make a video recording of all instructions. Coordinate schedule of instructions to facilitate this recording.
- D. The Architect/Engineer shall be notified of the time and place for the verbal instructions to be given to the Owner's representative so that their representative can be present if desirable.
- E. Refer to the individual specification sections for minimum hours of instruction time for each system.
- F. Operating Instructions:
 1. The Contractor is responsible for all instructions to the Owner and/or Owner's operating staff on the security systems.
 2. If the Contractor does not have Engineers and/or Technicians on staff that can adequately provide the required instructions on system operation, performance, troubleshooting, care and maintenance, they shall include in the bid an adequate amount to reimburse the Owner for the Architect/Engineer to perform these services.

2.7 SYSTEM COMMISSIONING

- A. The security systems included in the construction documents are to be complete and operating systems. The Architect/Engineer will make periodic job site observations during the construction period. The system start-up, testing, configuration, and satisfactory system performance is the responsibility of the Contractor. This shall include all calibration and adjustments of electrical equipment controls, equipment settings, software configuration, troubleshooting and verification of software, and final adjustments that may be required.
- B. All operating conditions and control sequences shall be simulated and tested during the start-up period.

- C. The Contractor, subcontractors, and equipment suppliers are expected to have skilled technicians to ensure that the system performs as designed. If the Architect/Engineer is requested to visit the job site for the purpose of trouble shooting, assisting in the satisfactory start-up, obtaining satisfactory equipment operation, resolving installation and/or workmanship problems, equipment substitution issues or unsatisfactory system performance, including call backs during the warranty period through no fault of the design; the Contractor shall reimburse the Owner on a time and material basis for services rendered at the Architect/Engineer's standard hourly rates in effect at the time the services are requested. The Contractor shall be responsible for making payment to the Owner for services required that are product, installation or workmanship related. Payment is due within 30 days after services are rendered.

2.8 RECORD DOCUMENTS

- A. Refer to the Division 1 Section: PROJECT CLOSEOUT for requirements. The following paragraphs supplement the requirements of Division 1.
- B. Mark specifications to indicate approved substitutions, change orders, and actual equipment and materials used.
- C. This Contractor shall maintain at the job site, a separate and complete set of Security Drawings which shall be clearly and permanently marked and noted in complete detail any changes made to the location and arrangement of equipment or made to the Technology Systems and wiring as a result of building construction conditions or as a result of instructions from the Architect or Engineer. All Change Orders, RFI responses, Clarifications and other supplemental instructions shall be marked on the documents. Record documents that merely reference the existence of the above items are not acceptable. Should This Contractor fail to complete Record Documents as required by this contract, This Contractor shall reimburse Architect/Engineer for all costs to develop record documents that comply with this requirement. Reimbursement shall be made at the Architect/Engineer's hourly rates in effect at the time of work.
- D. Record actual routing of all conduits sized 2" or larger.
- E. The above record of changes shall be made available for the Architect and Engineer's examination during any regular work time.
- F. Upon completion of the job, and before final payment is made, This Contractor shall give the marked-up drawings to the Architect/Engineer.

2.9 ADJUST AND CLEAN

- A. Contractor shall thoroughly clean all equipment and systems prior to the Owner's final acceptance of the project.
- B. Contractor shall clean all foreign paint, grease, oil, dirt, labels, stickers, and other foreign material from equipment.
- C. Contractor shall remove all rubbish, debris, etc., accumulated during the Contractor's operations from the premises.

END OF SECTION

SECTION 28 13 00

ELECTRONIC ACCESS CONTROL

1. PART GENERAL

1.1 SECTION INCLUDES

- A. Server
- B. Client Workstations
- C. Field Control Hardware
- D. Application Software
- E. Access Control Graphical User Interface
- F. Credentials and Badging
- G. Portal Devices
- H. Visitor Management
- I. Interfaces and Integrations

1.2 RELATED WORK

- A. Section 08 71 00 – Door Hardware
- B. Section 26 05 13 – Wire and Cable
- C. Section 26 05 33 – Conduits and Boxes
- D. Section 26 05 35 – Surface Raceways
- E. Section 27 05 26 – Communications Bonding
- F. Section 27 05 28 – Interior Communication Pathways
- G. Section 27 05 43 – Exterior Communication Pathways
- H. Section 27 05 53 – Identification and Administration
- I. Section 27 15 00 - Horizontal Cabling Requirements
- J. Section 28 05 00 – Basic Electronic Safety and Security System Requirements.
- K. Division 7 – Through Penetration Fire stopping.
- L. Section 28 16 00 – Intrusion Detection System
- M. Section 28 31 00 - Fire Detection and Alarm Systems.

1.3 QUALITY ASSURANCE

- A. Manufacturer: The manufacturer shall have a minimum of ten (10) years documented experience in the development and manufacture of access control software and hardware. The software developer shall be, at a minimum, a Microsoft Silver Certified Integrator and Partner for those systems that reside in a Microsoft environment.

- B. Contractor:

- 1. Shall be a factory-authorized installation, service and support company specializing in the selected manufacturer's product, with demonstrated prior experience of a minimum of ten (10) years installing, programming and supporting the selected manufacturer's system.
 - 2. Shall have been in business for a minimum of ten (10) years and shall have installed a minimum of three (3) similar or larger sized systems. Contractor shall have a minimum of two (2) service technicians who are certified in the proposed manufacturer's system.

Shall have as a regular, full time employee retain the services of a minimum of one employee with the following certification(s) or education. Should more than one certification be required, one employee may maintain multiple certifications.

- a. A certification of MCSA: Server or MCSE: Server Infrastructure from Microsoft.
 - b. A certification of CCENT or CCNA from CISCO. CCNP certification satisfies either of these requirements.

C. Material:

1. All material which is Contractor furnished shall be new, unused and free from defects.
2. Where more than one of any specified item of equipment or material is used, all such items shall be the same product from the same manufacturer.

1.4 REFERENCES

- A. International Building Code
- B. NFPA 70 - National Electrical Code.
- C. The BOCA National Building Code
- D. UL 294 - Standard for Access Control Systems.
- E. UL 365 - Standard for Police Station Connected Burglar Alarm Units and Systems.
- F. UL 464 - Standard for Audible Signal Appliances.
- G. UL 603 - Standard for Power Supplies for Use with Burglar Alarm Systems.
- H. UL 609 - Standard for Local Burglar Alarm Units and Systems
- I. UL 634 - Standard for Connectors and Switches for Use with Burglar Alarm Systems.
- J. UL 827 - Standard for Central Station Alarm Services.
- K. UL 1076 - Standard for Proprietary Burglar Alarm Units and Systems.
- L. UL 1449 - Standard for Surge Protective Devices.
- M. UL 1635 - Standard for Digital Alarm Communicator Systems.
- N. UL 1638 - Standard for Visual Signaling Appliances - Private Mode Emergency and General Utility Signaling.
- O. UL 1778 - Uninterruptible Power Systems.

1.5 SUBMITTALS

- A. Submit shop drawings and product data under provisions of Section 28 05 00.
- B. Product Data Submittal: Provide manufacturer's technical product specification sheet for each individual component type. Submitted data shall show the following:
 1. Compliance with each requirement of these documents. The submittal shall acknowledge each requirement of this section, item-by-item.
 2. All component options and accessories specific to this project.
 3. Electrical power consumption rating and voltage including UPS sizing.
 4. Heat generation for all power consuming devices.
 5. Wiring requirements.
 6. Server processor(s), workstation configurations, total and available disk space, and memory size.
 7. All network bandwidth, latency and reliability requirements.
 8. Backup/archive system size and configuration.
 9. Submit two of each type of credential to be used (access card, key fob, etc.).
- C. System Drawings: Project-specific system CAD drawings shall be provided as follows:
 1. Provide a system block diagram noting system components and interconnection between components. The interconnection of components shall clearly indicate all wiring required in the system. When multiple pieces of equipment are required in the exact same configuration (e.g., multiple identical controllers), the diagram may show one device and refer to the others as "typical" of the device shown. The diagram shall list room numbers where each controller will be located. This block diagram shall be provided in Adobe PDF.

2. Provide a schedule of all controllers and the doors/points each controller controls. This schedule shall be provided in Adobe PDF.
 3. Provide schedules describing each system input location by an architecturally familiar reference, e.g., Door 312A. The architectural door schedule shall be used as the basis. These schedules shall be provided in Adobe PDF
- D. Submit sample format of site specific programming guides to be used for system planning/programming conference with Owner. These guides shall be provided in Adobe PDF.
- E. So that required Owner personnel are present at the planning/programming conference required in Part 3 of this section, submit meeting agenda for the conference a minimum of two weeks prior to the conference.
- F. Submit detailed description of Owner training to be conducted at project end, including specific training times. Refer to Part 3 of this section for details.
- G. Contractor shall provide to Owner, in a documented transmittal and in Microsoft Excel format, the names and locations of devices and the IP addresses which the Contractor shall define. An authorized representative of the Owner shall approve the information in a documented transmittal. Should Owner change the IP address structure after approval of the list, Owner may be responsible for additional fees involved with reprogramming.
- H. Quality Assurance:
1. Provide materials documenting experience requirements of the manufacturer and Installing Contractor. Provide documentation of the training and other applicable certifications of the Contractor.
 2. Provide system checkout test procedure to be performed at acceptance. Test procedures shall include all external alarm events.

1.6 SYSTEM DESCRIPTION

- A. This section describes the furnishing, installation, programming and commissioning of a complete, turnkey access control system with integration to Mealtime Point of sale, Z-Pass student rider visibility, Trilogy wireless lock, Assay Abloy key management and Time Card systems. The terms "access control system" and "security management system", or SMS, may be used interchangeably herein.
- B. The company, manufacturer, and product names used in this section are for identification purposes only. All trademarks and registered trademarks are the property of their respective owners.
- C. Performance Statement: This section and the accompanying access control-specific design documents are performance based, describing the minimum material quality, required features, and operational requirements of the system. These documents do not convey every wire that must be installed and every equipment connection that must be made. Based on the equipment constraints described and the performance required of the system, as presented in these documents, the vendor and the Contractor are solely responsible for determining all wiring, programming, and miscellaneous equipment required. The Contractor shall be responsible for determining quantities of materials required for a complete and operational system. Floor plan drawings and schedules have been developed to aid the Contractor in determining device quantities and installation locations, but, where discrepancies between floor plans and schedules arise, the greater number shall govern.
- D. Basic System Description:
1. The access control system shall provide the following functionality:
 - a. Electronic control access to designated areas.

- b. Validation of cardholder credentials by use of personnel database, card formats, . The system shall compare the time, location, and unique credentials of an attempted entry with information stored in the database.
- c. Access to designated areas will be validated only when a user's credential has a valid number for its facility and the number is valid for the current time and for the reader where it is used.
- d. The system software shall access the hardware that validates the person and monitors the security of a building by use of intelligent system controllers, reader interfaces, locks, readers, inputs and outputs. When access has been validated, a signal to the portal locking device shall be activated to enable alarm free access at that location.
- e. The system shall be configured by use of application software.
- f. The system shall monitor activities using operator monitoring software which includes graphical maps which display alarms, status and activity.
- g. The system shall differentiate and restrict administrative and operational access through use of password authentication.
- h. The system shall report on various aspects of the system by use of reports, both default and customizable. Reports shall be able to be printed.
- i. The system shall have the capability to report alarms both audibly and visually.
- j. The system shall control hardware from the monitoring station by use of manual actions and events.
- k. The system shall provide record and data management by use of journals. There shall be a full audit trail.
- l. The system shall allow for data to be imported from other products by use of database migration tools. These products may include Human Resources databases for name and/or time and attendance information, information from previous access control systems consisting of badge numbers from credentials that will be re-used, Microsoft Excel spreadsheets, or other systems as defined herein.
- m. The system shall allow access using a web interface or a mobile application for use on the iOS and Android operating systems.

E. Integrations, Software Development Kit (SDK) and Application Programming Interface (API):

- 1. The manufacturers of the systems that are integrated shall make an SDK available to other manufacturers.
- 2. Prior to the release of this section, the manufacturers of the systems that are to be integrated shall have made available to each other all APIs to perform the specific integrated functions required in this section.
- 3. The integrations shall be completed and tested, and shall have been implemented on at least one system of similar size prior to the release of this section. The integrations shall not be accomplished for the first time for this project unless written pre-approval has been granted by Owner to Contractor prior to bid deadline.

4. During the warranty period, should a new API or version of software be released by the SMS manufacturer or any of the manufacturers of systems or devices that are integrated, that API or version of software shall be installed in the appropriate system or device defined in this section at no charge to Owner. Should any loss of functionality in the integration be exposed through this installation, as compared to the accepted system, Contractor shall correct the functionality at no charge to Owner.
5. Any and all development costs for specified functionality or inter-system integrations shall be included in the Contractor's bid. No additional costs or fees for the integrations shall be charged to Owner from the time of notice to proceed through system acceptance.

1.7 OWNER FURNISHED MATERIAL

- A. Telephone service
- B. Data circuit / internet service
- C. Active telephone service equipment, such as key system, PBX or VOIP switch equipment
- D. Active computer network equipment:
 1. Routers
 2. Switches
 3. Hubs
 4. Wireless access points
 5. Uninterruptible power supplies for Owner furnished products

1.8 LICENSING REQUIREMENTS

- A. All user licenses required for system operation shall be included in the Contractor's bid. User licenses shall include server and workstation software, network controllers, card readers, printers, badging stations, and any other licensing that is required by the manufacturer for operation of any system component.
 1. Licenses shall be provided on a one-to-one basis. One license shall be provided for each device requiring a license plus 15% growth. In the event the manufacturer requires the purchase of a block of licenses, license blocks provided shall be no greater than what is required for the number of devices in this project plus 15% growth. Contractor shall document the number of remaining licenses in the project record documents and Operations and Maintenance data.
 2. In addition to the licensing requirements listed above, provide licensing and configuration of system administration/operation software for 3 workstations. The workstation licenses shall be concurrent use seats, and the client software shall be able to be loaded on an unlimited number of workstations at no extra cost to the Owner. Contractor shall install client software on the same number of machines as licenses provided. As part of the training, Contractor shall demonstrate to Owner how to install client software on additional workstations.
 3. All Contractor-furnished software shall contain a perpetual, permanent license in which no other fees beyond the single payment for the work of this section are required in order to use the proposed software indefinitely. Owner understands that, after the initial warranty period has expired, maintenance and technical support fees may be required annually, quarterly, or monthly in order to receive software updates and technical support. However, it remains the option of Owner to purchase or decline this service. If Owner chooses to discontinue or never purchase this service, the software shall continue to be legally licensed for use. All software shall be the latest version released, and all Contractor-furnished servers and workstations shall be current on all patches and updates for all software on the machines at the time of acceptance of the associated systems.
 4. The SMS shall require only a single license key present on the server for the SMS to operate. The key shall be a physical device or a software key. License keys shall not be required at the client workstations.

1.9 PROJECT RECORD DOCUMENTS

- A. Submit documents under the provisions of Section 28 05 00.
- B. Provide final system block diagram showing any deviations from shop drawing submittal.
- C. Provide statement that system checkout test, as outlined in the shop drawing submittal, is complete and satisfactory.
- D. Provide schedules documenting:
 - 1. Controller installation locations including specific door numbers being controlled.
 - 2. All terminal block wiring, including cable numbers.
- E. Warranty: Submit written warranty and complete all Owner registration forms.
- F. Complete all operation and maintenance data manuals as described below.

1.10 OPERATION AND MAINTENANCE DATA

- A. Submit documents under the provisions of Section 28 05 00.
- B. Manuals: Final copies of the manuals shall be delivered within 10 days after completing the installation test. Each manual's contents shall be identified on the cover. The manual shall include names, addresses, and telephone numbers of the contractor responsible for the installation and maintenance of the system, and the factory representatives for each item of equipment for each system. The manuals shall have a table of contents and labeled sections. The final copies delivered after completion of the installation test shall include all modifications made during installation, checkout, and acceptance testing. Manuals shall be submitted in electronic format only, Adobe PDF. The manuals shall consist of the following:
 - 1. Hardware Manual: The manual shall describe all equipment furnished including:
 - a. General description and specifications.
 - b. Installation and check out procedures.
 - c. System and equipment layout and electrical schematics to the control board and field device level. For multiple devices wired identically, only one wiring diagram is required per door configuration, to be labeled "TYPICAL".
 - d. Alignment and calibration procedures.
 - e. Manufacturers repair parts list indicating sources of supply.
 - 2. Software Manual: The software manual shall describe the functions of all software and shall include all other information necessary to enable proper loading, testing, and operation. The manual shall include:
 - a. Definition of terms and functions.
 - b. System use and application software.
 - c. Initializations, startup, and shutdown procedures.
 - d. Reports generation.
 - e. Details on forms customization and field parameters.
 - 3. Operator's Manual: The operator's manual shall fully explain all procedures and instructions for the operation of the system including:
 - a. Computers and peripherals.
 - b. Log in/Log out procedures.
 - c. Use of system, command, and applications software.
 - d. Recovery and restart procedures.
 - e. Graphic alarm presentation.
 - f. Use of report generator and generation of reports.
 - g. Data entry.

- h. Operator commands.
 - i. Alarm messages.
 - j. System permissions functions and requirements.
4. Maintenance Manual: The maintenance manual shall include descriptions of maintenance for all equipment including inspection, cleaning, periodic preventive maintenance, fault diagnosis, and repair or replacement of defective components.

1.11 WARRANTY

- A. Unless otherwise noted, provide warranty for one (1) year after date of Substantial Completion for all materials and labor.
- B. Onsite Work During Warranty Period: This work shall be included in the Contractor's bid and performed during regular working hours, Monday through Friday.
 - 1. Inspections: The Contractor shall perform two minor inspections at six-month intervals (or more often if required by the manufacturer), and two major inspections offset equally between the minor inspections to effect quarterly inspection of alternating magnitude.
 - 2. Minor Inspections: These inspections shall include:
 - a. Visual checks and operational tests of all equipment, field hardware, and electrical and mechanical controls.
 - b. Mechanical adjustments if required on any mechanical or electromechanical devices.
 - 3. Major Inspections: These inspections shall include all work described under paragraph Minor Inspections and the following work:
 - a. Clean all equipment, including exterior surfaces and accessible and serviceable interior surfaces.
 - b. Perform diagnostics on all equipment.
 - c. Check, test, and calibrate (if required) all sensors.
 - d. Run all system software diagnostics and correct all diagnosed problems.
- C. Operation: Upon the completion of any scheduled adjustments or repairs, Contractor shall verify operation of the SMS.
- D. Service: The Owner will initiate service calls when the SMS is not functioning properly. If requested by the Owner, the Contractor shall respond or remain at the site after normal business hours, and the Owner shall reimburse the Contractor for the incremental cost difference between premium labor rates and standard labor rates. This reimbursement applies to premium labor rates that do not exceed time-and-one-half rates after normal business hours and double-time rates for Sundays and holidays. The Owner shall be furnished with telephone number(s) where service personnel can be reached 24/7/365. Qualified service personnel shall be at the site within 8 hours after receiving a request for service.
- E. Records, Logs and Work Requests: Contractor shall keep records and logs of each task completed under and outside of warranty. These logs shall be maintained in Microsoft Word or Excel. The log shall include the model and serial number identifying the component involved, its location, date and time the call was received, specific nature of trouble, names of service personnel assigned to the task, description of work performed, the amount and nature of the material used, and the time and date of commencement and completion of the work. Complete logs shall be kept and shall be available for review on site, demonstrating that planned and systematic adjustments and repairs have been accomplished for the SMS. The Contractor shall deliver a record of the work performed within three (3) business days after work is completed. Defective items that have been replaced shall be given to the Owner. Should the replacement item be a temporary replacement until the removed item is repaired, Contractor shall retain possession of the defective item for repair and subsequent re-installation.

- F. System Modifications: Modifications by the Contractor are allowed after system acceptance. Contractor shall make recommendations for system modification in writing to the Owner. No system modifications shall be made without prior, written approval of the Owner. Any modifications made to the system shall be incorporated into the Operations and Maintenance Manuals, and other documentation affected. The Owner shall be provided with electronic restorable versions of all configurations prior to the modifications being made.
- G. Software: At no charge, the Contractor shall provide to Owner all updates released by the manufacturer during the period of the warranty and verify operation of the system upon installation. These updates include system software updates, patches, bug fixes and revisions, as well as firmware updates. These updates shall be accomplished in a timely manner, fully coordinated with SMS administrators and operators, shall include training for the new changes/features, and shall be incorporated into the Operations and Maintenance Manuals and software documentation.
- H. Refer to the individual product sections for further warranty requirements of individual system components.

2. PART PRODUCTS

2.1 ELECTRONIC ACCESS CONTROL SYSTEM MANUFACTURERS

- A. Open Options - Basis of Design
- B. Genetec
- C. RS2 Technologies
- D. Vanderbilt
- E. Should the access control manufacturer offer, as an option, the use of hardware by Mercury Security, the Contractor proposed solution shall utilize this hardware. Contractor shall state whether or not the software is compatible with the SCP, AP and EP families of Mercury Security hardware. For future additions or defective hardware replacements, the system shall not be "locked" to require Mercury Security hardware be purchased only from the access control software manufacturer or from the original Installing Contractor.
- F. Approval of Alternate Manufacturers:
 - 1. Contractors seeking approval for alternate manufacturers for any devices or software in this section shall submit requests for approved equals as defined by Division 1 in addition to submitting:
 - a. Bill of materials for each piece of hardware and software proposed.
 - b. Manufacturer's data sheet for each piece of equipment proposed.
 - c. Line-by-line typewritten statement of compliance or non-compliance comparing Part 2 of this section with the published specifications of the proposed alternate products. This compliance statement shall be signed by an officer of the local contractor branch office that proposes to install the alternate product and either an officer of the manufacturer or an officer of the manufacturer's representative.
 - 2. Refer to the project drawings for manufacturer and model numbers for the Basis of Design products.

2.2 SERVER

- A. The system shall not be required to have a traditional or virtual server and, instead, may be provided with embedded server functionality integral to the controller if the following three (3) conditions are met. The server specified below shall apply if the system does not meet these three (3) conditions:
 - 1. The network controller is a distributed architecture, native IP network appliance.

2. The network appliance contains an onboard, embedded operating system (e.g., Linux-based), web server, ODBC-compliant database engine, data storage device and application logic controller.
 3. The network appliance contains onboard SSL communications.
- B. If the system architecture utilizes traditional servers, the system shall be a true multi-tasking, multi-threading application system architecture designed specifically for the Windows environment. All modules, including access control, alarm monitoring, credential management, etc., shall be built from a single unified 32-bit source code set.
- C. The system shall communicate on a TCP/IP based Ethernet LAN capable of utilizing 10/100/1000 BaseT.
- D. The system shall be functional in a virtual server environment.
- E. Provisioning:
1. The server shall be furnished by the Contractor and shall meet the specifications defined by the SMS software manufacturer to meet or exceed the functionality and performance specifications of the system and integrations defined in this and related sections. Contractor shall coordinate with Owner for possible requirements to utilize a specific manufacturer. Contractor furnished server shall have a three (3) year limited warranty.
 2. Acceptable manufacturers of Contractor-furnished server are:
 - a. Dell – Basis of Design Power Edge R730 Series
 - b. HP
 - c. Iomnis
 - d. Approval of Alternate Manufacturers:
 - 1) Contractors seeking approval for alternate manufacturers for the server in this section shall submit requests for approved equals as defined by Division 1 in addition to submitting:
 - a) Bill of materials for each piece of hardware proposed.
 - b) Manufacturer's data sheet for each piece of equipment proposed
 - c) Line-by-line typewritten statement of compliance or non-compliance comparing Part 2 of this section with the published specifications of the proposed alternate products. This compliance statement shall be signed by an officer of the local contractor branch office that proposes to install the alternate product and either an officer of the manufacturer or an officer of the manufacturer's representative.
 - 2) Refer to the project drawings for manufacturer and model numbers for the Basis of Design products.
- F. Hardware:
1. Enterprise class server.
 2. Rack mount configuration.
 3. Six (6) USB 2.0 ports, one (1) two port 10/100/1000 Ethernet NIC.
 4. Dual, redundant, hot swappable power supplies.

5. RAID Level 5 configuration with separate drives for data base, 500GB, and operating system, 500GB. One spare hot swappable hard drive for the database and one for the operating system.
6. Enterprise class hard drives, minimum 7200 RPM, 3.5" SATA, minimum mean time between failure, MTBF, 1.2 M hours, 100% duty cycle 24x7.
7. 8 GB RAM.
8. Internal DVD+/- RW ROM SATA drive.
9. On board VGA or HDMI video card.
10. Predictive failure analysis.
11. Two (2) cooling fan modules, each with two fans, hot swappable.
12. Rack mount LCD monitor with integrated keyboard, touchpad and KVM switch. This monitor, keyboard and touchpad may also serve the video management system server, if present, through the KVM switch
13. Redundant Server: The system shall maintain a primary server and a redundant backup server with mirrored database. Should the primary server fail, system control shall be automatically switched to the backup server without operator intervention. All access control field hardware shall be configured for communication with both primary and backup servers. Both primary and backup servers shall recognize the same TCP/IP address on the network. This system feature shall require two identical servers with minimum configurations as defined above.
14. Backup Power:
 - a. Contractor-Furnished Uninterruptible Power Supply (UPS):
 - 1) Line interactive, simulated or true sine wave.
 - 2) The critical load is normally supplied by utility power, and internal batteries are simultaneously float charged. The UPS shall boost or buck the voltage as needed, caused by fluctuations in utility voltage. Upon utility power failure, the UPS shall automatically switch to supplying load power from the batteries and internal inverter.
 - 3) Manufacturers:
 - a) APC: Smart UPS Series
 - b) Minuteman Pro-LCD Series
 - c) Emerson/Liebert
 - d) Eaton
 - e) Approved Equal
 - 4) Compliance:
 - a) Surge Suppression: ANSI C62.41
 - b) Safety: UL 1778
 - c) EMC: FCC Part 15
 - 5) Output rated for 2500 kVA.
 - 6) Hot swappable batteries.
 - 7) Battery Capacity: Capable of operating at full load for 30 minutes.

- 8) Rack mount.
- 9) Input of 120 VAC, single phase, two wire plus ground.
- 10) Supports external battery pack.
- 11) Outlet Receptacles: Minimum six (6) NEMA 5-15R receptacles.
- 12) Web browser or SNMP monitoring.
- 13) Operating ambient temperature of 32°F to 104°F.
- 14) Relative humidity 0% to 95% non-condensing.
- 15) Internal input circuit breaker.
- 16) Audible alarms for low battery warning, internal faults, overload, weak/dead battery.
- 17) Transfer time of 6 m sec typical.
- 18) Emergency Power Off (EPO) switch.
- 19) Modes of Operation:
 - a) Normal/On-line – critical load is supplied by AC source, harmonics are filters and batteries are float charged
 - b) Boost – with a sag in utility power from 90 VAC to 105 VAC, UPS shall boost the voltage until AC source rises to 112 VAC
 - c) Buck – with a swell in utility power ranging from 130 VAC to 150 VAC, UPS shall buck the voltage until AC source drops to 125 VAC
 - d) Battery – upon failure, brownout or overvoltage of AC power, the load shall be supplied power from the UPS batteries and inverter
 - e) Recharge – batteries shall be recharged to 90% capacity within 8 hours after return of normal AC power from low battery cut off
 - f) DC start – UPS shall start and operate without AC power applied

G. Operating System:

1. Windows Server 2016
- 2.

H. Database:

1. SQL Server 2016

I. The SMS software shall utilize the native Windows security features and be registered with the Windows operating system as a service. The security features shall be configured with the following layers:

1. Workstation: Prohibits non-operators from accessing the system.
2. Desktop: Controls which applications a given operator can run.
3. Applications Commands: Controls which commands within an application a given operator can perform.
4. Files: Controls an operator's read/write access rights to individual files.

- 5. Breakthrough Alarms: The operating system shall allow high priority alarm condition notification regardless of the application software currently opened.
- J. Upgrades or expansion of the SMS to a larger size system in scale shall not require installation of a different and/or new SMS application or require the administrator/operator to learn a different and/or new interface from the previous version.
- K. Associated Software:
 - 1. Support for web client.
 - 2. Support for mobile client.

2.3 CLIENT WORKSTATIONS

- A. Provisioning:
 - 1. The workstation(s) shall be furnished by the Owner and shall meet the specifications defined by the SMS software manufacturer to meet or exceed the functionality and performance specifications of the system and integrations defined in this and related sections. Contractor shall furnish specifications to the Owner in writing as part of the submittals.
 - 2. Contractor shall install client software on up to 3 workstations.
- B. Hardware:
 - 1. Desktop
 - 2. Pentium 4 Dual Core CPU, 2.5 GHz or greater
 - 3. 4 GB RAM
 - 4. 100GB hard drive, 7200 RPM
 - 5. Four (4) USB 2.0 ports, single 10/100/1000 network interface card
 - 6. Audio with amplified speakers with AC adapter
 - 7. One (1) 19" flat screen LCD monitor(s)
 - 8. USB keyboard, USB optical mouse
 - 9. Three (3) year limited warranty
 - 10. NVIDIA graphics dual output board, PCI Express x 16 graphics bus, 512 MB DDR3 memory buffer, 1280 x 1024 resolution
 - 11. 16x DVD/CD RW drive
- C. Operating System:
 - 1. Windows 10 Professional

2.4 FIELD CONTROL HARDWARE

- A. Interior Control Panels:
 - 1. Control boards, power distribution and terminals shall be enclosed in a NEMA 1 rated enclosure that is key lockable. Contractor shall not furnish padlock. All enclosures that are part of this project shall be keyed alike. Contractor shall furnish and install a mechanically fastened tamper switch on the interior of the enclosure.
 - 2. Control boards are allowed to be in an enclosure separate from the power supplies/power distribution. Should they be in separate enclosures, the interface wiring shall be in rigid metallic conduit, RMC, with Myers hubs at both ends of the conduit.
 - 3. Intra-enclosure wiring shall be dressed using tie wraps and/or covered plastic wire way. Hook-up wires for identical purposes shall have the same color insulation. For example, if one input pair utilizes green and white insulated conductors, all similar inputs shall use green and white insulated conductors. The same color scheme shall be followed for all access control panels that are part of this project.

4. Cabling from field devices such as readers, door position switches, request-to-exit devices and locking devices shall not be directly terminated to the control boards and power supplies. The field devices shall be terminated to terminals located on the left side, right side or both sides of the enclosure back panel. Intra-enclosure wiring shall be routed from the terminals to the control boards and power distribution. Quantity and functional sequence of the terminals shall be identical portal to portal.
5. All devices inside the enclosure, less cabling and batteries, shall be mechanically fastened to a removable solid or perforated metal back panel with either:
 - a. Metal or plastic standoffs
 - b. DIN rail
6. Hook and loop fasteners, double sided tape or adhesives are not allowed to attach devices to the back panel. Mounting devices to the interior of the door shall only be allowed when the following two (2) conditions are met:
 - a. The access control hardware manufacturer offers prefabricated enclosures with devices mounted to the interior of the door.
 - b. Only the same devices that the access control manufacturer mounts to the interior of the door are allowed to be mounted in a different enclosure, and those devices shall be mounted in an identical manner.
7. 120V 20A input power shall be hard wired to a circuit breaker disconnect and to one duplex receptacle on the interior of the enclosure. Should devices in the enclosures require plug-in transformers/power supplies, the receptacle shall be utilized. One (1) power strip with integrated circuit breaker shall be located in the bottom of the enclosure as needed.
8. Power to the locking devices shall be provided by a power distribution board with no fewer than four (4) outputs. Each lock shall be individually protected. The power distribution board shall:
 - a. Provide protection with fuses or positive temperature coefficient (PTC) devices.
 - b. Provide control so that each output is individually selectable as latching or non-latching with fire alarm activation.
 - c. Provide control so that each output shall have Fail Safe and Fail Secure terminals.
 - d. Provide a fire alarm input with associated trigger LED.
 - e. Provide an individual LED per output to indicate when an input has been triggered and the associated output has been activated.
 - f. Accept a dry, closed contact input to activate the individual lock outputs.
 - g. Provide a dry, Form C relay that energizes on activation of the fire alarm input. This output may then be used as a fire alarm input to other power distribution boards in the same or a different enclosure, or may provide input to another device such as a multi-pole relay.
9. A minimum of four (4) 12V 7 AH rechargeable, sealed, lead acid batteries shall be located in the bottom of the enclosure. Two of the batteries shall be connected in series for 24V devices, and two batteries shall be connected in parallel for 12V devices. Connections to the batteries shall be made with appropriate terminals crimped on the connecting conductors. Batteries shall be clearly labeled in a permanent manner with the date of installation.

10. Power to control boards, readers and auxiliary devices such as request-to-exit motion detectors shall be provided by a power distribution board with no fewer than four (4) outputs. All devices powered by the same voltage at an individual portal shall be protected by the same fuse or PTC unless current requirements dictate otherwise. Individual fuses or PTCs may protect more than one control board.
11. All access control panels, when populated with control boards and power supplies, shall have the following capacities:
 - a. Control of a minimum of two (2) portals.
 - b. Spare capacity of a minimum of one (1) access control portal, two (2) auxiliary inputs and two (2) auxiliary outputs greater than the requirements of the project at the time of system specification.
 - c. Five (5) spare fuses of each type used, to be in their original packaging, to be located in each power supply enclosure.
 - d. 50% spare current capacity on all power supplies located in unconditioned spaces and 40% spare capacity for those in conditioned spaces. Lower spare capacities are allowable based on prior approval of Contractor-provided power calculations.
12. Locations where enclosures may be mounted are shown on the plans. Final location, with approval of Owner's representative, shall be selected by Contractor based on distribution of controlled portals and devices.
13. At time of Substantial Completion, Contractor shall furnish a schematic diagram of intra-enclosure wiring and a complete bill of materials for the enclosures and the devices located within. This documentation shall include a schedule of fuses and the device(s) that each fuse protects. This documentation shall be placed by Contractor in a Contractor-furnished print pocket located on the inside of the enclosure door.

B. Exterior Control Panels:

1. Control panels, power distribution and terminals shall be located in a NEMA 4X stainless steel enclosure that is pad-lockable. Contractor shall not furnish padlock. Enclosures shall have a tamper switch mechanically attached to the interior of the enclosure.
2. Control boards and power supplies shall be in the same enclosure.
3. Intra-enclosure wiring shall be dressed using tie wraps and/or covered plastic wire way. Hook-up wires for identical purposes shall have the same color insulation. For example, if one input pair utilizes green and white insulated conductors, all similar inputs shall use green and white insulated conductors. The same color scheme shall be followed for all access control panels which are part of this project.
4. All devices inside of the enclosure shall be mechanically attached to a removable solid or perforated metal back panel. Hook and loop fasteners, double sided tape or adhesives are not allowed in order to attach devices to the back panel. Mounting devices to the interior of the door is not allowed.
5. 120V 20A input power shall be hardwired to a circuit breaker disconnect and to one (1) duplex receptacle located within the enclosure. Should devices require plug-in transformers/power supplies, the receptacle shall be utilized. One (1) power strip with integrated circuit breaker shall be located in the bottom of the enclosure as needed.
6. Power to devices and gate activation relays shall be provided by a power supply and power distribution board with no fewer than four (4) outputs. The power distribution board shall provide protection with fuses or positive temperature coefficient (PTC) devices.

7. Activation of gate operator inputs shall be via an ice cube, plug-in, DPDT, DIN rail-mounted relay, located on the inside of the access control enclosure. The relay shall have a manual check button and an indicator LED.
 8. Devices inside of enclosure shall be rated for the temperatures to which they will be exposed. Contractor shall furnish and install a heater and ventilation rated for use in the enclosure to meet the temperature ratings of the devices in the enclosure.
 9. All access control panels, when populated with power supplies and control boards, shall have the following capacities:
 - a. Control of a minimum of two (2) access control portals.
 - b. Spare capacity of a minimum of one (1) access control portal, one (1) auxiliary input and one (1) auxiliary output greater than the requirements of the project at time of system acceptance.
 - c. Five (5) spare fuses of each type used, to be in their original packaging, to be located in the enclosure.
 - d. 50% spare current capacity on all power supplies located in unconditioned spaces and 40% spare capacity for those in conditioned spaces. Lower spare capacities are allowable based on prior approval of Contractor provided power calculations.
 10. All strands of fiber that are routed to the enclosure shall be terminated with landed patch panel style connectors. Refer to Section 27 15 00 for fiber connector type.
 11. All cables that enter the enclosure shall be in rigid metal conduit, RMC, or liquid tight flexible conduit, with Myers hubs at both ends of the conduit. Conduits shall enter the enclosure only from the bottom.
 12. At time of Substantial Completion, Contractor shall furnish a schematic diagram of intra-enclosure wiring and a complete bill of materials for the enclosure and the devices located within. This documentation shall be placed by Contractor in a Contractor-furnished print pocket located on the inside of the enclosure door.
- C. Intelligent System Controllers (ISC):
1. The controller shall communicate with the host via an on board 10/100 Base T Ethernet port.
 2. The controllers shall be a distributed architecture with full peer-to-peer networking capability. Master/Slave controller configurations are not acceptable. All controllers in the system shall be capable of operating in a standalone mode if communication is lost with the server or main controller. In no case shall a controller depend on communication with an upstream controller for proper standalone operation.
 3. The communications bus shall be supervised for wiring integrity. If a communication failure is detected, the system shall report the loss. All controllers unable to receive communication shall operate as standalone devices including grant/deny decisions, complete with event buffers. All events shall be uploaded to the server upon restoration of communications.
 4. The controllers shall utilize flash memory or similar technology, allowing program updates to be downloaded from the server. Program storage shall be in ROM.
 5. The controllers shall have the capacity for 15,000 cardholders and 45,000 transactions. All access decisions involving these cardholders shall be made at the lowest controller level without communication to the server.
 6. 32-bit microprocessor controlled.

7. Handle all non-host related access control monitoring and decision making.
8. LED indicators for power, fault and communications.
9. Provide for local and global input/output linking:
 - a. The SMS shall support a global linkage feature whereby any input/output/event shall be linked to any other input/output/event in the SMS. Input/output linkages shall be able to span across intelligent system controllers.
 - b. System administrators shall be able to create global input/output function lists, each consisting of a sequence of actions to be performed, such as changing card reader modes, activating outputs, and opening or closing anti-pass back areas. Each function list may include up to six actions.
10. Reporting of transactions and status information to the server.
11. Interface with standard reader technologies without special interface hardware, additional logic panels or other integrators. Supported technologies shall include:
 - a. 13.56 MHz Contactless Smart with or without biometrics or keypad
 - b. 13.56 MHz Multi-technology Smart
 - c. Proximity, with or without keypad
 - d. Magnetic stripe, with or without keypad
 - e. Wiegand
 - f. Bar code
 - g. Keypad
 - h. Biometric, with Wiegand output

D. Reader Interface Module (RIM):

1. Reader interface modules are not shown on the plans. Refer to the installation section of this specification for allowable equipment mounting locations. It is the responsibility of the Contractor to determine the number and configuration of reader interface modules required based on the inherent characteristics of each product line and the requirements and restrictions described in this document.
2. RIM shall interface with and accept data from TTL, Wiegand and RS-485 type readers and door hardware.
3. RIM shall provide a minimum of three (3) inputs per portal for portal position, request to exit and auxiliary input.
4. RIM shall provide a minimum of two (2) outputs per portal for locking device and auxiliary output. Each output shall be Form C and shall be rated at 3A at 28VDC.
5. RIM shall communicate to controller by RS-485.

E. Input Control Module (ICM):

1. The input control module shall provide supervised and non-supervised alarm input zones and monitor/report line fault conditions, alarm conditions, power faults and tampers.
2. Input control modules are not shown on the plans. Refer to the installation section of this specification for allowable equipment mounting locations. It is the responsibility of the Contractor to determine the number and configuration of input control modules required, based on the inherent characteristics of each product line and the requirements and restrictions described in this document.
3. UL 294 and 1076 listed.

4. Each input configurable for normally open or normally closed.
5. Each input configurable for timing.
6. Each input configurable for end of line resistance.
7. Status LEDs for communication to the host, heartbeat and input status.
8. Communications line supervision.
9. AES 128 bit encryption.
10. 2-wire RS485 communications.
11. No fewer than eight (8) inputs per board/control module.
12. Assignment of unit addresses and communications speed.
13. Alarm Masking: The ability to mask the alarm input on a time zone basis.
14. Activate Output: The ability for any input to activate any output.
15. Configuration of Debounce Time: The ability to control the amount of time that an input state change must remain consistent in order for it to be considered a real change of state.
16. Elevator control support for number of floors shown on the drawings.
17. Noise rejection filtering to prevent false alarms.
18. Global Linkage: The ability to link outputs with inputs that are attached to any ICM/output control module (OCM).
19. Checkpoint: The ability to configure an input as a designated stop on one or more guard tours.
20. Entry/Exit Delay: The ability to set up entry/exit delays for inputs that are attached to any ICM. This shall include:
 - a. Non-Latched Entry: When an input activates, the alarm will not be reported until the entry delay expires. If the input is still active when the entry delay expires, the alarm will be reported. If the input is not active when the entry delay expires, then the alarm will not report.
 - b. Latched Entry: When an input activates, the alarm will not be reported until the entry delay expires. If the input is still active when the entry delay expires and the alarm has not been masked, the alarm will be reported. If the input has been masked when the entry delay expires, then the alarm will not report.
 - c. Exit Delay: When an input activates, the alarm will not be reported (operates as if masked) until the exit delay expires. If the input is still active when the exit delay expires, the alarm will be reported. If the input is not active when the exit delay expires, the alarm will not be reported.

F. Output Control Module (OCM) and Functionality:

1. Output control modules are not shown on the plans. Refer to the installation section of this specification for allowable equipment mounting locations. It is the responsibility of the Contractor to determine the number and configuration of output control modules required, based on the inherent characteristics of each product line and the requirements and restrictions described in this document.

2. The output control module(s) shall provide Form C relay contacts for load switching, rated at 3A at 28VDC.
3. Each relay shall support "On" "Off" and "Pulse."
4. Outputs can be pulsed from 0.1 seconds to 24 hours.
5. Status LEDs for communication to the host, heartbeat and relay status.
6. 2-wire RS485 communications.
7. No fewer than eight (8) outputs per board/control module.
8. Communications line supervision.

2.5 APPLICATION SOFTWARE

A. General Performance:

1. The application software, in conjunction with the associated hardware, shall have the following features, functionality and capabilities. The functions that are to be implemented shall be determined in the planning conference between Contractor and Owner referenced in Part 3 of this section.
2. All Users:
 - a. All users shall be capable of being authenticated against Active Directory using LDAP before being granted system access. Should the Owner not use Active Directory, the system shall provide a built-in login and credential management tool to permit rules-based access rights on a per-user basis.
 - b. The access rights shall be selectable on a per-user basis. In addition, user groups shall be capable of being assigned whereby each user group has a common set of access rights. Users shall be capable of being assigned to these user groups by the system administrator.
3. Operators:
 - a. The SMS operator interface shall be standard Windows style graphical interface allowing point and click access to features such as drop-down menus, radio buttons, check boxes, list boxes and other standard Windows components.
 - b. On-line Context Sensitive Help: The SMS shall provide on-line context sensitive help files to guide system administrators and system operators in the configuration and operation of the SMS. The help menu shall be available from any window in the SMS by pressing one function key or clicking on the "HELP" icon/selection in the toolbar. Help windows shall be context sensitive so operators and system administrators can move from form to form without leaving the help window. The SMS shall come with complete on-line documentation on CD or the ability to offload the documentation to removable media.
 - c. Operator Groups: A minimum of 32 operator groups, allowing specific system module privileges to be accessed with each module being granted specific views, edit and execute privileges.
 - d. Operator Levels: System access shall require a valid operator name and password, governing a specific operator's level of access to each menu item.

- e. The SMS shall allow a system operator to login over another system operator who is already logged into the same client workstation without the need to reboot the system. This process shall log the first system operator off alarm monitoring and log the new system operator on, changing any permission necessary for that system operator.
4. Logs, Status, Maintenance, Diagnostics:
- a. Historical Log: The system shall allow event history to be written to the hard disk in an archive format. At a minimum, the system shall support 500,000 transactions. Warning messages shall be generated at a user defined level of capacity. The system shall have the ability to offload the archive files to removable media automatically or manually.
 - b. System Status: The system shall query the status of any or all of the system's access control points, inputs and outputs.
 - c. System Maintenance/Diagnostics: The system shall provide for remote diagnostic capabilities. In addition, online diagnostics and communications maintenance shall be able to be activated from the operator interface.
5. Administrator:
- a. The SMS shall provide system administrators with the ability to segment their access control SMS field hardware devices into various zones or areas where alarm monitoring client workstations will monitor. These zones shall be assigned an alphanumeric name using up to a minimum of 64 characters.
 - b. The SMS shall allow other devices such as card readers, input and output modules and intelligent system controllers to be automatically part of the monitoring zone when an intelligent system controller is selected, and it shall allow the system administrator to define which devices such as card readers, etc. belong to that monitor zone.
 - c. Updating of monitor zones shall take place in real time and without requiring operators to re-login.
6. General:
- a. Elevator control support for the number of floors and cabs shown on the drawings.
 - b. The SMS software shall be written to Microsoft's published standards for user interface design, secure coding practices and database implementation guidelines such as Microsoft Open Database Connectivity (ODBC) interface.
 - c. All tasks shall be accessible from any compatible client workstation on the network using one or all of the following:
 - 1) Traditional client/server architecture.
 - 2) N-Tier architecture where the SMS shall support the expansion of the system architecture and allow for end-user deployment. The SMS shall allow, but not require, the separation of the database, application server, web server and client interface. The system shall require that all connections to the database be performed through a trusted link from the client or internet browser interface.
 - 3) Centralized publishing of applications using Windows Terminal Server and Citrix through any compatible internet browser application and/or by mobile computer including tablet PC.

- d. The SMS shall use an open architecture where all data must reside on a single database and must be accessible in real time to every SMS workstation or web-based client connected to the network. The system database shall be used to create and maintain the cardholder database. A screen designer module shall allow the creation and editing of custom database tables and data entry screens.
- e. The SMS shall be able to connect to and interface bi-directionally with external data sources using all of the following methods:
 - 1) ASCII with support for XML-formatted text exchange of data activated both manually and automatically.
 - 2) ASCII with support for XML-formatted text exchange of data using a direct table interface activated both manually and automatically.
 - 3) Real time exchange of data via Active Directory/LDAP utilizing an API supported by the SMS manufacturer. The live exchange of data shall permit exposure of SMS events and transactions to other data sources in real time and allow for receipt of data into the SMS, permitting this data to be acted upon and trigger linked events in the SMS in real time.
- f. Security: Access privileges within the application software shall be permitted by use of a password protection system. The cardholder database shall have the following password security levels.
 - 1) A minimum of six (6) unique operator access levels
 - 2) Ability to view only the database fields
 - 3) Ability to restrict operator viewing to any of the individual database screens within a record
 - 4) Ability to restrict operator viewing to any of the database partitions
- g. Cardholder Configurations: The system shall have the capacity to support a minimum of 240,000 cardholder files. Each cardholder shall be capable of having up to five (5) access levels actively assigned to their account.
- h. The system shall have cardholder identifications for "Visitor" and "Escort", with an associated optional validity period assignable with an activation and deactivation date.
- i. The cardholder database screen shall have the following data associated with each cardholder:
 - 1) Last edit by operator with edited date and time
 - 2) Last date/time card was used
 - 3) Last reader giving valid access
 - 4) Last reader denying access
 - 5) Anti-pass back status
- j. The system shall provide advanced query capability with the following search criteria: equal to, not equal to, greater than, greater than or equal to, less than, less than or equal to, like, is empty, is not empty, is between, and, or, not.
- k. Access Control Configuration: The configuration application shall be password protected, restricting what each individual may edit or display inside the configuration application.
- l. Text descriptions of access points such as doors.

7. Time Zones:
 - a. The SMS shall be capable of creating and storing up to 255 time zones. Each time zone shall have a minimum of six (6) intervals. Each interval shall be assignable to any day of the week.
 - b. Each time zone shall be assignable to an alphanumeric name. Time zones shall be applied to access levels, card reader modes, alarm inputs, alarm outputs, and alarm masking and logging functions. Time zones shall be allowed to belong to any or all access levels so that the time zone only has to be defined once.
8. Access Levels:
 - a. The SMS shall be capable of defining a minimum of 32,000 access levels with a minimum of 32 access levels per cardholder per database segment. Access levels shall consist of a combination of card readers and time zones.
 - b. Each access level shall be assignable to an alphanumeric name.
 - c. Card readers shall have the ability to be assigned to any or all access levels defined in the SMS. Individual card readers shall be capable of having a distinct time zone assigned to it.
 - d. The SMS shall allow an 'Allow User Commands' option to be assigned on a per access level basis where keypad readers are in use.
 - e. The SMS shall allow a 'First Card Unlock' option to be assigned on a per access level basis. First Card Unlock feature, when configured, retards a pre-determined time zone activated unlock command until a valid credential has been presented and granted access to the portal.
9. Temporary Access Levels:
 - a. The SMS shall be capable of assigning temporary access levels inclusive of the 32,000 assignable access levels.
 - b. Each temporary access level shall be assignable to an alphanumeric name.
 - c. Each temporary access level shall be definable with a start and end date.
 - d. Temporary access levels shall be stored in the ISC, and functionality shall be maintained in the event of disconnection with the ISC.
10. Access Groups:
 - a. The SMS shall be capable of assigning access groups, with a maximum of 32 access levels per access group.
 - b. Each access group shall be assignable to an alphanumeric name.
11. Precision Access Levels:
 - a. The SMS shall be capable of assigning precision access levels in addition to the 32,000 access levels, with the ability to assign unlimited card reader and time zone combinations. Precision access levels provide capability of assigning a unique access level on a per card basis.
 - b. Each precision access level shall be assignable to an alphanumeric name.

12. Holidays:

- a. The SMS shall provide a minimum of 255 holiday assignments using an embedded calendar. Holidays shall be assigned an alphanumeric name and shall be grouped into eight (8) types of holidays, and shall be assignable to individual time zones. Access rights, card reader modes, and alarm masking schedules must be able to be altered when the current date is designated as a holiday.
- b. Dates for Daylight Saving Time changes shall be definable and shall take effect automatically.
- c. The SMS shall support holiday ranges that allow a single holiday to span across multiple calendar days.

13. Database Segmentation:

- a. The SMS shall be required to support data segmentation whereby each segment shall have its own set of cardholders, field hardware, and system parameters (time zones, access levels, etc.). This segmentation shall expand the limitations of the SMS parameters (e.g., access levels and time zones) to the maximum capacity of each parameter multiplied by the number of segments. The following list shall be made available for segmentation:

- 1) Access group
- 2) Access levels
- 3) Actions
- 4) Action groups
- 5) Alarm inputs
- 6) Alarm mask groups
- 7) Alarm outputs
- 8) Areas
- 9) Credential types
- 10) Card formats
- 11) Cardholders
- 12) Card readers
- 13) Central station receivers
- 14) Device groups
- 15) Digital video archive servers
- 16) Fire alarm panels
- 17) Guard tours
- 18) Global I/O function lists
- 19) Global I/O links
- 20) Holidays
- 21) Intercom panels
- 22) Intercom stations
- 23) Intrusion detection panels
- 24) ISCs
- 25) Maps
- 26) Monitor zones
- 27) Precision access groups
- 28) Receiver accounts
- 29) System operators
- 30) Time zones
- 31) Tour groups
- 32) Visitors
- 33) User permission groups

14. Field Hardware Communications:
- a. The SMS shall support communications with the intelligent system controllers (ISCs) by the following protocols:
 - 1) RS-232
 - 2) RS-485
 - 3) TCP/IP
 - 4) Dial-up modem
 - b. Communication baud rate shall be system selectable with a range between 1,200- to 115,200 bits per second.
 - c. Download communication between the SMS and the ISC shall be fully multi-tasking and shall not interfere with operational functions.
 - d. Upon loss of communications between the SMS server and the ISC, an alarm shall be created with a time stamp. Upon re-established communication, the SMS and the ISC shall automatically re-synchronize from the point of communication loss without operator intervention.
15. Dual Path Field Hardware Communication:
- a. The SMS shall support dual path communications between the SMS server and the ISCs. This shall allow for a redundant communication path in the event the primary path fails. The secondary path shall support all primary path protocols.
 - b. In the event of a communication failure of the primary path, the ISC shall initiate a switchover to the secondary path. During this fail switchover period, the ISC shall periodically check to see if the primary path has been re-established and will automatically switch back upon a successful connection. Alarms shall be generated upon loss or restoration of communications.
16. Intelligent System Controller Remote Support:
- a. The SMS shall support remote operations to and from the intelligent system controller (ISC). The remote connection shall be either a constant connection or a scheduled connection. If the connection is constant, then every panel shall have its own connection at the host. If the connection is scheduled, then all panels using remote connections shall have the ability to share the same host connection(s).
 - b. System administrators shall have the ability to define the remote connections available in the pool. For each connection, system administrators shall be able to define the connection type and the client workstation to which it is installed.
 - c. Remote sessions shall occur under any of the user defined scenarios:
 - 1) On Demand Connection: A system operator shall have the ability to automatically initiate a remote session to an ISC via the alarm monitoring module.
 - 2) Scheduled Connection: System administrators shall have the ability to configure the SMS so that the ISC remotes into the SMS at pre-determined times through use of time zones.
 - 3) Critical Alarm Activated: System administrators shall have the ability to configure the SMS so that the ISC initiates a remote session with the SMS when a critical alarm is activated in the field.

- 4) Buffer Threshold: System administrators shall have the ability to configure the SMS so that the ISC initiates a remote session with the SMS when a pre-determined number of events are stored in the ISC memory buffer.

17. Area Control:

- a. Area control shall be a security method of preventing a person from passing their credential to another person for dual entry into a single location using one card. The SMS shall support the following area control features.
- b. Global Hard Anti-Pass Back:
 - 1) The Global Hard Anti-Pass Back feature shall require that a credential always be used to enter and exit an area. The controlled areas shall have both entry and exit card readers at all portals. Entry and exit readers shall be able to span across multiple ISCs. Areas shall be logically defined under the SMS, and area control shall not be required at all areas. Global Hard Anti-Pass Back shall work in the following manner:
 - a) A cardholder must present his/her credential at the entry card reader of the area that the person wishes to enter. Once access has been granted into the area, the cardholder cannot present the credential to another entry card reader within the same area without first presenting his/her credential to the respective exit card reader of that area. Should a cardholder attempt to use any other card reader in the same area besides the occupied area's exit card reader once access has been granted to that area, the cardholder shall be denied access and an alarm shall be reported to the alarm monitoring client workstation. Nested control areas (areas inside areas) shall be definable with a minimum of 64 entry and exit card readers. It shall be possible to have an area within an area and/or multiple areas that are independent of each other in which Global Hard Anti-Pass Back rules shall apply.
- c. Global Soft Anti-Pass Back:
 - 1) The Global Soft Anti-Pass Back feature shall require that a credential be used to enter and exit an area. The controlled areas shall have both entry and exit card readers at all portals. Entry and exit readers shall be able to span across multiple ISCs. Areas shall be logically defined under the SMS, and area control shall not be required at all areas. Global Soft Anti-Pass Back shall work in the following manner:
 - a) A cardholder must present his/her credential at the entry card reader of the area that the person wishes to enter. Once access has been granted into the area, the cardholder cannot present the credential to another entry card reader within the same area without first presenting his/her credential to the respective exit card reader of that area. Should a cardholder attempt to use any other card reader in the same area besides the occupied area's exit card reader once access has been granted to that area, the cardholder shall be allowed access (if that cardholder has the appropriate access level to access the new area), and an alarm shall be reported to the alarm monitoring client workstation. It shall be possible to have an area within an area and/or multiple areas that are independent of each other.

d. The following summary criteria shall apply under Global Hard or Soft Anti-Pass Back:

- 1) Initially all card holders are reset to Area 0.
- 2) Any cardholder shall enter a controlled area any time after Time 0 by presenting a credential to a SMS entry card reader.
- 3) A cardholder shall not exit the controlled area unless he/she has entered the area presenting a credential to the SMS entry card reader.
- 4) A cardholder shall not enter the controlled area a second time unless the cardholder has exited that area previously.
- 5) A cardholder shall be able to enter through any entry card reader and exit through any exit card reader of a single controlled area.
- 6) These options shall include a "forgiveness" feature that will allow the system administrator to reactively reset the anti-pass back of all cardholders to Area 0, either through a manual override or a time zone command.
- 7) The SMS shall provide an anti-pass back exempt option for privileged or VIP cardholders. Cardholders with this option will not have anti-pass back rules applied to them.
- 8) The SMS shall also have a "forgiveness" feature that will allow the system administrator to proactively assign an automatic reset to an individual cardholder. This shall allow the system administrator to reset the anti-pass back of an individual cardholder to Area 0 automatically for a defined number of times.

e. Timed Anti-Pass Back:

- 1) Timed Anti-Pass Back shall allow the system administrator to decide how long after a cardholder has presented their credential that they will have to wait before the same credential will be accepted again at the same card reader. This helps prevent multiple swipes by an individual to allow access to others through turnstile doors.

f. Two-Person Control:

- 1) Two-Person Rule shall be provided to restrict access to certain areas unless there are two (2) cardholders present. This restricts individuals from being alone in restricted or highly secure areas. When an area is configured for Two-Person Rule, the following criteria shall prevail:
 - a) The card reader shall grant access only if two valid cardholders (with authorized access levels) swipe their credentials one after the other. In the event a second authorized card is not presented within 10 seconds of the first authorized credential, the card reader shall reset and the first card will have to be swiped again.
 - b) Once two people occupy an area, individual access shall be granted.
 - c) Individual exit shall be permitted until an area is occupied by only two cardholders, at which point the Two-Person Rule applies for exit.

g. Occupancy Limit:

- 1) Occupancy Limit shall restrict the number of cardholders that shall be present in an area at any given time. The Occupancy Limit area shall be able to be defined by the system administrator up to the limits of the cardholder capacity of the system. Once the occupancy limit has been reached, a cardholder must swipe out of the exit card reader before the next cardholder may enter. Each area for which Occupancy Limit is enabled shall be definable with up to 64 entry/exit card readers. Multiple Occupancy Limit areas shall be definable.

h. Mustering:

- 1) The SMS shall support Mustering functionality. The Mustering function shall provide an automatic capability for registering cardholders that are on site during an incident. Designated exit and entry card readers shall be used to enter and leave hazardous locations and safe locations. When an incident occurs, a muster report shall be generated that consists of a listing of all personnel that are within the hazardous locations, as well as all personnel that have registered in a safe location.

i. Alarm Masking Groups:

- 1) The SMS shall support a group alarm masking feature whereby system administrators shall be able to create groups of alarm inputs that enable them to mask or unmask multiple input control module inputs and card reader inputs simultaneously.
- 2) The following events shall have the ability to be part of an alarm masking group:
 - (1) Input Control Module Events
 - (2) Alarm Input Active
 - (3) Card Reader Events
 - (4) Auxiliary Input Active
 - (5) Denied Count Exceeded
 - (6) Door Contact Tamper
 - (7) Door Forced Open
 - (8) Door Held Open
 - (9) Card Reader Input Tamper
- a) Alarm Masking Groups shall be able to be masked as a group or as individual points.
- b) Alarm Masking Groups must support the ability to be masked multiple times. Alarm Masking Groups shall be able to be masked and/or unmasked via alarm monitoring commands by guards, via card reader keypad function keys, or via global linkage commands.
- c) The SMS shall support "2-man control" for masking Alarm Masking Groups.
- d) The SMS shall support an Alarm Masking Group status change (masked to unmasked or unmasked to masked) action to be linked to a function list that is capable of performing many system actions, such as activating a relay output. The SMS shall support a minimum of 64 Alarm Masking Groups per intelligent system controller. with a minimum of 200 alarm inputs per Alarm Masking Group.

- j. Cardholder Escort Control:
 - 1) The SMS shall support comprehensive escort functionality based upon access levels. Access levels shall include options for "Escort Required", "Designated Escort", "Not an Escort" and "Does not require an Escort." Contractor shall integrate escort level and designation into badge design in cooperation with Owner.
 - 2) The escort feature shall be capable of one-to-one and one-to-many Escort to Escorted functionality.
- k. Cardholder Use Limits:
 - 1) The SMS shall support a Cardholder Use Limit feature that shall allow system administrators to specify the maximum number of times that a cardholder may use their credential at card readers in the SMS.
- l. Extended Individual Strike Times:
 - 1) The SMS shall support Extended Individual Strike Times that allows a card reader's strike to be active for an extended period of time beyond the pre-determined standard strike time on a per cardholder basis. The extended strike time shall be user definable up to 255 seconds. Extended strike times shall be set on a card reader by card reader basis.
- m. Extended Individual Door Held Open Times:
 - 1) The SMS shall support Extended Individual Door Held Open Times that allow a card reader's door to be held open for an extended period of time beyond the pre-determined standard held open time on a per cardholder basis. The extended held open time shall be user definable up to eight (8) hours. Extended held open times shall be set on a card reader by card reader basis.
- n. Extended, On Demand, Door Held Open Times:
 - 1) The SMS shall support Extended, On Demand, Door Held Times via a command keypad located in the field. The Extended Held Open command configuration shall consist of a command key sequence that shall be from three to six keys used to enter the number of minutes to extend the door held open time (up to 999 minutes) and a pre-alarm time (from 0 to 30 minutes).
 - 2) Only those cardholders having command authority at a given card reader configured for 'Allow User Commands' shall have the ability to execute the Extended Held Open command at that card reader. The Extended Held Open command shall be available after a valid cardholder has received an access grant at the card reader. The cardholder shall have a period of 15 seconds after the access grant to enter the extended held open command sequence.
- o. Guard Tour:
 - 1) The SMS shall support Guard Tour functionality. A tour shall consist of one or more checkpoints defined as card readers or alarm inputs that a guard shall check during a guard tour.
 - 2) Each tour shall be assigned a name of up to 128 characters and subsequently assigned to one or more alarm monitoring workstations that indicate from where automatic tours are to be launched.

- 3) Each tour shall consist of a series of checkpoints that shall include card readers and/or alarm inputs. Tour checkpoints shall be ordered in the sequence within which they are to be visited. Tour checkpoints shall be assigned minimum and maximum times within which to be reached. A "Tour Beginning" checkpoint shall also be defined to be linked with output actions. Checkpoints shall be able to be placed onto a graphical map.
 - 4) A tour shall be able to be linked to live video. Instructional text shall be assigned to a tour. These instructions shall be able to be viewed and printed prior to launching the tour from an alarm monitoring workstation.
 - 5) Tours shall have the option of being scheduled.
 - 6) The SMS shall support random tours.
- p. Tour Groups:
- 1) The SMS shall support tour groups. Tour groups will consist of one or more tours, listed by alphanumeric names.
- q. Guard Tour Live Tracking:
- 1) The Guard Tour Live Tracking window shall be opened automatically at the initiating monitoring station whenever a tour is launched. The Guard Tour Live Tracking window shall consist of a series of columns including:
 - a) Checkpoint sequence number
 - b) Checkpoint name
 - c) Checkpoint status
 - d) Checkpoint minimum time
 - e) Checkpoint maximum time
 - f) Checkpoint time
 - 2) The following checkpoint statuses shall be supported:
 - a) Checkpoint Not Reached
 - b) Checkpoint Reached On Time
 - c) Checkpoint Reached Early
 - d) Checkpoint Overdue
 - e) Checkpoint Reached Late
 - f) Checkpoint Out of Sequence
 - g) Checkpoint Missed
 - h) Guard Tour Initiated
 - i) Guard Tour Completed
 - j) Guard Tour Completed With Errors
 - k) Guard Tour Cancelled
 - l) Guard Tour Terminated
- r. Guard Tour Live Video:
- 1) Multiple live camera views shall be able to be displayed simultaneously in a "sliding window" format. The next checkpoint to be hit shall be able to be highlighted within the surveillance system.
- s. Elevator Control:
- 1) The SMS shall support Elevator Control using standard access control field hardware.

- 2) For card readers placed within elevator cabs, Elevator Control shall permit the restriction of cardholder access to certain floors while also allowing general access to other floors.
 - 3) For card readers placed in elevator lobbies, Elevator Control shall permit the restriction of cardholder access from calling the elevator using the elevator call buttons until an allowed credential is presented at the card reader.
 - 4) The feature shall allow, at the elevator, the use of any card reader and all card reader modes used on any other card reader in the SMS. Each elevator card reader shall control access for the number of floors shown on the plans.
 - 5) The SMS shall be able to track which floor was selected by an individual cardholder for auditing and reporting purposes.
- t. Graphical System Overview Tree:
- 1) A Graphical System Overview Tree shall display a graphical representation of all field hardware. System administrators shall be able to modify a device that is depicted on the Graphical System Overview Tree or see its properties by double clicking on the icon, and the SMS shall bring them to the appropriate form.
- u. Pre-Alarm:
- 1) The SMS shall support a Pre-Alarm feature at the card reader. The pre-alarm will sound a tone at the card reader prior to the door held open alarm. The pre-alarm setting shall be configurable for up to the maximum allowable door hold open time.
- v. Alarm/Event Logging:
- 1) All alarms and events in the SMS shall, by default, always be recorded in the database. The SMS shall give system administrators the ability to select, on a time-zone basis, the times that they require the SMS to log specific events to the database.
 - 2) System administrators shall have the option for particular alarm/events to be set to log or not to log on any individual reader and/or input.
- w. Scheduling Utility:
- 1) The SMS shall provide an integral Scheduling Utility. The Scheduling Utility shall allow system administrators to schedule actions to occur on a one-time or a recurring basis. Recurring schedules shall be configured to begin immediately, last indefinitely, or have optional start and end dates.
 - 2) The Scheduling Utility shall be available from both the system administration and alarm monitoring modules.
 - 3) The types of actions that shall be schedulable include, but are not limited to:
 - a) Action Group
 - b) Event Archiving/Purging
 - c) Arm/Disarm Area
 - d) Start of Guard Tour
 - e) Execution of Scripts

- f) Activate, Deactivate, Pulse Device Output and Device Output Groups
 - g) Global Anti-Pass back Reset
 - h) Download Firmware to equipment.
 - i) Download Database to ISCs
 - j) Execute Function List
 - k) Mask/Unmask Inputs, Input Groups, Alarm Mask Groups, Door Forced Open or Held Open
 - l) Open Door, Open Door Group
 - m) Change Reader Mode
 - n) Automatic Reports
 - o) Reset Use Limit
 - p) Move Bulk Credentials from an Area
 - q) Deactivate Credentials
 - r) Logout Visitors
 - s) Schedule PTZ Presets
 - 4) The Scheduling Utility shall maintain a history log in the database for actions that it executes.
18. Multiple Card Formats:
- a. Each ISC shall support a minimum of eight (8) access control card formats and, if applicable, eight (8) asset formats.
19. Card Reader Cipher Mode:
- a. The SMS shall support a Card Reader Cipher Mode that shall allow authorized cardholders to enter their credential ID by typing it into a card reader keypad, thus emulating the presentation of the credential to the card reader.
20. Denied Access Attempts Counter:
- a. The SMS shall support a Denied Access Attempts Count on a per card reader basis. The "Denied Attempts Count" value shall be configurable from 0 to 255. The following access denial types shall cause the current denied count to be incremented:
 - 1) Unknown PIN entry at a card reader configured as 'PIN or Card' mode.
 - 2) Invalid cipher entry at a card reader in Cipher Mode.
 - 3) Invalid PIN entered for a given card at a card reader configured as 'Card and PIN' mode.
 - 4) Non-matching biometric presented for a given card at a card reader in Biometric Verify mode.
21. Card Reader Time Zone Overrides:
- a. The SMS shall allow for the pre-defined default card reader settings to be overridden or temporarily changed on a time-zone basis. At the beginning of the selected time zone, the selected card reader's operational mode shall be modified from its default mode to any one of the following modes: Locked, Unlocked, Facility Code, Card Only, Card or PIN, Card and PIN, Card and Biometric, Card or PIN and Biometric, and/or Card and PIN and Biometric. The aforementioned options shall be available depending on the type of card reader used.
 - b. Each card reader shall have the ability to have multiple time zone setting overrides assigned to them as required by the system administrator.

22. Alarm/Event Routing:

- a. The SMS shall be capable of allowing system administrators to route alarms and events to various alarm monitoring client workstations on the network. The SMS shall allow any alarm or event to be routed to one or multiple client workstations on the network regardless of where the alarm is generated in the field. Alarms shall be routed to client workstations on a device-by-device level.
- b. The SMS shall be capable of automatic re-routing of an alarm from workstation X to workstation Y if the alarm is not responded to within a user definable time period.
- c. The SMS shall implement network synchronization such that in the event that an alarm is routed to multiple client workstations, once the first client workstation acknowledges the alarm, the alarm shall be cleared from all other client workstations. As such, alarms that are routed to an Alarm Monitoring client workstation that does not have a System Operator logged in shall be queued so that all unacknowledged alarms will report to that client workstation once a System Operator has logged into the SMS. Alarms/Events shall be routed based on default settings or time zone control.

23. Text Instructions:

- a. The SMS shall allow for a set of text instructions to be associated with each alarm that arrives into the SMS. The text instruction function shall allow the system administrator to enter a minimum of 32,000 characters of text for procedures to follow for each alarm that arrives at the alarm monitoring client workstations. Each alarm or event in the SMS shall have its own unique set of text instructions.

24. Customizable Voice Instructions:

- a. The SMS shall allow for a customizable voice instruction to be associated with SMS alarms. The customizable voice instruction feature shall allow the system administrator to record a voice instruction of unlimited length.

25. Alarm Attributes:

- a. The system administrator shall have the ability to configure how the SMS handles the annunciation of alarms on an individual basis. Each alarm and/or event shall have the option(s) to:
 - 1) Display at one or more alarm monitoring client workstation.
 - 2) Allow higher priority alarms to be displayed on the alarm monitoring client workstation ahead of lower priority alarms.
 - 3) Require the field device that generated the alarm to be restored to its normal state before the alarm is cleared.
 - 4) Print the alarm to the local event printer.
 - 5) Have a customized voice message annunciate at the client workstation.
 - 6) Have the alarm breakthrough to the alarm monitoring window should the system operator be working in another application
 - 7) Allow system operators to change the journal entry once the alarm has been acknowledged.
 - 8) Ensure that the alarm will not be able to be deleted from the alarm monitoring window upon acknowledgment.

- 9) Display text and audio instructions outlining the procedures to follow when responding to the alarm.
- 10) Automatically call-up associated maps.
- 11) Automatically call up the associated cardholder record.
- 12) Automatically call up the associated cardholder photo using the video verification function.
- 13) Require a password to view the alarm.
- 14) Require a password to acknowledge the alarm.
- 15) Require acknowledgment to clear.
- 16) Allow mandatory journal entry upon acknowledgment.
- 17) Use pre-defined journal entries for alarms.
- 18) Select the option for journal entry based upon the specific alarm.
- 19) Send surveillance interface commands to the surveillance system.
- 20) Automatically send an e-mail message.
- 21) Automatically send an alphanumeric page.
- 22) Have the alarm appear on the alarm monitoring window with a flashing colored coded bar across the alarm for high priority alarms.
- 23) Have the alarm, when acknowledged, display an alternative flashing color coded bar across the alarm than for the original alarm color.
- 24) Trigger a function list(s) when the alarm is acknowledged.
- 25) Require user login for acknowledgment.
- 26) Have the ability to mark an alarm as "In Progress" where the system shall silence any repeating audio notifications on the workstation where the alarm was routed, and remove the alarm sprite notification on the graphical map. Additional operators' monitoring alarms shall be notified that the alarm has been marked "In Progress".

26. Alarm-Event Mappings:

- a. The SMS attributes in Alarm Attributes shall be assignable on a 'global' basis to all devices that share an alarm description. Thus, the 'Door Forced Open' alarm attributes shall apply to any door with a card reader that is forced open in the SMS. The SMS shall have the capability to assign a unique group of alarm attributes to specific device/alarm combinations to override the global settings for specific case settings. Each device/alarm combination shall have the ability to have its own unique attribute set if the system administrator desires.

27. System Downloads:

- a. The SMS shall provide for the downloading of data to the ISCs. Downloads shall load SMS information such as time zones, access levels, alarm configurations, cardholder information and card reader configurations.

- b. All ISCs on the SMS shall be capable of either full or selective downloads to individual intelligent system controllers, and bi-directionally so that alarms will still report to their respective alarm monitoring client workstations as cardholder information is being downloaded.
- c. Information on cardholder status, credential status, time zones or access levels shall download in real time as they are added, modified, or deleted from the SMS.

28. Portal Configuration Options:

- a. The SMS shall include the following options for each portal on the system:
 - 1) Allow user commands such as manual door unlock
 - 2) Rename auxiliary inputs
 - 3) Rename auxiliary outputs
 - 4) Independently supervise REX and DPS
 - 5) Configure REX and DPS as Normally Open or Normally Closed
 - 6) Deny if duress
 - 7) Assume door used
 - 8) Alarm masking
 - 9) Activate outputs
 - 10) Two card control
 - 11) Checkpoint
 - 12) Do not activate strike on REX
 - 13) The ability to allow system administrators to determine on a time-zone basis to log or not to log on a card reader by card reader basis
 - 14) Access grants
 - 15) Access denied
 - 16) Card reader status alarms
 - 17) The SMS shall allow for user definable door strike functionality for each card reader in the SMS
 - 18) The SMS shall allow for each card reader to be selected as either an 'In' reader, 'Out' reader, or 'None' to allow for ease of reporting time and attendance basic 'Time In' and 'Time Out' data.
 - 19) Enforce Use Limit: This option shall enable card use limits at the card reader. limiting the number of times that cardholders may use their credential to gain access at the card reader
 - 20) Supervise Door: Sets the SMS so that the card reader door contact is wired as a supervised input

29. The SMS shall allow for one or more access points in a specified area to be armed and disarmed directly from a control keypad.

30. Real-Time, Live Video User Verification:

- a. The SMS shall have the capability of interfacing to a surveillance system and displaying a live video image next to a stored cardholder image record. This feature shall be system configurable.

31. Traces:

- a. The SMS shall allow for a live or historical trace on any ISC, ICM, alarm input, credential (cardholder), intrusion detection device, monitor zone, or card reader. If applicable, the SMS shall allow for a trace on any asset, intercom, or camera. Multiple traces may be run simultaneously. The SMS shall allow system operators to filter alarm types from the history trace window. Alarms that shall be filtered from the trace window are access granted alarms, access denied alarms, system alarms, duress alarms, and area control alarms.

- b. Destination Assurance: The system shall provide the ability to alert the system operator when a cardholder does not reach a required location and present their credential after entering at a designated checkpoint in a designated period of time.

32. Real-Time, Dynamic Graphical Maps:

- a. The SMS shall support graphical maps that display device and group status, function lists dynamically in real time. The maps may be configured to appear on command or when specified alarms are selected for acknowledgment. Map device icons shall have the ability to dynamically change shape and/or color to reflect the current state of the device.
- b. The SMS shall support all map formats listed below:
 - 1) Adobe Photoshop (.psd)
 - 2) AutoCAD DXF (.dxf)
 - 3) Encapsulated Post Script (.eps)
 - 4) JPEG (.jpg)
 - 5) TIFF (.tif)
 - 6) Windows Metafile (.wmf, .emf)
 - 7) Windows Bitmap (.bmp, .dib)
- c. The SMS shall support map hierarchies or maps within maps. There shall be no limit to the number of maps that shall be nested hierarchically with each other. Multiple maps may be displayed simultaneously.
- d. The SMS shall support user defined icons for field hardware devices. The SMS shall also give system operators the ability to affect the mode of card readers, open doors, start a trace on a device, mask/unmask alarm inputs, and activate/deactivate/pulse an output from the map icons.
- e. The graphical maps shall have the ability to be printed to a local printer.

2.6 ACCESS CONTROL GRAPHICAL USER INTERFACE (GUI)

- A. A workstation based custom GUI shall be provided for complete display of real time system activity.
- B. The GUI shall provide the following features:
 - 1. Display in real-time, the status of devices by dynamically changing shape or color to indicate status.
 - 2. Acknowledge alarm conditions.
 - 3. Perform manual operations on all monitor and control points.
 - 4. Perform graphic editing functions.
 - 5. Customization of icons color or shape based on status.
- C. Graphical representations shall be made of the following activity:
 - 1. Cardholder Activity: Access granted (including duress), access denied, lost card used, stolen card used, inactive card used, unescorted visitor.
 - 2. Input Point Activity: Input condition (normal, abnormal, cut, short, shunt, unshunt).
 - 3. Output Point Activity: On status (automatic, by operator, by link), off status (automatic, by operator, by link), access level on, access level off.

4. Door Activity: Auto unlock, auto lock, closed, opened, forced open, left open, door switch cut, door switch shorted, REX status (cut, shorted, normal, abnormal), input unlock, operator lock, operator unlock.
 5. Controller Activity: Controller on-line, controller off-line, controller communications normal, communications cut.
 6. System Activity: System error, workstation start, workstation stop, printer off-line, printer unavailable, printer overflow, unknown card.
 7. Regional Group Activity: Occupancy restriction (high limit, low limit), anti-pass back (entry, exit), policy violation, escort left, number of escorts, numbers of users, number of visitors.
- D. The GUI shall have the ability to display a minimum of 100 custom graphical screens, developed by the SMS vendor with electronic maps provided by Owner.
 - E. The system shall have the ability to automatically call up specific maps. Each input point shall be linked to a primary map.
 - F. Graphical editing software shall be included, allowing the Owner to create and edit the graphical screens.
 - G. Graphics screens shall be developed using a minimum of eight (8) colors from a palette of 64 available.
 - H. The system shall operate on a Windows workstation as provided and recommended by the SMS vendor.

2.7 CREDENTIALS AND BADGING

- A. Badging Station:
 1. Provisioning:
 - a. The workstation(s) shall be furnished by the Owner and shall meet the specifications defined by the SMS software manufacturer to meet or exceed the functionality and performance specifications of the system and integrations defined in this and related sections. Contractor shall furnish specifications to the Owner in writing as part of the submittals.
 2. Software:
 - a. General:
 - 1) The SMS shall support a credential design module that is integral to the SMS source code with the ability to create and maintain credential designs. Features shall include the ability to support:
 - a) Complete credential design and layout tools
 - b) Chroma key
 - c) Image import
 - d) Ghosting
 - e) Signature capture
 - f) Barcodes
 - g) Smart chip support
 - b. Licensing
 - 1) Required badging/credential management licensing shall be furnished.

3. Hardware:

- a. Desktop configuration.
- b. Pentium 4 Dual Core CPU, 2.5 GHz or greater
- c. 4 GB RAM
- d. 100 GB hard drive, 7200 RPM
- e. Four (4) USB 2.0 ports, 10/100/1000 network interface card
- f. One (1) 19" flat screen LCD monitor
- g. NVIDIA graphics dual output board, PCI Express x 16 Graphics bus, 512 MB DDR3 memory buffer, 1280 x 1024 resolution
- h. Internal DVD +/- RW ROM drive
- i. Printer:

1) Printer Manufacturer shall be:

- a) Fargo DTC4500e

2) The SMS shall support a printer with industry standard and Microsoft certified drivers. The printer shall support:

- a) Double sided printing at a resolution of no less than 300 dpi, full color on the front, monochrome on the back
- b) Edge to edge printing
- c) High speed printing per card of a minimum of 7 seconds for monochrome and 35 seconds for YMCKO
- d) Holographic overlay
- e) Inline magnetic stripe encoding
- f) Inline Contactless Smart card encoding
- g) An input feeder/hopper with a minimum capacity of 100 cards and an output stacker/hopper with a minimum capacity of 30 cards

j. Images:

1) Camera:

- a) The badging station shall be compatible with flash lighting and USB connected cameras, allowing the capture of a cardholder image at a minimum resolution of 3 mega pixels.
- b) SMS image capture, storage, and hardware compression techniques must be in compliance with the ANSI standard or JPEG (Joint Photographic Experts Group).
- c) The SMS shall provide the ability to capture a cardholder's image through the use of any industry standard scanner or digital camera that utilizes a TWAIN interface. Images shall be able to be scanned at up to 16.7 million colors for a true color scanned image. When using a digital camera that supports multiple resolutions, the system shall allow the operator to select the desired resolution.
- d) Include required USB interface box, camera, camera power supply, integral or external integrated flash, tripod and 4' x 4' wall mounted white backdrop.

2) Image Import:

- a) The SMS shall allow system operators to have the ability to import a cardholder's image at the time of enrollment. The SMS shall support importing image formats of Bitmap (.bmp, .dib), JPEG (.jpg), JFIF (.jif), Adobe Photoshop (.psd), Macintosh PICT (.pct), Portable Network Graphics (.png), TIFF (.tif), Windows Metafile (.wmf, .emf).

4. Badge Design:

- a. Provide training and work in conjunction with Owner for development of four (4) badge designs.

5. Supplies:

a. Print Ribbons:

- 1) YMCKOK YMCKO KO BO YMC YMCKK Resin Black ribbons shall be provided to print 3500 hundred (#00) badges, plus one spare ribbon of the same type and capacity.

b. Cleaning Kits:

- 1) One cleaning kit shall be provided for every ribbon provided.

c. Lanyards and Sleeves:

- 1) Lanyards and badge sleeves shall be furnished by Owner.

d. Badge Quantities:

- 1) Badge quantities and types shall be as defined below.

B. Credentials:

- 1. Multi-Technology Contactless Smart Cards: 13.56 MHz and 125 kHz proximity radio frequency identification electronics, passive design. Card shall meet ISO 15693 and ISO 14443B2 standards.

- a. Maximum Dimensions: CR 79: 3.313" x 2.063" x 0.04", CR 80: 3.375" x 2.125" x 0.04".

- b. Construction to be of PVC or polyester laminate.

- c. Each card shall contain a unique serial number.

- d. Cards shall contain options for various memory capacities of 2k, 16k or 32k with a fixed number of application areas or areas which are sized by dynamic allocation.

- e. Each application area shall contain a unique authentication key. The card and reader shall require matching keys in order to function together. All RF communication between card and reader shall be encrypted using a secure algorithm.

- f. The card shall be protected with SEOS encryption algorithms.

- g. The cards shall be provided with custom keys uniquely matched to individual sites/customers to allow a non-interchangeable, high level of security through the use of formatting programs such as HID iClass Elite or Corporate 1000.

- h. Cards shall be encoded with bit lengths that are compatible with all other components of the SMS.
- i. Application areas shall be reserved for cashless vending applications or future applications as Owner requires.
- j. Cards shall support programming and updating of custom applications after issue.
- k. Cards shall be capable of having a photo and/or other graphical images printed directly on the surface of the card.
- l. Provide optional slot punch-outs on the short and long edge of the card.
- m. Provide 3500 multi-technology Seos cards. Cards shall be individually numbered with sequential matching of internal and external numbers.
- n. Cards shall be provided with a lifetime warranty.

C. Credential Management:

1. The SMS shall support a Credential Management and Enrollment module that is integral to the SMS source code with the ability to create and maintain the cardholder database. Features shall include the ability to:
 - a. Add, modify and delete records based upon permissions
 - b. Capture photo images, biometric information and signatures
 - c. Print credentials
 - d. Boolean search on any single or multiple fields
 - e. Customization of screen layout and field names
 - f. Advanced customization of fields, field names and screen tabs (pages) with optional Forms Designing and Editing module
 - g. Determine single or multiple active credentials
 - h. Assign access levels and access groups
 - i. Bulk assignment/modification/deletion of access levels
 - j. Bulk deletion of cardholder records.
 - k. Limit the number of times the credential can be printed
 - l. Limit the access for searching the database based upon user defined criteria
 - m. Mobile badging operations.
2. The SMS shall support the following bar codes:
 - a. Code 3 of 9 (3:1)
 - b. Code 93
 - c. UPCA
 - d. EAN 13
 - e. EAN 8
 - f. Code 128 A
 - g. Code 128 B
 - h. Code 128 C
 - i. Codabar
 - j. PostNET (Zip + 4 Postal)
 - k. Code 3 of 9 (2:1)
 - l. Interleaved 2 of 5 (2:1)
 - m. PDF-417 (2D)
 - n. Code 128 Auto
 - o. UCC-128
 - p. MSI Plessey
 - q. Extended Code 3 of 9
 - r. Extended Code 93
 - s. 2D Aztec

2.8 PORTAL DEVICES

A. Credential Readers:

1. Manufacturers:
 - a. HID Multiclass SE
 - 1) Shillage AD Series (AD300 & AD400) door hardware shall have the credential reader built-in.
 - 2) Trilogy Keypay/Credential device shall have the credential reader built-in.
2. Multi-Technology:
 - a. Compatible with 125 kHz proximity, 13.56 MHz Contactless Smart card, MIFARE, DESFire EV1, SEOS.
 - b. Backwards compatibility with legacy 13.56 MHz Contactless Smart cards and 125 kHz proximity access control formats, including 26, 32, 35, 37 bit as well as HID Corporate 1000 format.
3. Card readers manufactured specifically for non-access control applications shall not be acceptable.
4. Provide compatibility with most access control systems by providing card data outputs in Wiegand and Clock/Data.
5. Allow the firmware to be updated in the field without the need to remove the reader from the wall.
6. Secure mounting methods using tamper resistant screws.
7. An audio beeper that provides various tones to signify access granted, access denied, power up and diagnostics.
8. Tri-color LED or three (3) LEDs for visual notification of various conditions.
9. ISO1443A, 1443B and 15693 compliant.
10. The ability to transmit an alarm from an integrated tamper switch.
11. Support dual authentication of identity through the combined use of access badge and personal identification number (PIN) on an integrated 12 key keypad.
12. PBT polymer or UL94 polycarbonate.
13. Read Range:
 - a. Using 125 kHz cards or 13.56 MHz Contactless Smart cards, minimum operational read range shall not be less than one (1) inch after the readers have been installed in their permanent locations.
14. Operational voltage of 5-16 VDC, with operating temperature range of -31° F to 150° F, and rated for outdoor use with a minimum rating of IP55.
15. Readers and credentials shall be compatible with each other and shall be from the same manufacturer.

16. Available in sizes to be mounted to a standard single gang box or to a mullion. Maximum sizes:
 - a. Single gang box mount, with or without keypad: 5.1" x 3.1" x 1.1"
 - b. Mullion mount: 6.0" x 1.9" x 0.9"
 17. Lifetime warranty against defects in material and workmanship.
- B. Request-To-Exit Motion Detector:
1. Manufacturers:
 - a. Bosch DS 160 Series
 - b. Pre-approved equal
 2. Door monitor with sounder alert. Sounder alert shall have adjustable volume.
 3. Adjustable latch time.
 4. Selectable fail safe/fail secure.
 5. Activation LED.
 6. 12 or 24 VDC operation.
 7. Sequential logic input.
 8. Two (2) Form C contacts.
 9. Tamper switch.
 10. Field of view masking.
- C. Request-To-Exit Button:
1. Manufacturers:
 - a. Dynalock 6290 Series
 - b. Seco-Larm SD7213 Series
 - c. RCI 991 Series
 - d. Pre-approved equal
 2. 0-60 second adjustable pneumatic action.
 3. Contacts shall be one of the following:
 - a. DPDT
 - b. SPDT double break with isolated common
 - c. DPST
 - d. Normally closed SPST with normally open SPST
 4. One and one-half inches (1-1/2") to two inches (2") red mushroom button.
 5. Stainless steel or aluminum plate labeled "EXIT" or "PUSH TO EXIT".
 6. Available in mullion mount.
- D. Door Position Switch
1. Manufacturers:
 - a. GE
 - b. GRI
 - c. Honeywell
 - d. Pre-approved equal

2. Interior or Perimeter Door:
 - a. One (1) inch or 0.75 (3/4) inch diameter, recessed
 - b. DPDT contacts
 - c. 0.75" to 1.25" (3/4" to 1-1/4") gap for wood door
 - d. Maximum 0.375" to 0.625" (3/8" to 5/8") gap for steel door
 - e. Basis of Design: UTC/GE/Sentrol 1076D
3. Overhead Door:
 - a. Three (3) inch gap
 - b. SPDT contacts
 - c. 18" stainless steel armored cable
 - d. Aluminum construction
 - e. Basis of Design: UTC/GE/Sentrol 2207AU
4. Steel Door:
 - a. A rare earth magnet shall be used.
5. Cage/Gate:
 - a. Maximum 1.5 (1-1/2) inch gap
 - b. DPDT contacts
 - c. Three feet (3') stainless steel armored cable
 - d. Aluminum construction
 - e. Basis of Design: UTC/GE/Sentrol 2507AD

E. Duress Buttons:

1. Manufacturers:
 - a. Honeywell (Hardwired) 269R, 270R
 - b. United Security Products (Hardwired) HUB Series
 - c. Inovonics (Wireless) EN4216/32 MR Series
 - d. Linear (Wireless) DXSR-1508
 - e. Honeywell (Wireless) 5800 Series
 - f. Pre-approved equal
2. Multi technology:
 - a. Hardwired:
 - 1) DPDT contacts
 - 2) Silent operation
 - 3) Recessed activation button to prevent accidental activation.
 - 4) Screw terminal connections
 - 5) Momentary contacts

F. Cable:

1. Composite cable is allowed, although sufficient conductors may not be available in composite cables for all portal configurations. Contractor shall be responsible for additional required cables beyond one composite cable to each portal to meet functional requirements of the system.
 - a. Reader: 22 AWG, 3 pair, stranded, overall shield. Shield shall be grounded at control panel end only.
 - b. Request to Exit Motion Detector: 22 AWG, 4 conductor, stranded.

- c. Door Position Switch: 22 AWG, 2 conductor, stranded.
- d. Request to Exit Button: 18 AWG, 4 conductor, stranded.
- e. Lock: Minimum 18 AWG, 4 conductor, stranded.
 - 1) Lock may require heavier gauge cable depending on door hardware solution power requirements. Contractor shall coordinate with door hardware provider for higher current devices and shall adjust the gauge of the lock cable accordingly.
- f. Auxiliary Devices: Refer to plans for requirements.

G. Locks and Door Hardware:

- 1. Electric/electronic locks shall be furnished and installed by the door hardware provider.
- 2. Access Control Contractor shall interface with and terminate cables to locks.
- 3. Access Control Contractor shall coordinate with door hardware provider for specified sequences of operation at the various portals.
- 4. Magnetic locks shall have a magnetic bond sensor.
- 5. Refer to architectural specifications and/or the architectural door schedule.

2.9 VISITOR MANAGEMENT SYSTEM (VIMS)

A. Software:

- 1. Manufacturers:
 - a. Stopware
 - b. Veristream
 - c. Pre-approved equal
- 2. Functionality:
 - a. A visitor management system (VIMS) shall be provided as a standalone, seamlessly integrated solution within the SMS. All functionality described from this point forward shall reflect functionality of the seamlessly integrated system.
 - b. The VIMS shall allow the operator to enroll, schedule, assign to an employee, capture photos, assign access levels, sign in or out, print badges, and track visitors as they move throughout the facilities.
 - c. Site visitors shall have, via the VIMS, the ability to be assigned access levels and move throughout the facility using an assigned credential. Visitor alarms shall report in the main alarm monitoring window and shall be logged to the SMS database. All visitor data shall reside on the SMS database.
 - d. A record for each visitor shall be created in the VIMS by entering the required data into appropriate data fields. The SMS shall provide the ability to define dropdown list box fields for repetitively entered text (e.g.: company representing, reason for visit, etc.). Dropdown list boxes shall allow the operator a variety of pre-defined choices for data input. The screen design shall be configurable to allow the entry of data in any format desired.
 - e. A data import function shall be available to pre-load the VIMS with visitor records and industry standard image formats. This import function shall be capable of adding records to the database at any time.

- f. Visitors to an organization shall be assigned to a cardholder in the database for the scheduled visit. A visitor shall be assigned to more than one cardholder if multiple visits are involved. Cardholders shall have the ability to have multiple visits assigned to them. The SMS shall have the ability to be configured for which cardholders are authorized to host visitors.
- g. The VIMS shall support visitor self-registration at a kiosk.
- h. The VIMS shall support visitor pre-registration by employees through a web-based application.
- i. The VIMS shall allow operators to pre-schedule a visit for a visitor. The information that is required for a visit shall be user defined by the SMS administrator. Fields that shall be defined include:
 - 1) Visit Time/Date In
 - 2) Visit Time/Date Out
 - 3) Visit Type
 - 4) Purpose of Visit
- j. The VIMS shall provide the option for visitor "Sign In". When signing in, a dialog box shall prompt the operator to optionally print a disposable credential, assign an access control credential to a visitor, and notify the cardholder of the visitor arrival via email. When the scheduled visitor has been signed in but not signed out, the option to "Sign Out" shall be made available. When signing out, the actual Time Out field shall be updated, and all active credentials for the visitor shall be deactivated.
- k. The VIMS shall support a visitor logout action that signs out all active visits for a particular visitor based upon an event or transaction.
- l. The VIMS shall support bulk sign-in capabilities to allow for batch sign-in for all visitors associated with a single visit.
- m. The VIMS shall allow system administrators to configure the system such that visitors are unable to sign in for a pre-scheduled visit before the pre-scheduled visit Time In defined.
- n. The VIMS shall include an advanced visit status user interface. The user interface shall be automatically updated and shall display:
 - 1) All visits currently in progress (signed-in)
 - 2) Visitors due in during the next user defined minutes
 - 3) Visitors whose visit should have started, but who have not checked in
 - 4) Visits due to expire in the next user defined minutes
 - 5) Overstayed visits
 - 6) Completed visits
- o. The VIMS shall support integration with email systems. When scheduling a visit, system operators shall have the ability to send an email message to one or more recipients that includes the scheduled visit information. Upon changing the initial visit details, an email update shall be sent to all email recipients of the initial visit notification email.
- p. The VIMS shall provide a screen designer tool that allows SMS administrators to choose the layout and design of the VIMS forms.

- q. Each visitor shall have his/her own unique record in the SMS database. Each visitor record shall have the following information stored with them.
 - 1) User defined fields of visitor information:
 - a) Photo
 - b) Current credential assigned with credential type
 - c) Current credential information
 - d) Previous credential history
 - e) Assigned access levels with expiration dates
 - f) Cardholder / visit link
- r. The VIMS shall maintain a complete visit history that shall be stored with each visit, complete with the cardholder visited, time in and out, as well as the purpose of the visit.
- s. The VIMS shall have the ability to trace visitors who are carrying access cards.
- t. The VIMS shall support historical traces. Historical traces shall allow system operators to specify the number of days prior of information that they would like displayed for the particular visitor that is being traced.

B. Reader/Scanner:

1. Manufacturers:

- a. Intellicheck Driver's License Reader
- b. Snapshell Driver's License and Business Card Scanner
- c. Scanshell 1000 Passport, Driver's License, Business Card Scanner
- d. Cardscan B9 Business Card Scanner
- e. Assure Tec ID-150 Driver's License Scanner
- f. Assure Tec ID-150A Driver's License Scanner with authentication
- g. ID Tech Mag Stripe Reader 33411
- h. Topaz 1 x 5 LCD Signature Pad
- i. Topaz 4 x 5 LCD Signature Pad
- j. Approved equal

2. Functionality:

- a. Use optical character recognition to read the front of a typical business card and automatically populate the relevant fields. All relevant data may not be captured based on the card design, colors, graphics and logos. Owner shall have control over which fields from the card are stored.
- b. Decode information from the magnetic stripe or 2D barcode on the license and automatically populate the relevant fields. Owner shall have control over which fields from the license are stored.
- c. Capture the visitor's image from the credential as an option. Owner shall retain the option of importing an image from an attached camera.
- d. Once enrolled, a visitor shall not require re-entry of information. Upon a return visit, the visitor's information shall be available via a Boolean search from any of the VIMS data fields.
- e. The VIMS shall allow for re-assignment of credential IDs for use with re-assignable visitor credentials. Credential IDs shall be stored in the database, and requested reports shall show the specific credential ID linked to the specific visitor record for the time period requested.

- f. The VIMS shall have the ability to capture a visitor's signature. Signatures may also be captured by importing a signature file into the SMS or by scanning it in using an industry standard scanning device that utilizes a TWAIN interface.

C. Camera:

1. Manufacturers:

- a. Logitech Orbit PTZ
- b. Same manufacturer and model as access control badging camera
- c. Approved equal

2. Functionality:

- a. Minimum 1.3 Mega pixel resolutions.
- b. USB 2.0 connectivity.
- c. The VMS shall include equipment required to capture visitor images. While capturing visitor images, the operator must have the option of capturing a new image without affecting the existing record. VIMS image capture, storage, and hardware compression techniques must be in compliance with the ANSI standard or JPEG (Joint Photographic Experts Group).
- d. The VIMS shall allow system operators to import a visitor's image at the time of enrollment. The VIMS shall support the same image formats as the SMS.

D. Printer:

1. Manufacturers:

- a. Printer as used for access control system badging
- b. Dymo 450 Turbo black and white thermal printer
- c. Approved equal

2. Functionality:

- a. The visitor credential format, including layout, background color, location of photo, text, applicable graphics or company logos, etc., shall be designed through use of the VIMS graphical user interface (GUI).

E. Supplies:

- 1. 500 badge stock
- 2. Topaz signature pad replacement pen, quantity two (2)

2.10 INTERFACES AND INTEGRATIONS -

A. Video Surveillance Integration and Interface:

- 1. The SMS shall be required to integrate with the surveillance system.
- 2. The SMS integration to the surveillance system shall be classified as a high-level interface. The supported surveillance system manufacturers shall be those listed in Section 28 23 00. Dry contact closure or other low-level interface methods are not acceptable. The SMS shall be capable of passing alarm information via a Serial RS232 interface with any surveillance system that utilizes ASCII commands, or by a TCP/IP protocol interface using APIs. The two systems may be from different or the same manufacturers.

3. Command information sent through the high-level interface shall include input point, door event, terminal controller points, operator events and system events, with the associated surveillance system commands.
4. The SMS vendor shall be responsible for providing the interface programming in a protocol that is understandable by the surveillance system.
5. The SMS to surveillance system integration shall perform the following:
 - a. Display a live video image next to a stored cardholder image record upon presentation of an access badge to a reader.
 - b. Any alarm event in the SMS shall have the ability to be associated with a video clip in real time, with configurable pre- and post-event recording duration.
 - c. SMS alarm events shall be capable of triggering a defined video sequence of operation, such as camera movement to a preset position.
 - d. PTZ control via the SMS, including activating presets and starting/stopping tours.
 - e. Video alarm acknowledgement, such as motion detection, and alarm reset shall be supported from the SMS.
 - f. In the SMS, display a tiled screen of operator-selected live images in a similar format as what is viewable via the video management system alone.
 - g. Ability to view recorded images based on operator selected date, time and duration through the SMS.
 - h. Linking of an access control event to a video clip so that clicking on an event begins playing of that clip.
 - i. Ability to click on a camera icon on the SMS map to display live video from that camera and to select recorded video from the same camera.
6. Should the integration fail or malfunction after installation, the systems shall be able to operate independently until the problem(s) is resolved.

B. Intrusion Detection Integration and Interface:

1. The SMS shall provide seamless integration with intrusion detection panels. This shall allow for the ability to monitor intrusion detection alarms in real time inside the SMS alarm monitoring module and allow for command and control of supported intrusion detection. Once alarms are brought into SMS, they shall have the ability to be linked to digital video and/or global I/O, and they shall be stored in the SMS database.
2. Communication with the intrusion detection panel shall be direct wired RS-232 or a LAN connection.
3. Intrusion detection panel devices (zones, relays) shall be definable and added to the SMS database.
4. The SMS shall allow for the configuration of intrusion detection zones, areas, relays and doors. Operators shall have the ability to mark intrusion detection zones, areas, relays and doors as 'Enabled' or 'Disabled'.
5. Should the SMS manufacturer offer intrusion hardware, specifically a full function intrusion system keypad, as well as intrusion system functionality, it is not required to interface with a separate intrusion system manufacturer.

C. Text Paging Interface Option:

1. The SMS shall support a paging interface seamlessly integrated within the SMS alarm monitoring module. System operators shall have the ability to manually or automatically send numeric or alphanumeric paging messages on demand regarding any alarm currently displayed in the main alarm monitoring window. Pages shall have the ability to be sent to multiple pagers if desired. The SMS shall allow any pager to be accessed through a paging terminal that communicates through the TAP (telocator alphanumeric paging) protocol.

D. Email Interface Option:

1. The SMS shall support an email interface seamlessly integrated within the SMS alarm monitoring module. System operators shall have the ability to manually or automatically send ASCII text email messages from the alarm monitoring module on demand regarding any alarm currently displayed in the main alarm monitoring window. Emails shall have the ability to be sent to multiple email accounts if desired. The SMS shall integrate with Microsoft Exchange Server.

E. Point of Sale (POS) Interface:

1. The SMS shall support integration with the Mealtime POS equipment that provides cash register event annunciation in the alarm monitoring console. These events/transactions shall have the same attributes as all other alarm events in the SMS.

F. Time Clock

1. The SMS shall support integration with the Time Clock equipment that provides clock in/clock based on SMS credentials.

G. Wireless Gate Keypads/Card reader

1. The SMS shall support integration with the Trilogy Wireless keypad with card reader equipment that provides entry authentication, remote open, and monitoring for automotive gate entry. These events/transactions shall have the same attributes as all other alarm events in the SMS.

3. PART EXECUTION

3.1 INSTALLATION

- A. Comply with the manufacturer's instructions and recommendations for installation of all products.
- B. Provide all system wiring between all components as shown on the project drawings or as directed by the manufacturer, whichever is the more stringent requirement.
- C. Network controllers shall be installed centralized in the nearest telecommunications room(s). Mount controllers to the structural walls in a location coordinated with other utilities. Coordinate exact location with Architect/Engineer prior to installation. Provide dedicated +120 VAC emergency power circuit to the controllers using #12 AWG wiring from the nearest emergency electrical power distribution panel board.
- D. Provide wiring and connection to all electrified locking hardware devices. Complete programming and testing of all electrified locking hardware devices.
- E. Install all credential readers in accordance with manufacturer's instructions where shown on floor plans, in accordance with the Americans with Disabilities Act (ADA) requirements. Provide wiring and connection to all credential readers. Complete programming, adjustment, and testing of all credential readers.

- F. Provide wiring and connection to all hardware request-to-exit devices that are integral to electrified door hardware. Provide wiring and connection to all request-to-exit motion detectors. Complete programming and testing of all integrated request-to-exit devices. Where possible, avoid false activation by persons passing by but not exiting.
- G. Install all request-to-exit motion detectors in accordance with manufacturer's instructions directly above the door frame, centered on the door opening. Adjust sensitivity to permit operation on motion of persons within 2'-0" of door. Avoid false activation by persons passing by where possible.
- H. Install all request-to-exit pushbuttons in accordance with manufacturer's instructions where shown on floor plans, in accordance with the Americans with Disabilities Act (ADA) requirements. Provide wiring and connection to all request-to-exit pushbuttons. Complete programming, adjustment and testing of all request-to-exit pushbuttons.
- I. Install all door alarm contacts in accordance with manufacturer's instructions either recessed in the door header or surface mounted as required. Provide wiring and connection to door alarm contact devices. Complete programming, adjustment and testing of all door alarm contacts.
- J. Install all duress switches in accordance with manufacturer's instructions, surface mounted under counter in locations shown on plans. Verify exact mounting location with Owner prior to cable rough-in or installation. For hard wired devices, provide wiring and connection to duress switch devices. For wireless duress switch devices, mount receivers in accessible locations. Complete programming, adjustment and testing of all duress switch devices. Wireless testing shall include signal reception when transmitter is in all sections of the area in which it will be used in normal operations.
- K. Install, wire, configure, adjust, program and test all access control system servers, workstations, badging workstations and other user interfaces.
- L. Install, wire, configure, adjust, program, and test all specified interfaces and integrations between access control and other systems. Contractor shall provide all cabling, wiring, terminations, components, devices, accessories, hardware, software and other material and accessories necessary to complete all specified interfaces and integrations and make them fully operational.
- M. All low voltage access control cabling shall be routed and supported completely separate from any and all other telecommunications or other low voltage system cabling .
- N. Electronic access control system cabling shall not be spliced.
- O. Flexible conduit is not allowed except with prior approval. Refer to Section 26 05 33 for conduit requirements. Refer to Section 27 05 28 for cable hanger and support requirements.
- P. Each cable shall be appropriately identified, as defined on the record documents, at each end's termination point using pressure sensitive label strips.
- Q. The conductor color code used in terminating system cabling at system devices shall remain consistent from device to device for each unique device type throughout the project.
- R. Install and tighten all connectors in accordance with manufacturer's instructions using the appropriately designed tools recommended by the manufacturer for that purpose. Do not strip or damage connectors, terminals, or equipment by over tightening termination fasteners.
- S. Grounding and Bonding Requirements:
 - 1. Provide a minimum of 6AWG bonding conductor from each electronic access control system control panel, power supply and surge suppression device to the nearest telecommunications grounding busbar. Actual bonding conductor size is determined by its length; refer to Section 27 05 26 for grounding and bonding conductor sizing criteria.
 - 2. Cables containing shields shall not have the shields grounded at conduits, boxes, racks, etc. Ground the shield only at the control panel end.

- T. Coordinate installation of all devices with other trades and utilities in the vicinity.
- U. Cabling shall be plenum rated when installed outside conduit in plenum ceilings.

3.2 FIELD QUALITY CONTROL

- A. Where these specifications require a product or assembly without the use of a brand or trade name, provide a product that meets the requirements of the specifications as supplied and warranted by the system vendor. If the product or assembly is not available from the system vendor, provide product or assembly as recommended by the system vendor.
- B. Periodic observations will be performed during construction to verify compliance with the requirements of the specifications. These services do not relieve the Contractor of responsibility for compliance with the contract documents.
- C. Furnish products listed and classified by Underwriters Laboratories, Inc. (UL) as suitable for purpose specified and indicated.

3.3 MANUFACTURER AND INTEGRATOR COMBINED FIELD SERVICES

- A. Installation shall be performed by a factory-trained and certified Contractor.
- B. The Contractor shall provide a comprehensive, site-specific customer planning guide for the system. The Contractor shall conduct conference(s) with the Owner prior to any installation to discuss the programming and configuration options of the system and the planning guide.
- C. The Contractor shall include labor for all planning and all programming activities required to implement the Owner's access policies for each system point and each operator and administrator. Any software programmable access policy, within the bounds of the hardware specified, shall be included.
- D. It shall be the responsibility of the Contractor to provide a complete, functional system as described by the design documents. These responsibilities include:
 - 1. Complete hardware setup, installation, wiring and software configuration of the system server, all workstations and all peripheral hardware.
 - 2. Complete programming of all operator software in accordance with the Owner's access policies determined by the planning guide conference(s).
 - 3. Manual data entry of 100 cardholders based on a printed roster provided by the Owner.
 - 4. Configuration of the network software for operation of the system. Templates shall be established representative of all user access right levels.
 - 5. Programming of all cardholder database screens including cardholder information screens, report templates, queries, etc. Encoding of 200 Contactless Smart cards shall be included.
 - 6. Programming of all custom graphic GUI screens including devices.
 - 7. Complete system diagnostic verification.
- E. The SMS Installation Contractor shall be present at meetings to coordinate all door hardware requirements with the door hardware vendor.

3.4 SYSTEM DOCUMENTATION

- A. Complete documentation shall be provided for the system. The documentation shall describe:
 - 1. All operational parameters of the system
 - 2. Complete documentation of programming and access policies
 - 3. Complete operating instructions for all hardware and software
- B. The following sections shall be provided in the system documentation:
 - 1. System Administrator Manual: Provides an overview and a step-by-step guide and instructions detailing all system administrator responsibilities and functions.
 - 2. User Manual: A step-by-step guide and instructions detailing all system user functions.
 - 3. Alarm Monitoring Manual: A step-by-step guide and instructions detailing all alarm monitoring system functions and responsibilities.
 - 4. Technical Maintenance Manual: A comprehensive document providing all maintenance actions, system testing schedules, troubleshooting flowcharts, functional system layout, wiring diagrams, block diagrams and schematic diagrams.
 - 5. Refer to Part 1 for details.

3.5 SYSTEM TRAINING

- A. All labor and materials required for on-site system training by a certified representative of the system manufacturer shall be provided. Training shall be conducted at the project site using the project equipment.
- B. Coordinate training days and times with Owner.
- C. Provide a training outline agenda describing the subject matter and the recommended audience for each topic.
- D. At a minimum, the following training shall be conducted:
 - 1. System Administrators: A course detailing the system functions, configurations and operations. Provide training on all aspects of the system including data import/export, report, cardholder management, system workstation and server configuration and maintenance, software and hardware configuration and peripheral hardware operation.
 - 2. Operators: A course detailing the operational features of all aspects of the user interface. Topics shall include alarm monitoring functions, reports, error handling, alarm handling, output relay control, operation of integrated systems interface, and general overview of the report hardware.
 - 3. GUI Editing: Conduct detailed training on using the GUI editing software. Topics shall include the editing of existing graphical maps and the creation of new graphical maps.
- E. Minimum on-site training times shall be:
 - 1. System Administrators: Eight (8) hours
 - 2. Operators: Eight (8) hours.
 - 3. GUI Editing: Eight (8) hours.
 - 4. Integrations : Eight (8) hours

5. Badging System: Eight (8) hours.
6. Four (4) additional hours of training each quarter for the 12-month period of the project warranty shall be provided. A minimum of half of this additional training shall be on site; the remainder may be support by telephone or email. Contractor shall document this training, including dates performed, trainer and Owner representative(s) present. Each phone call or email shall be documented as a minimum of 15 minutes duration.

3.6 SYSTEM ACCEPTANCE

- A. The SMS vendor shall submit for review a formal acceptance and system checkout program. The system checkout procedures shall include all system components, software and functionality. The Contractor shall perform the tests and document all results under the supervision of the manufacturer's systems engineer.
- B. All operational scenarios, as defined by the customer planning guide, shall be tested to simulate the actual use of the system in the normal operating environment. The successful completion of these operational scenarios shall be documented.
- C. The system shall not be accepted until all requirements of system documentation and training have been completed.

END OF SECTION

SECTION 28 16 00

INTRUSION DETECTION SYSTEM

1. PART GENERAL

1.1 SECTION INCLUDES

- A. Security Control Panel.
- B. Initiation Devices.
- C. Notification Devices.

1.2 RELATED WORK

- A. Section 26 05 33 - Conduit and Boxes
- B. Section 26 05 13 - Wire and Cable
- C. Section 28 05 00 - Basic Electronic Safety and Security System Requirements
- D. Section 28 13 00 - Electronic Access Control

1.3 QUALITY ASSURANCE

- A. Manufacturer: The access control system shall be a single-source manufacturer such that the single vendor distributes, supports, warranties and services all components. The manufacturer shall have a minimum of five (5) years documented experience.
- B. Installer: The installing dealer must be a factory-authorized service and support company specializing in the selected manufacturer's product, with demonstrated prior experience with the selected manufacturer's system installation and programming.
- C. Servicing Contractor: The manufacturer of the system must have local service representatives within 60 miles of the project site.

1.4 REFERENCES

- A. NFPA 70 - National Electrical Code.
- B. UL 294 - Standard for Access Control Systems.

1.5 SUBMITTALS

- A. Submit shop drawings and product data under provisions of Section 28 05 00.
- B. Product Data Submittal: Provide manufacturer's technical product specification sheet for each individual component type. Submitted data shall show the following:
 - 1. Compliance with each requirement of these documents. The submittal shall acknowledge each requirement of this section, item-by-item.
 - 2. All component options and accessories specific to this project.
 - 3. Electrical power consumption rating and voltage.
 - 4. Wiring requirements.

- C. System Drawings: Project-specific system CAD drawings shall be provided as follows:
 - 1. Provide a system block diagram noting system components and interconnection between components. The interconnection of components shall clearly indicate all wiring required in the system. When multiple pieces of equipment are required in the exact same configuration (i.e., multiple identical controllers), the diagram may show one device and refer to the others as "typical" of the device shown.
 - 2. Provide schedules describing each system input location by an architecturally familiar reference (i.e., Door 312A). The architectural door schedule shall be used as the basis.
- D. Submit detailed description of Owner training to be conducted at project end, including specific training times.
- E. Quality Assurance:
 - 1. Provide materials documenting experience requirements of the manufacturer and Installing Contractor.
 - 2. Provide system checkout test procedure to be performed at acceptance. Test procedures shall include all external alarm events.
- F. Coordination Drawings:
 - 1. Include all ceiling-mounted devices in composite electronic coordination files. Refer to Section 28 05 00 for coordination drawing requirements.

1.6 SYSTEM DESCRIPTION

- A. This specification section describes the furnishing, installation, commissioning and programming of a complete, turnkey intrusion detection system integrated with the access control system.
- B. Performance Statement: This specification section and the accompanying access control-specific design documents are performance based, describing the minimum material quality, required features, and operational requirements of the system. These documents do not convey every wire that must be installed and every equipment connection that must be made. Based on the equipment constraints described and the performance required of the system, as presented in these documents, the Vendor and the Contractor are solely responsible for determining all wiring, programming and miscellaneous equipment required for a complete and operational system.
- C. Basic System Description: The security management system shall provide an integrated hardware and software solution for access control.

1.7 PROJECT RECORD DOCUMENTS

- A. Submit documents under the provisions of Section 28 05 00.
- B. Provide final system block diagram showing any deviations from shop drawing submittal.
- C. Provide statement that system checkout test, as outlined in the shop drawing submittal, is complete and satisfactory.
- D. Provide schedules documenting:
 - 1. Controller installation locations including specific door numbers being controlled.
 - 2. All terminal block wiring, including cable numbers.

- E. Warranty: Submit written warranty and complete all Owner registration forms.
- F. Complete all operation and maintenance manuals as described below.

1.8 OPERATION AND MAINTENANCE DATA

- A. Submit documents under the provisions of Section 28 05 00.
- B. Operation Data: Provide full system operation instructions for each piece of equipment.
- C. Maintenance Data: Document any manufacturer's recommended preventative maintenance procedures to be performed by the Owner.

1.9 WARRANTY

- A. Unless otherwise noted, provide warranty for one (1) year after Date of Substantial Completion for all materials and labor.
- B. The warranty shall include emergency service and repair on-site, with acknowledgment response time of one (1) hour from time of notification and on-site response within four (4) hours. The system shall be repaired and restored to operation within twenty-four (24) hours of notification.
- C. Refer to the individual product sections for further warranty requirements of individual system components.

2. PART INTRUSION DETECTION PRODUCTS

2.1 INTRUSION DETECTION SYSTEM MANUFACTURERS

- A. Bosch - Basis of design
- B. Pre-Approved equal

2.2 SECURITY CONTROL PANEL

- A. Control Panel: Modular construction with surface wall-mounted enclosure.
- B. Power Supply: Adequate to serve control panel modules, remote detectors, remote annunciators, relays, and alarm signaling devices. Include battery operated emergency power supply with capacity for operating system in standby mode for 24_hours.
- C. System Supervision: Provide electrically-supervised system, with supervised alarm initiating and alarm signaling circuits. Component or power supply failure places system in alarm mode.
- D. Initiating Circuits: Supervised zone module with alarm and trouble indication.
- E. Signal Circuits: Supervised zone coded signal module, sufficient for signal devices connected to system; occurrence of single ground or open condition places circuit in trouble mode and does not disable that circuit from transmitting alarm.
- F. Remote Station Signal Transmitter: Electrically supervised, capable of transmitting alarm and trouble signals over telephone lines to central station receiver.
- G. Auxiliary Relays: Provide sufficient SPDT auxiliary relay contacts for each detection zone to provide accessory functions specified.
- H. Occupied/Unoccupied Selector: Keypad and Access Control system.
- I. Entry and Exit Time Delays: 60s.

- J. Alarm Sequence of Operation: Actuation of Intrusion Detecting device places system in alarm mode, which causes the following operations:
1. Sound and display local alarm signaling devices with non-coded signal.
 2. Transmit zone-coded signal to central station.
 3. Indicate location of actuated device on control panel.
 4. Zone Bypass Switch: Keypad.
 5. Alarm Reset: Key-accessible reset function resets alarm system out of alarm if alarm initiating circuits have cleared.
- K. Lamp Test: Manual lamp test function causes alarm indication at each zone at control panel.

2.3 ACCESS CONTROL

- A. Refer to 28 13 00

2.4 INITIATION DEVICES

- A. Duress/Panic Switch:

1. SPDT, 12 VDC switch with latching LED light indicating switch activation.
2. LED to provide green light glow for visibility of switch in low light conditions.
3. Small form factor white ABS plastic housing (2" W x 3" H x 1" D) containing electronics and magnetic contacts.
4. Housing to contact actuator lever alarming at 20 to 45-degree movement (approximately 1") from resting position.

- B. Door Contacts:

1. Contacts shall be single-pole, double-throw (SPDT) suitable for use in a line supervision circuit. Gap length shall be 1" on the latch side.
2. Provide magnetic alarm contacts at each door (recessed in the door header) where shown on the plans. Contacts shall provide a signal to the controller when the contact status changes.
3. The contacts shall have the capability of being shunted by a request-to-exit device. When the system grants access at a controlled point, the system shall shunt the door alarm input for that point.

- C. Motion Detectors:

1. Passive infrared, ceiling mounted, 12 VDC.
2. Adaptive technology for humidity and temperature stability.
3. 360-degree coverage, 60' coverage range.
4. Fresnel pattern lens with a minimum of a 30-zone pattern.

- D. Glass Break Detectors:

1. Shock sensor type, mounted to glass.
2. 10' protection range on single-pane glass.
3. Piezo transducer technology providing power to sensor. No external power is required.

4. +15 VDC maximum input.

2.5 NOTIFICATION DEVICES

A. Alarm Horn:

1. Ceiling mounted, location above the ceiling adjacent to the security point.
2. Piezo siren type, with alternating high/low sound.
3. 106 dB at 10'.
4. 6 to 13.8 VDC operation.

3. PART EXECUTION

3.1 INSTALLATION

- A. Comply with the manufacturer's instructions and recommendations for installation of all products.
- B. Provide all system wiring between all components as directed by the manufacturer.
- C. Mount all readers where shown on plans in accordance with Americans with Disabilities Act (ADA) requirements.
- D. Locate all request to exit motion detectors directly above the door frame, centered on the door opening. Adjust sensitivity to permit operation on motion of persons within 2'-0" of door. Avoid false activation by persons passing by where possible.
- E. Provide wiring to the request-to-exit devices located in the electrified door hardware.
- F. Install, terminate and test all door alarm contacts. Contacts shall be recessed in the door header.

3.2 FIELD QUALITY CONTROL

- A. Where these specifications require a product or assembly without the use of a brand or trade name, provide a product that meets the requirements of the specifications, as supplied and warranted by the system vendor. If the product or assembly is not available from the system vendor, provide product or assembly as recommended by the system vendor.
- B. Periodic observations will be performed during construction to verify compliance with the requirements of the specifications. These services do not relieve the Contractor of responsibility for compliance with the Contract Documents.

3.3 MANUFACTURER'S FIELD SERVICES

- A. Installation shall be performed by a factory-trained and certified Contractor Installer.
- B. The Installer shall provide a comprehensive, site-specific customer planning guide for the system. The installer shall conduct a conference with the Owner prior to any installation to discuss the programming options of the system and the planning guide. The result of this planning guide shall be the determination of the system access policies for each point.
- C. The Installer shall include labor for all planning and all programming activities required to implement the Owner's access policies for each system point. Any software programmable access policy, within the bounds of the hardware specified, shall be included.

- D. It shall be the responsibility of the Contractor/Installer to provide a complete, functional system as described by the Contract Documents. These responsibilities include:
 - 1. Complete hardware setup, installation and wiring, and software configuration of the system.
 - 2. Complete programming of all operator software in accordance with the Owner's access policies determined by the planning guide conference.
 - 3. Complete system diagnostic verification.
- E. The Installation Contractor shall be present at two (2) four-hour meetings in project location to coordinate all door hardware requirements with the door hardware vendor.

3.4 SYSTEM ACCEPTANCE

- A. The SMS Vendor shall submit for review a formal acceptance and system checkout program. The system checkout procedures shall include all system components and software, including but not limited to all system computers, field controllers, card reader devices, biometric readers and remote system interfaces. The Contractor shall perform the tests and document all results under the supervision of the manufacturer's system engineer.
- B. All operational scenarios, as defined by the customer planning guide, shall be tested to simulate the actual use of the system in the normal operating environment. The successful completion of these operational scenarios shall be documented.

3.5 SYSTEM DOCUMENTATION

- A. Complete documentation shall be provided for the system. The documentation shall describe:
 - 1. All operational parameters of the system.
 - 2. Complete documentation of programming and access policies.
 - 3. All data sets.
 - 4. Complete operating instructions for all hardware and software.
- B. The following sections shall be provided in the system documentation:
 - 1. User Manual: A step-by-step guide and instructions detailing all system user functions.
 - 2. Technical Maintenance Manual: A comprehensive document providing all maintenance actions, system testing schedules, troubleshooting flowcharts, functional system layout, wiring diagrams, block diagrams and schematic diagrams.

3.6 SYSTEM TRAINING

- A. All labor and materials required for on-site system training by a certified representative of the system manufacturer shall be provided. Training shall be conducted at the project site using the project equipment.
- B. Provide two weeks advanced notice of training to the Owner.
- C. Provide a training outline agenda describing the subject matter and the recommended audience for each topic.
- D. At a minimum, the following training shall be conducted:
 - 1. Alarm Monitoring Users: Provide a detailed course outlining the operational features of all aspects of the user interface. Topics shall include alarm monitoring functions, reports, error handling, alarm handling, output relay control and general overview of the report hardware.

E. Minimum on-site training times shall be:

1. Alarm Monitoring Users: One day.

END OF SECTION

SECTION 28 31 00

FIRE ALARM AND DETECTION SYSTEMS

1. PART GENERAL

1.1 SECTION INCLUDES

- A. Fire alarm and detection systems
- B. One-way emergency communications system with voice notification within-building, wide-area, and distributed recipient coverage.

1.2 RELATED WORK

- A. Section 26 05 53 – Electrical Identification: Refer to electrical identification for color and identification labeling requirements.

1.3 QUALITY ASSURANCE

- A. Manufacturer: Company specializing in smoke detection and fire alarm systems with ten years' experience.
- B. Installer: A factory-authorized Electrical or Security Contractor licensed with the State and local jurisdiction with five years' experience in the design, installation, and maintenance of fire alarm systems by that manufacturer.
- C. Qualifications: The person managing/overseeing the preparation of shop drawings and the system installation/programming/testing shall be trained and certified by the system manufacturer and shall be Fire Alarm Certified by NICET, minimum Level 3. This person's name and certification number shall appear on the start-up and testing reports.

1.4 REFERENCES

- A. ASME A17.1 - Safety Code for Elevators and Escalators
- B. California Electrical Code
- C. NFPA 72 - National Fire Alarm and Signaling Code
- D. NFPA 101 - Life Safety Code
- E. UL 2017 – General Purpose Signaling Devices and Systems
- F. UL 2572 - Control and Communication Units for Mass Notification Systems
- G. California Fire Code (CFC)

1.5 SUBMITTALS

- A. Submit shop drawings and product data under provisions of Section 26 05 00 and as noted below.
 - 1. Failure to comply with all the following and all the provisions in 26 05 00 will result in the shop drawing submittal being rejected without review.
 - 2. Failure to submit the fire alarm without all requirements fulfilled in a single comprehensive submittal will be grounds to require a complete resubmittal.
- B. Provide product catalog data sheets as shop drawings.
 - 1. Provide a product catalog data sheet for each item shown on the Electrical Symbols List and for each piece of equipment that is not shown on the drawings, but required for the operation of the system.

2. Where a particular Electrical Symbols List item has one or more variations (such as those denoted by subscripts, etc.) a separate additional product catalog data sheet shall be provided for each variation that requires a different part number to be ordered. The corresponding Electrical Symbols List symbol shall be shown on the top of each sheet.
 3. Where multiple items and options are shown on one data sheet, the part number and options of the item to be used shall be clearly denoted.
- C. Submit CAD floor plans as shop drawings:
1. The complete layout of the entire system, device addresses, auxiliary equipment, and manufacturer's wiring requirements shall be shown.
 2. Indicate the precise routing of notification appliance circuits under the provisions of circuit survivability. Refer to "Wiring" under Part 3 - Execution of this specification section for requirements.
 3. A legend or key shall be provided to show which symbols shown on the submittal floor plans correspond with symbols shown on the Contract Documents.
- D. About all fire alarm circuits, provide the following: manufacturer's wiring requirements (manufacturer, type, size, etc.) and voltage drop calculations.
- E. Provide installation and maintenance manuals under provisions of Section 26 05 00.
- F. Submit manufacturer's certificate that system meets or exceeds specified requirements.
- G. Provide information on the system batteries as follows: total battery capacity, total capacity used by all devices on this project, total available future capacity.
- H. Voice Alarm Communication System: Submit equipment rack or console layout, grounding schematic, amplifier power calculations, and wiring diagram.
- I. Submit photocopy proof of NICET certification of the person overseeing the preparation of drawings and installation/testing.
- J. When required to comply with local or state regulatory reviews, the fire alarm submittal shall have a Professional Engineer's stamp and signature NICET Level 3 Certification of the state in which the project is completed. NOTE: The Architect/Engineer cannot stamp and seal submittal drawings not prepared under their supervision.

1.6 EXTRA MATERIALS

- A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
1. Provide quantity equal to 2 percent (2%) of amount of each type installed, but no less than two (2) units of each type.
 - a. Smoke and heat detectors, manual pull stations, duct smoke detectors, monitor modules, control modules and relays.
 - b. Notification appliances: Speakers, speaker strobes, and strobes.
 2. Keys: The installing contractor shall collect all equipment spare keys provided with each lockable or resettable device/cabinet [minimum of one (1) set each] and shall turn over to the Owner upon completion.
 3. All spare parts shall be housed in metal cabinet labeled "Fire Alarm Spare Parts."

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Deliver products to site under provisions of Section 26 05 00.
- B. Store and protect products under provisions of Section 26 05 00.

1.8 REGULATORY REQUIREMENTS

- A. System: UL or FM Global listed.
- B. Conform to requirements of NFPA 101.
- C. Conform to requirements of Americans with Disabilities Act (ADA).
- D. Conform to UL 864 Fire Alarm, UL 1076 Security, UL2017 General Signaling, and UL 2572 Mass Notification Communications.

1.9 SYSTEM DESCRIPTION

- A. Performance Statement: This specification section and the accompanying fire alarm specific design documents describe the minimum material quality, required features, and operational requirements of the system. These documents do not convey every wire that must be installed and every equipment connection that must be made. Based on the equipment described and the performance required of the system, as presented in these documents, the Vendor and the Contractor are solely responsible for determining all wiring, programming and miscellaneous equipment required for a complete and operational system.
- B. This section of the specifications includes the furnishing, installation and connection of the microprocessor controlled, intelligent reporting, fire alarm equipment required to form a complete coordinated system that is ready for operation. It shall include, but is not limited to, alarm initiating devices, voice evacuation equipment, control panels, auxiliary control devices, annunciators, power supplies, and wiring as indicated on the drawings and specified herein.
- C. Fire Alarm System: NFPA 72; Automatic and manual fire alarm system, non-coded, analog-addressable with automatic sensitivity control of certain detectors, multiplexed signal transmission.
- D. Campus Ethernet IP Network: A complete fire alarm and mass notification Ethernet network shall be provided. The network shall be Class X, Resilient Ethernet Protocol (REP) 100BaseTX / 100 Mbps that shall be able to operate with any single break and self-restoring network communications. Each building shall contain an independent building fire alarm / voice communications system, with full command and control from the campus command center. In no case shall read only network annunciation be acceptable as the only networking function.
- E. Voice Communication: The facility shall have an emergency voice alarm communication system. The digitized recorded voice message shall notify occupants that a fire condition has been reported. Emergency manual voice override shall be provided.
- F. Firefighter Phone System: A two-way talk path shall be provided for the fire department's use from the voice command center to the secondary fire alarm attack entrances, elevator lobbies, primary and backup power rooms and the entrance to all enclosed stairways.
- G. System Supervision: Provide electrically supervised system, with supervised Signal Line Circuit (SLC) and Notification Appliance Circuit (NAC). Occurrence of single ground or open condition in initiating or signaling circuit places circuit in TROUBLE mode. Component or power supply failure places system in TROUBLE mode.
- H. Alarm Reset: Key-accessible RESET function resets alarm system out of ALARM if alarm initiating circuits have cleared.
- I. Lamp Test: Manual LAMP TEST function causes alarm indication at each zone at fire alarm control panel and at annunciator panels.

- J. Drawings: Only device layouts and some equipment have been shown on the contract drawings. Wiring and additional equipment to make a complete and functioning system has not been shown, but shall be submitted on the shop drawings.

1.10 PROJECT RECORD DOCUMENTS

- A. Submit documents under the provisions of Section 26 05 00.
- B. Include location of end-of-line devices.
- C. Provide a CAD drawing of each area of the building (minimum scale of 1/16" = 1'-0") showing each device on the project and its address. The devices shall be shown in their installed location and shall be labeled with the same nomenclature as is used in the fire alarm panel programming.
- D. Submit test results of sound pressure level (dBA) and intelligibility (STI) with the rooms tested designated on the floor plan. Notification devices shall have the tap wattage designated.

1.11 OPERATION AND MAINTENANCE DATA

- A. Submit data under provisions of Section 26 05 00.
- B. Include operating instructions, and maintenance and repair procedures.
- C. Include results of testing of all devices and functions.
- D. Include manufacturer's representative's letter stating that system is operational.
- E. Include the CAD floor plan drawings.
- F. Include shop drawings as reviewed by the Architect/Engineer and the local Authority Having Jurisdiction.

1.12 DOCUMENT STORAGE CABINET

- A. The cabinet shall have all fire alarm system documents, including record drawings, wiring diagrams, operation manuals, etc. A legend sheet permanently attached to the door shall contain system passwords and inspection logs. The enclosure shall also provide two (2) key ring holders for system keys and a location for a standard size business card with service contact information. The cabinet will have, permanently and securely mounted inside, a digital flash memory device with a minimum of 4 GB of storage capacity and a standard USB B connector for uploading and downloading electronic versions of record documents and system programming information.
- B. The cabinet shall be red in color with an identification label reading "FIRE ALARM DOCUMENTS". Refer to Identification Section 26 05 53. The cabinet shall be lockable. Minimum cabinet size shall be 14" x 14" x 48".
- C. The final version of the system database program shall be stored within the cabinet.
- D. Locate cabinet as indicated on drawings.

1.13 WARRANTY

- A. Provide one (1) year warranty on all materials and labor from Date of Substantial Completion.
- B. Warranty requirements shall include furnishing and installing all software upgrades issued by the manufacturer during the one (1) year warranty period.

1.14 ANNUAL INSPECTION/TESTING AND SERVICE CONTRACT

- A. Provide cost to furnish service, inspect, and test all devices of the fire alarm system per the requirement of NFPA for one (1) year, starting one year after the Date of Substantial Completion. Submit written reports of inspection testing per NFPA 72, Chapter 14.
- B. Provide an alternate cost for a complete inspection/testing and service/maintenance contract for the fire alarm system for one (1) year two (2) years, starting one year after the Date of Substantial Completion. Submit sample contract terms and conditions for review with shop drawings.
- C. The Owner may enter into a contract directly with the vendor after shop drawing submittals. This specification is not a contract between the Owner and the vendor to perform these services.

2. PART PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

- A. Gamewell - FCI E3 Series or District approved equal.

2.2 [FAP-#]: FIRE ALARM CONTROL PANEL (FAP)

- A. Control Panel: Modular, power-limited electronic design. Provide flush surface wall-mounted enclosure as shown on plans. Enclosure shall be minimum 0.060 steel with provisions for electrical conduit connections into the sides and top. The door shall provide a key lock and shall include a glass or other transparent opening for viewing of all indicators.
- B. Each Signaling Line Circuit (SLC loop) shall not be loaded over 80% of the maximum device capacity. For example, in the minimum system capacity column listed below, if the fire alarm manufacturer's system capacity of analog sensors per loop is 99 devices, then no more than 79 devices shall be wired on that loop. The minimum system capacity shall be as follows:

Minimum Total Addressable Points: 2000

Minimum Total SLC loops (including board, ready for field connections): 10

Panel Expansion Capability, Minimum Total SLC loops: 10

- C. Signal Line Circuit (SLC) and Notification Appliance Circuit (NAC) Boards:
 - 1. Each board shall communicate directly with each addressable analog sensor and binary input to determine normal, alarm, or trouble conditions. Analog signals would be used for automatic test and determination of maintenance requirements.
 - 2. Each board shall contain its own microprocessor and shall be provided to monitor addressable inputs and to control addressable outputs (addressable relays). The board shall communicate and provide power to all devices on its loop over a single pair of wires, except where 4-wire devices require a separate power circuit.
 - 3. Pathway Class B: Circuits NOT capable of transmitting an alarm beyond the location of the fault condition. Wiring of outgoing and return conductors is permitted to be run in the same conduit or cable.
- D. Central Processing Unit:
 - 1. The central processing unit (CPU) shall communicate with the monitor and control all other modules in the panel. Removal, disconnection or failure of any control panel module shall be detected and reported to the CPU.

2. The CPU shall execute all control-by-event programs for specific action to be taken if a designated situation is detected in the system. A real-time system clock for time annotations on the display and printer shall be included.
 3. All power for the unit shall be supervised and supplied by the FAP.
- E. Display:
1. The board shall provide all controls and indicators used by the system operator and may also be used to program all control panel parameters.
 2. The board shall provide an alphanumeric array for display of custom alphanumeric labels for all addressable points. It shall also provide indicators for AC Power, System Alarm, System Trouble, Display Trouble and Signal Silence.
 3. Displayed descriptions of addressable points shall include actual room names/numbers selected by the Owner. This information shall be obtained prior to programming. Room names/numbers shown on floor plans shall not be used.
 4. The board shall provide a touch key-pad with control capability to command all system functions and entry of any alphanumeric information. Twenty different passwords with four levels of security shall be supported to prevent unauthorized manual control or programming.
- F. Memory: The CPU and display interface board shall be augmented by non-volatile field programmable memory. EPROM memory will also be allowed provided the memory is burned in with minimum expansion capability equal to the total system capacity of the panel. Memory shall not be lost upon primary and secondary power failure.
- G. Serial Interface Board: The board shall provide interfaces to a printer, LCD display and other monitoring devices through RS-232 connections. The minimum operational distance between the board and the peripheral devices shall be 500 feet. Up to three (3) RS-232 outputs shall be supported.
- H. Power Supply:
1. Input power shall be 120 VAC, 60 Hertz. Output power shall be as noted on the device specifications and drawings. Each component of the fire alarm system requiring 120 VAC input power shall be served from a dedicated emergency branch circuit. Provide two #12 conductors and one #12 ground in 3/4" conduit to a dedicated 20A/1P circuit breaker with a red handle and a manufacturer's standard handle lock-on device. Identify/label breaker and branch circuit in accordance with NFPA requirements and Specification Section 26 05 53.
 2. Adequate to supply 125% of all control panel and peripheral power needs as well as 125% of power required for all external audio-visual devices. The power supply may be increased as needed by adding additional modular expansion power supplies. Over-current protections shall be provided on all power outputs.
 3. All power supplies shall be designed and installed to meet UL and NFPA requirements for power-limited operation on all external initiating and indicating circuits.
 4. The power supply shall provide integral charger for use with internal batteries. Battery capacity shall be sufficient for operation of the entire system for 24 hours in a non-alarm state followed by alarm mode for 15 minutes, plus 25% spare capacity for future devices.
- I. Surge Protection:
1. All fire alarm control panels, NAC panels, etc. shall be provided with a surge protection device (SPD). The SPD shall be UL listed to Standard 1449 Rev 3. The unit should be clearly labeled in accordance with Identification Section 26 05 53. The SPD shall have thermal fuses to protect against fire in short circuit conditions. The unit shall provide visual indication that the unit is protecting and functioning.

2. Any communications or signaling circuits associated with the fire alarm system, which leave or enter a facility, shall be provided with a surge protection device. The devices shall be as recommended by the fire alarm system manufacturer.

J. Dual Digital Communicator:

1. Provide dual phone line interface capable of fire alarm notification to the local fire department, fire protection agency, or monitoring service. Communicator shall report in SIA and most major communication formats, with the capability of transmitting each device address point in a format compatible with the central station receiver.
2. Monitoring fees and initial connection charges are not part of this project.
3. Communicator shall be fully supervised and shall operate on loop start phase lines ahead of the building PBX system.
4. Communicator shall be FCC registered. Contractor shall provide two RJ31X jacks. Contractor to provide connection of communicators to Owner's telephone system as shown on the drawings.
5. Approvals: UL listed - UL 864/NFPA 72, FM approved.
6. The communicator shall be provided integral to the fire alarm panel as furnished by the fire alarm panel manufacturer. If the panel construction requires a separate unit, the unit shall be as manufactured by Silent Knight, Ademco, or fire alarm panel manufacturer approved equal.

K. **[VCC-#]:** Digitized Voice Command Center (VCC):

1. The Digitized Voice Command Center (VCC) shall contain all equipment required for all audio control, firefighter phone system control, signaling, and supervisory functions. This shall include digital voice units, speaker zone indication, firefighter phone circuit indication and control, microphones, and main firefighter phone handset.
2. Function: The Voice Command Center equipment shall perform the following functions:
 - a. Operate as a supervised single dual channel automatic digitized voice evacuation system with manual emergency voice communication system.
 - b. Dual channel speaker circuits shall be arranged such that there is a minimum of one (1) speaker circuit per floor of the building or smoke zone, whichever is greater.
 - c. Operate as a two-way emergency firefighter phone system control center. The two-way emergency telephone system shall support a minimum of seven (7) handsets on line without degradation of the signal.
 - d. Audibly and visually annunciate the active or trouble condition of every signal circuit and firefighter phone circuit.
 - e. Audibly and visually annunciate any trouble condition of tone generators and digital voice units required for normal operation of the system.
 - f. Provide all-call activities through activation of a single control switch.
 - g. Provide automatic, digitally recorded voice messages and tones.
3. Audio Amplifiers:
 - a. The audio amplifiers will provide a single dual channel audio power at 25/70 volts RMS for distribution to speaker circuits.

- b. Provide multiple audio amplifiers mounted in the transponder or in the main fire alarm control panel, either to supply incremental audio power, or to function as an automatically switched backup amplifier(s).
 - c. The audio amplifier shall include an integral power supply, and shall provide the following controls and indicators:
 - 1) Normal Audio Level LED
 - 2) Incorrect Audio Level LED
 - 3) Battery Trouble LED
 - 4) Amplifier Trouble LED
 - 5) Audio Amplifier Gain Adjust
 - d. Includes audio input and amplified output supervision backup input and automatic switchover function, if primary amplifier should fail.
 - e. Amplifier shall be backed up in groups (one amplifier backs up several). Failure of any one amplifier in the system shall not degrade system performance in any way.
4. Audio Message Generator (Digitized Voice):
- a. Each initiating zone or intelligent device shall interface with an emergency voice communication system capable of transmitting a digitized voice message to all speakers in the building.
 - b. Actuation of any alarm initiating device shall cause a digitized message to sound over the speakers. The message shall be repeated four (4) times.
 - c. A built-in microphone shall be provided to allow paging through speaker circuits.
 - d. The audio message generator shall have the following controls and indicators to allow for proper operator understanding and control:
 - 1) All Call LED
 - 2) On-Line LED
 - 3) All Call Switch
5. Voice Messages:
- a. A pre-programmed custom digital voice message shall be used for notification appliance speaker circuits. The messages shall be approved by the Authority Having Jurisdiction (AHJ). Voice messages shall be from a male voice. The messages shall be provided in the multi-lingual language of the predominant building population.
 - b. Message shall be preceded by a tone and message shall be repeated four times until silenced.
 - c. Messages shall be annunciated by a single channel in all evacuation signal zones throughout the building.
 - d. Primary messages shall be annunciated in the zone of fire alarm and adjoining areas' evacuation signaling zones, and the secondary message in all other evacuation signaling zones.

- e. Message shall be as shown in the following table. These messages are not intended to specify the exact wording required, but to specify the minimum information conveyed by the message:

Alarm Type	NAC Area	Preceding Tone	Message
Fire Alarm	Single Channel-all areas	Three Chimes	May I have your attention please? A fire emergency has been reported in the building. Proceed calmly to the nearest exit and leave the building immediately. Do not use the elevators. Use stairwells where necessary. Occupants that are unable to use stairways shall report to designated Areas of Rescue Assistance.
Fire Alarm	Dual Channel-Primary Message Area of alarm and adjoining evacuation signaling zones	Three Chimes	May I have your attention please? A fire emergency has been reported in the building. Please evacuate to a different area or floor of the building and await further instructions. Occupants that are unable to use stairways shall report to designated Areas of Rescue Assistance.
Fire Alarm	Dual Channel-Primary Message Area of alarm and adjoining evacuation signaling zones	Three Chimes	May I have your attention please? A fire emergency has been reported in the building. Proceed calmly to the nearest exit and leave the building immediately. Do not use the elevators. Use stairwells where necessary. Occupants that are unable to use stairways shall report to designated Areas of Rescue Assistance.
Fire Alarm	Dual Channel-Secondary Message All other evacuation signaling zones	Three Chimes	May I have your Attention please? A fire emergency has been reported in another area of the building. Please stand by for further instructions. Please do not use elevators
Test	All areas	One Chime	"May I have your attention please? May I have your attention please? This is a test of the building emergency alarm system. This is only a test."
All Clear	All areas	One Chime	"May I have your attention please? May I have your attention please? The reported emergency has been investigated and normal conditions have been restored. You may return to all areas of the building."
Severe Weather	All areas	Wail	"May I have your attention please? May I have your attention please? A severe weather warning has been received. Please walk to the nearest designated safe area. Stay away from windows and glass. Do not use the elevators."
Homeland Security Warning	All areas	Wail	[Custom Message]
Custom Message	All areas	Wail	[Custom Message]

6. Speaker Circuit Control Switches/Indicators:
 - a. The speaker circuit control switches/indicators shall include visual indication of active and trouble status for each speaker circuit in the system.
 - b. The speaker circuit control panel shall include switches to manually activate or deactivate each speaker circuit in the system.
 - c. Buttons shall be provided on the voice command center to manually activate all auxiliary messages. (i.e. all clear, severe weather, homeland security warning, custom message)

2.3 **[ACU-#]: AUTONOMOUS CONTROL UNIT (ACU)**

- A. The autonomous control unit shall be a listed combination system with the fire alarm system as described in NFPA 72 and meeting UL Standard 864.
- B. Microphone for delivering live voice messages. Ability to interrupt public address system announcements and to silence building background music while delivering voice messages.
- C. Available for use for general paging or other non-emergency messages without the activation of strobes.
- D. ACU shall be able to activate strobes and discrete output for text signs.
- E. Capacity for multiple prerecorded messages. Prerecorded messages shall be passed in the English language and also in the predominant language(s) used. Messages should address at least the following:
 1. Bomb threat or actual bomb within/around the building.
 2. Intruder/hostile person sighted within/around the building.
 3. Occupants directed to take cover within the building.
 4. Evacuation of the building using exits other than the normal main entrance/exit (since the front entrance/exit is often a location targeted by terrorists).
 5. Emergency weather conditions appropriate for the local area.
 6. "All Clear" message.
 7. A test message intended for verifying functionality of the system.
- F. Ability to automatically repeat prerecorded messages until terminated.
- G. Allows the ECS to temporarily override fire alarm audible messages and provide intelligible voice commands during simultaneous fire and terrorist events. All other features of the fire alarm system, including the transmission of signals to the fire department, shall function properly.
- H. Provide a supervisory signal if the ECS is used to override fire alarm audible messages during simultaneous fire and terrorist events. The supervisory signal shall be annunciated at the FACP and any remote fire alarm annunciators, and be transmitted to the fire department. The visual annunciation of the separate supervisory signal shall be distinctly labeled or otherwise clearly identified.
- I. Provide single switch or operating mechanism capable of turning off or on the system's white/clear strobes. The switch shall function as a "dead-man" type to turn off the strobes.
- J. Provide a 3-position switch to allow manual control on/off of strobes; center return to automatic mode.

- K. Provide a single switch or operating mechanism capable of shutting down all heating, ventilating, and air conditioning (HVAC) equipment in the facility.
- L. Complete set of self-diagnostics for the controller and appliance network. Local diagnostic information display, information, and system event log file.
- M. Interfaces to LOC for initiating recorded messages and delivering live voice messages from locations in the building other than at the ACU.
- N. Establishes priority for passing messages to prevent interference between the ACU, LOC, and the wide-area notification.

2.4 **[FA-110]: EMERGENCY TELEPHONE DEVICES**

- A. Portable Emergency Telephone Handset Jack:
 - 1. Flush mounted on stainless steel plate at locations indicated on plans.
 - 2. Insertion of the remote handset plug into a jack shall send a signal to the fire command center and shall sound a ring indication in the handset.
- B. Fixed Emergency Telephone Handset:
 - 1. Recessed telephone cabinet painted red and clearly labeled EMERGENCY TELEPHONE at locations indicated on plans.
 - 2. Lifting of the handset cradle shall send a signal to the fire command center and shall sound a ring indication in the handset.

2.5 SIGNALING LINE CIRCUIT DEVICES

- A. **[FA-120]: Smoke Detectors:**
 - 1. Analog Photoelectric Type Sensor: Shall use the photoelectric principle to measure smoke density and send data to the control panel representing the analog level of smoke density measured.
 - 2. Each smoke detector shall connect directly to an SLC loop.
 - 3. Each detector shall be mounted, where shown on the drawings, on a twist-lock base with all mounting hardware provided. Provide a two-piece head/base design.
 - 4. Each detector shall have a manual switching means to set the internal identifying code (address) of that detector, which the control panel shall use to identify its address with the type of sensor connected.
 - 5. Dual alarm and power indicators shall be provided that flash under normal conditions and remain continuous under alarm or trouble conditions. Remote indicator terminals shall be provided. Provide a remote LED indicator device if detector is not visible from a floor standing position.
 - 6. A test means shall be provided to simulate an alarm condition.
 - 7. Where operation is noted as required below 32°F and/or above 120°F, a conventional device shall be installed with a unique monitor module located in the nearest available location with maintained temperatures between 32°F and 120°F.

8. Audible sounder detector base for sleeping room applications:
 - a. The audible base shall sound an alarm in the local room in UL2017 operation and UL484 for general evacuation. The unit shall be programmable by the main control panel for the duration of operation.
 - b. The audible sounder base shall sound Temporal 3 (fire) or Temporal 4 (CO alarm) and be at 75 dB at 10 feet.
9. A subscript is used to identify the device with a specific sequence of operation as follows: E=Elevator Recall, S=Sleeping/Patient Room, D=HVAC Control, A=Atrium, SW=Stairwell, CR=Computer Room, SD=Smoke Dampers, DH=Door Hold Release, FD= Fire Door Release, MP=Medical Procedure Room.

B. [FA-121]: Projected Beam Type Detectors:

1. This device shall utilize photoelectric analog smoke sensor technology. Provide with transmitter and associated receiver. Microprocessor-based detector shall provide a minimum of eight sensitivity levels, temperature and dirt compensation, and automatic gain control. Sensor to contain beam alignment adjustments and receiver calibration.
2. Detector shall connect directly to an SLC loop or shall be provided with multiple monitor modules, as required, to connect to the SLC loop and for monitoring alarm and trouble output contacts. The detector shall be provided complete with all mounting hardware provided and installed where indicated on the drawings.
3. Dual alarm and power indicators shall be provided that flash under normal conditions and remain continuous under alarm or trouble conditions. Remote indicator terminals shall be provided.
4. Provide with remote indicator panel providing LED indications of alarm and trouble.

C. [FA-122]: Duct Smoke Detectors:

1. Duct-type smoke detectors shall use the same analog photoelectric sensor technology, with the same features specified for standard smoke detectors, except with additional features as specified below.
2. Provide sampling tubes and mounting hardware to match the duct to which it is attached. Where the detector housing is larger than the duct height, the Contractor shall fabricate a mounting bracket for the detector and attach according to the fire alarm manufacturer's recommendations.
3. Provide a remote alarm LED indicator device (FA-240/241) if detector is not visible from a floor-standing position. If detector is located above a suspended ceiling, mount remote indicator in ceiling directly below detector with a white single-gang faceplate labeled: Duct Smoke Detector.

D. [FA-123] In-Duct Smoke Detectors:

1. Analog Photoelectric Type Sensor: Shall use the photoelectric principle to measure smoke density and send data to the control panel representing the analog level of smoke density measured.
2. Low Flow Type: Listed for use in duct with 0-2000 feet per minute velocity.
3. Each smoke detector shall connect directly to an SLC loop.
4. Each detector shall be mounted, where shown on the drawings, on a twist-lock base with all mounting hardware provided to match the duct application. Provide a two-piece head/base design.

5. Each detector shall have a manual switching means to set the internal identifying code (address) of that detector, which the control panel shall use to identify its address with the type of sensor connected.
6. Provide a remote LED indicator device (FA-240/241), mounted in ceiling directly below detector with a single-gang faceplate labeled: Duct Smoke Detector.

E. Manual Pull Stations:

1. Manual stations shall match the description on the drawings (refer to the General Electrical Equipment Schedule). The stations shall be mounted where shown on the drawings and be provided with all necessary mounting hardware. WG subscript indicates wire guard is required.
2. **[FA-130]:** Addressable, single action, reset key lock, semi-flush mount, red high abuse plastic or cast metal construction with white lettering.
3. **[FA-131]:** Addressable, single action reset key lock, semi-flush mount, red high abuse plastic or cast metal construction with white lettering. Provide device with clear Lexan tamper resistant cover with integral 9V battery powered alarm that sounds when shield is lifted.
4. Manual stations shall connect directly to an SLC loop. Stations shall provide address setting means using rotary decimal or DIP switches.
5. Where operation is noted as required below 32°F and/or above 120°F, a conventional device shall be installed with a unique monitor module located in the nearest available location, with maintained temperatures between 32°F and 120°F.

F. Heat Detectors:

1. **[FA-140]:** Combination rate of rise and 135°F fixed temperature analog thermal type sensor. Factory programmed to alarm at 135°F and at 15°F per minute rate-of-rise. Sensor shall measure heat level and send data to the control panel representing the analog level of thermal measurement and rate-of-rise.
 - a. A subscript is used to identify the device with a specific sequence of operation as follows: E=Elevator Shutdown.
2. **[FA-141]:** 200°F fixed temperature. Provide a remote addressable monitor module to interface with addressable system as shown on the plans.
3. **[FA-142]:** Explosion-proof. Combination rate of rise and 135°F fixed temperature. Non-current carrying metal enclosure. Hazardous classification: Class I Class II, Group E. Provide a remote addressable monitor module to interface with addressable system as shown on the plans.
4. Provide a two-piece head/base design, with a manual switching means to set the internal identifying code (address) of that detector, which the control panel shall use to identify its address with the type of sensor connected.
5. Heat detectors shall connect directly to SLC loops. Where fixed temperature or explosion proof detectors are used, one monitor module may be used to monitor all detectors in one room/area as shown on the drawings.
6. Detectors shall be mounted, where shown on the drawings, on a twist-lock base with all mounting hardware provided.
7. Provide a remote LED indicator device if detector is not visible from a floor-standing position.

8. Dual alarm and power indicators shall be provided that flash under normal conditions and remain continuous under alarm or trouble conditions. A connection for attachment of a remote indicator shall be provided.
 9. A test means shall be provided to simulate an alarm condition.
 10. Where operation is noted as required below 32°F and/or above 120°F, a conventional device shall be installed with a unique monitor module located in the nearest available location with maintained temperatures between 32°F and 120°F.
- G. **[FA-150]: Carbon Monoxide/Heat/Smoke Combination Detector:**
1. Multi-criteria sensor for photoelectrical smoke sensing, heat and carbon monoxide (CO) detection. Carbon monoxide electrolytic sensing module shall provide toxic gas sensing to UL2034 and UL2075 standards.
 2. The combined photoelectric smoke detection/heat/CO module shall have separate sensors that adjust the detection profile in response to the input from the sensors.
 3. The combined photoelectric smoke detection / CO module shall have selectable modes of operation for OSHA compliant toxic gas sensing, enhanced fire sensing, and nuisance alarm reduction mode.
 4. The detector shall use only one address on the SLC.
 5. CO sensor cartridge element shall be field replaceable.
- H. **[FA-160]: Monitor Modules:**
1. Monitor Module shall connect directly to an SLC loop and receive power from a separate 24 VDC circuit. It shall interface initiating devices with the control panel using Style D or Style B circuits. Contractor option: Use an interface module (2-wire operation) for Style B circuits connected to normally-open dry contacts, such as a flow switch.
 2. The module shall be mounted in an enclosure located in an accessible service location as near as possible to the device(s) being monitored, or where shown on the drawings. All mounting hardware shall be provided.
 3. The module shall supply the required power to operate the monitored device(s).
 4. The module shall provide address setting means using rotary decimal or DIP switches.
- I. **[FA-161]: Addressable Relays:**
1. Relay that represents an addressable control point used primarily for the control of auxiliary devices as indicated on the drawings. Contractor to provide additional slave relay(s), as required, rated for the electrical load being controlled (contractor to match voltage, amps, etc.).
 2. Relay shall connect directly to an SLC loop and receive power from a separate 24 VDC circuit.
 3. The relay shall be mounted in an enclosure located in an accessible service location as near as possible to the device(s) being controlled, unless otherwise shown on the drawings. All mounting hardware shall be provided.
 4. The relay shall supply 24 VDC power to the device(s) being controlled, unless otherwise indicated on the drawings.

J. **[FA-280]:** Isolation Module:

1. Provide fault isolation modules or isolator detector base capable of isolating and removing the fault from Class A or Class X addressable loop data circuits while allowing the remaining data loop to continue operation. Provide a minimum of two isolation modules or bases and between every 15 devices.

2.6 NOTIFICATION APPLIANCE DEVICES

A. Device Color:

1. Wall Mounted: White housing with red lettering or pictogram.
2. Ceiling Mounted: White housing with red lettering or pictogram.
3. WG subscript indicates wire guard is required.

B. Visual Alarm Devices:

1. **[FA-200]:** Wall mounted.
2. **[FA-201]:** Ceiling mounted.
3. High intensity (candela rating as scheduled on the drawings) xenon strobe or equivalent under a lens. Candela rating shall be visible from exterior of the device.
 - a. Candela Ratings: V1=15, V3=30, V7=75, VH=110, VS=177.
4. The maximum pulse duration shall be 0.2 seconds with a maximum duty cycle of 40%. The flash rate shall be 1 Hz. Where more than two strobes are visible from any one location, the fire alarm visual devices shall be synchronized.
5. Device, housing, and backbox shall be UL listed for fire alarm/emergency applications.

C. **[FA-210]:** Audio (Speaker) Alarm Devices - Wall Mounted:

1. Sound rating shall be dependent on the tap (wattage) setting. Tap settings shall be available in 3 dBA increments. A minimum of four (4) tap settings should be available to allow field adjustment of the sound output across a minimum range of 78 to 87 dBA, 400Hz to 4KHz (6 dBA cutoff) frequency range.
2. Speakers shall operate on a 25V RMS system, unless otherwise noted on drawings.
3. Speakers shall clearly reproduce a signal consisting of a live or prerecorded human voice and background music with voice intelligibility.
4. Speaker, housing, and backbox shall be UL listed for fire alarm/emergency applications.

D. **[FA-230]:** Audio (Speaker) Alarm Devices - Ceiling Mounted:

1. 4" speaker, round housing, flush mounted (provide tile bridge where applicable).
2. Sound rating shall be dependent on the tap (wattage) setting. Tap settings shall be available in 3 dBA increments. A minimum of four (4) tap settings should be available to allow field adjustment of the sound output across a minimum range of 78 to 87 dBA, 400Hz to 4KHz (6 dBA cutoff) frequency range. Speakers shall operate on a 25V RMS system, unless otherwise noted on drawings.
3. Speakers shall clearly reproduce a signal consisting of a live or prerecorded human voice and background music with voice intelligibility.

4. Speaker, housing, and backbox shall be UL listed for fire alarm/emergency applications.
- E. Combination Audio (Voice) and Visual Notification Device:
1. **[FA-211]:** Wall mounted.
 2. **[FA-231]:** Ceiling mounted.
 3. Combine speaker and visual components into a single device. Refer to the corresponding paragraphs above for requirements of each component.
- F. **[FA-203]:** Weatherproof Visual Notification Device:
1. High intensity strobe, square housing, 75 candela rating, suitable for wet locations. Provide with weatherproof back box.
 2. Mounting: Semi-flush wall.
 3. Conduit shall not be exposed.
- G. **[FA-212]:** Weatherproof Voice/Visual Notification Device:
1. Speaker with high intensity 75 candela rated strobe. 25 VRMS with a minimum of four (4) tap settings which shall allow field adjustment of the sound output across a minimum range of 78 to 87 dBA (UL 1480), 400 Hz to 4 KHz (6dBA cutoff) frequency range.
 2. Mounting: Semi-flush wall.
 3. Conduit shall not be exposed.

2.7 DOOR HOLD-OPEN DEVICES

- A. **[FA-270]:** Electromagnetic Door Holder Devices:
1. Flush wall mounted Surface wall mounted.
 2. Voltage: 24VDC.
 3. Holding force shall be 25 pounds minimum.
 4. Provide fail-safe operation; power failure releases door.
 5. Provide self-adjusting swivel catch plate with pivot points to adjust to door alignment changes.
 6. Provide all hardware and wiring needed to accommodate the complete functioning door holder installation.
 7. Ensure that the door hardware and trim projections are compatible with total projection of door release.
 8. Provide firm anchoring for the electromagnet, such that the mounting box and device will not move independently from the wall or floor they are mounted to. This device and mounting will function as a doorstop and hold the force of the door closer mechanism.
 9. Follow manufacturer's recommended installation and location instructions unless noted otherwise.
 10. Electromagnetic door holder devices, housing, and back box shall be UL listed.

2.8 **[NEP-#]:** NAC EXTENDER PANELS (NEP)

- A. As shown on the plans or as a Contractor's option if not shown, furnish and install NAC extender panels as necessary to provide remote power supply for notification appliance circuits (NAC). Contractor shall indicate quantity and locations of each NEP on the shop drawing submittals.
- B. Each NEP shall be self-contained remote power supply with batteries, and battery charger mounted in a surface lockable cabinet. Battery capacity shall be sufficient for operation for 24 hours in a non-alarm state followed by alarm for 15 minutes, plus 25% spare capacity for future devices. Each NEP provides a minimum of up to 4 outputs, 2A continuous, or 6A full load total capacity.
- C. Power for each NEP shall be from a local 120 VAC emergency circuit. Provide two #12 conductors and one #12 ground in 1/2" conduit to each NEP from a dedicated 20A/1P circuit breaker with a red handle and a manufacturer's standard handle lock-on device. Coordinate panel and circuit number with Architect/Engineer prior to installation.
- D. NAC extender panels may be installed only where shown on drawings.
- E. Mounting: Surface.

2.9 ANNUNCIATION

- A. **[CGA-#]:** Color Graphics Network Annunciation System:
 - 1. The annunciator shall provide custom color graphics displays for the control panel to annunciate the status of the panel and every peripheral device. It shall record and display system historical information on an LCD flat panel display.
 - 2. The annunciator shall have the ability to display a minimum of 256 custom screens and shall be fully field programmable. The fire alarm vendor shall develop screens from DXF or DWGCAD files provided by the Owner.
 - 3. Operator control shall be via an attached keyboard and mouse.
 - 4. The annunciator shall store all alarms, troubles and operator activity to an internal hard drive and shall have a capacity of 10,000 events without data loss.
 - 5. Events shall have a time and date stamp.
 - 6. Graphics shall contain eight (8) different colors from a palette of sixty-four (64).
 - 7. Graphics software shall be provided to display on single or multiple screens, the status of every device located on a floor plan of the building. Alarms shall be audio and visual and shall annunciate regardless of the screen that is currently visible. Text on screens shall be a minimum of 1/10" high. Coordinate with the Owner, the floor plan on each screen prior to programming.
 - 8. Provide TROUBLE ACKNOWLEDGE, DRILL, and ALARM SILENCE capability at the color graphics annunciation location.
 - 9. The systems shall operate on the most current UL 864 listed computer system. The system shall be supplied by the fire alarm vendor and be listed for fire alarm use.
 - 10. Provide an uninterruptible power supply (UPS) to provide a minimum of 10 minutes of operating power for the computer graphic annunciator upon loss of normal power.
 - 11. All equipment for the color graphics network annunciator shall be suitable for locating on a desk. When multiple workstations are required (multiple locations within a facility or multiple buildings on a campus), they shall be server/client based configuration.

12. Remote Client Workstations: All workstations shall have the same user functionality. User shall have the ability to take over network control functionality from any station as follows:
 - a. Request to take control
 - b. Accept/deny control request
 - c. Restore command center to normal operation
 - d. Priority request override
13. PC computer workstation shall have the following minimum operating system requirements:
 - a. Operating system shall be a minimum of Microsoft Windows 10.
 - b. 3.0 GHz processor (server workstation)
 - c. 128 GB RAM installed (server workstation)
 - d. i7 Intel processor (client workstation)
 - e. 32 GB RAM installed (client workstation)
 - f. 500 GB hard drive
 - g. 22-inch LCD monitor minimum

B. Printer:

1. Printer shall be UL 864 listed and shall be the automatic type with code, time, date, location, category and condition.
2. The printer shall provide hard copy printout of all changes in status of the system and shall time-stamp such printouts with the current time of day and date. The printer shall be standard carriage with 80 characters per line and shall use standard bond paper. The printer shall be enclosed in a separate enclosure, suitable for placement on desk or countertop. The printer shall communicate with the control panel using an interface complying with Electrical Industries Association Standard EIA-232D. Power to the printer shall be 120 VAC, 60 Hertz.
3. The printer shall be connected to the PC and shall have all interfaces in place to be connected to the Fire Command Center and all transponders in case of network or hardware failure.

C. [FAA-#]: Remote LCD Annunciators:

1. Auxiliary annunciators shall indicate alarm and trouble conditions visually and audibly as shown on the drawings. Provide local TROUBLE ACKNOWLEDGE, TEST, and ALARM SILENCE capability. Minimum 80-character display.
2. Communications and power to the annunciators shall be supervised. The annunciator shall receive power from the fire alarm control panel.
3. A single key switch shall enable all switches on the annunciator.
4. Mounting: Flush.
5. Provide BACnet IP interface for fire alarm panel to communicate status with the FMCS. Provide list of points and descriptions to FMCS supplier.
 - a. UL listed to Standard 864. Provide RJ45 connection and cable.

D. [FA-241]: Fire Alarm Remote Indicator:

1. Red LED type.
2. Mounts flush to a single gang box.

E. **[FA-242]:** Fire Alarm Remote Indicator and Test Switch:

1. Red LED type.
2. Key switch test selector.
3. Mounts flush to a single gang box.

2.10 ETHERNET NETWORK

- A. Campus Ethernet IP Network: A complete fire alarm and mass notification Ethernet network shall be provided. The network shall be Class X wiring, Resilient Ethernet Protocol (REP) 100BaseTX / 100 Mbps that shall be able to operate with any single break and restore network communications.
- B. The IP network shall be fiber optic cable, single or multi-mode fiber. The TCP/IP network switches shall be industrial grade managed switching hubs. Network switches shall be UL864 listed, shall provide a minimum of four (4) or a maximum of eight (8) 10/100 Mbps shielded RJ-45 connectors for Ethernet connections, and selectable multi-mode or single-mode fiber ports. The switches shall operate on a nominal 24 VDC supplied from a battery backed up fire alarm control panel or booster power supply to ensure power to the switch is always available. Switches shall provide LED indicators for data rate, activity/link integrity, power, and loop detection.
- C. IP Monitor and Relay Module: The IP relay/input module shall have a minimum of four (4) dry contact inputs and four (4) dry contact outputs. The relay output shall be rated at 0.5 amps at 24 VDC. This unit shall be monitored and controlled by the graphics workstation to operate functions and/or operations/activations on any fire alarm network system connected to the GEGW. The module shall be UL2572 and UL864 listed.
- D. Voice Over IP Module Encoder/Decoder: Each control panel audio source connected to the LAN/WAN network interface shall consist of a supervised audio decoder capable of decoding MP3, WMA, G.700, and PCM data streams in HTTP, UDP, or RTP format. Audio decoder shall operate on filtered-regulated 24 VDC power derived from the panel power supply. Power shall be supplied directly from the FACP to ensure reliable and monitored power. UL 2572 and UL864 listed.

2.11 CONNECTIONS TO AUXILIARY DEVICES PROVIDED BY OTHERS

A. **[FA-250]:** Smoke Damper:

1. Motorized type, 24 VDC, furnished and installed by MC. Fire alarm control and power connections by EC. A subscript is used to identify the device with a specific air handler or zone for its sequence of operation. Refer to the Operation Matrix and these specifications for complete requirements. Mechanical contractor to provide 120V-24V transformer.

B. **[FA-251]:** Smoke or Fire/Smoke Damper Controller:

1. Provide an enclosure and equipment for interface of dampers with the fire alarm system and temperature control system. Refer to Details for layout, wiring and components.

C. **[FA-252]:** Hoistway Damper (Elevator Shaft Damper):

1. Motorized type, 24 VAC, furnished and installed by MC. Fire alarm control and power connections by EC. A subscript is used to identify a hoistway damper with a specific elevator or bank of elevators. Mechanical contractor to provide 120V-24V transformer.

D. **[FA-254]:** Duct Smoke Detector and Smoke Damper Control:

1. Sampling type duct detector [FA-122] in ducts 18" and larger. In-duct smoke detector [FA-123] in ducts less than 18". Detector shall be mounted within 5' of smoke damper. Motorized type 24 VDC, smoke damper furnished and installed by MC. Fire alarm control and power connections by EC. Remote indicator [FA-241] or [FA-242] mounted in visible location. Provide auxiliary relay base or addressable control module. The smoke damper shall close upon activation of the detector, and a supervisory signal shall be sent to the fire alarm control panel.

- E. **[FA-260]:** Flow Switch:
1. Connection to flow switch to monitor fire protection flow switch or discharge output contacts. Normally open dry contacts for fire alarm interface. Furnished and installed by MC; wired by EC.
- F. **[FA-261]:** Monitor Switch:
1. Connection to monitor switch to monitor fire protection system supervisory switches or output contacts. Normally open dry contacts for fire alarm interface. Furnished and installed by MC; wired by EC.
- G. **[FA-262]:** Post Indicator Valve:
1. Connection to post indicator valve for sprinkler system supervisory notification. Normally open dry contacts for fire alarm interface. Furnished and installed by MC; wired by EC. Provide surge protection device as recommended by the fire alarm system manufacturer on line entering/leaving the facility.
- H. **[FA-263]:** Electronic Bell:
1. Electronic bell for sprinkler alarm, electro-mechanical type, 120 VAC. Furnished and installed by MC. Fire alarm control and power connections by EC.
- I. **[FA-271]:** Door Hold Open Device:
1. Integral with door hardware, 24 VDC. Furnished and installed by GC. Fire alarm control and power connections by EC.
- J. **[FA-272]:** Hold Open Override:
1. Hold open override connection to GC-provided power door operator. EC shall intercept the hold open switch wiring (unless specific contacts for this purpose are provided on the door) and connect addressable relay to override this switch and allow the door to close. All modifications to the power door operator shall be coordinated with the GC.

2.12 WIRING

- A. Fire alarm wiring/cabling shall be furnished and installed by the Contractor in accordance with the manufacturer's recommendations and pursuant to National Fire Codes. Cabling shall be UL listed and labeled as complying with NFPA 70, Article 760 for power-limited fire alarm signal service.
- B. Approved manufacturers of fire alarm cable:
1. Comtran Corp.
 2. Helix/HiTemp Cables, Inc.
 3. Rockbestos-Suprenant Cable Corp.
 4. West Penn Wire/CDT.
 5. Radix.

3. PART EXECUTION

3.1 SEQUENCES OF FIRE ALARM OPERATION

- A. General:
1. Refer to the Fire Alarm Operation Matrix on the drawings for basic requirements and system operation.

2. The GUI/graphic annunciator shall display audible and visual alarms. The device activated shall be immediately displayed on a CAD floor plan at approximately 1/8" scale. Visual indication shall further indicate the device by utilizing an easily recognized color change of the symbol. The use of flashing symbols is encouraged.
 3. All system output programs assigned via control-by-event equations to be activated by the particular point in alarm shall be executed, and the associated system outputs (alarm notification appliances and/or relays) shall be activated.
- B. Panel/Annunciator Alarm, Trouble, Supervisory Indication:
1. Appropriate system Alarm, Trouble, or Supervisory LED shall flash at the control panel, transponder, and annunciator locations.
 2. A local signal in the control panel and the color graphics PC shall sound.
 3. The LCD display shall indicate all information associated with the condition, including the name of the item, type of device and its location within the protected premises.
 4. Printing and history storage equipment shall log the information associated with the fire alarm control panel (FAP) condition, along with the time and date.
 5. Transmit the appropriate signal (supervisory, trouble, alarm) to the central station via the digital communicator.
 6. Transmit the appropriate signal (supervisory, trouble, alarm) to the building automation system via addressable relays tied to contact monitors on the system.
- C. Audible Alarms Sequence:
1. Audible alarms throughout the building shall sound.
- D. Visual Alarms Sequence:
1. Visual alarms throughout the building shall flash.
- E. Fire Protection Electric Sprinkler Bell Sequence:
1. The fire alarm shall utilize an addressable relay to energize the electric sprinkler bell upon activation of the flow switch.
- F. Kitchen Hood Fire Suppression System Sequence:
1. The fire alarm system shall utilize an addressable relay to de-energize the hood supply fan controller.
 2. The fire alarm system shall utilize an addressable monitor module to monitor the fire suppression system.
 3. The fire alarm system will shutdown electrical power under the kitchen hood via relay contactors.
- G. Smoke Damper Control Sequence:
1. The fire alarm system shall utilize an addressable relay to open the power connection to smoke or fire/smoke dampers and allow them to close. Coordinate other requirements with damper installer.
 2. Where a damper is in a main air duct, where closure of that single damper will entirely block airflow in the duct system, the smoke damper sequence shall also initiate the AHU and mechanical fan shutdown sequence for the affected unit.

3. The AHU and mechanical fan shutdown sequence shall be initiated only when ALL the dampers associated with that unit or mechanical fan are closed. Otherwise, the AHU or mechanical fan shall continue to serve other areas.
 4. Smoke and fire/smoke dampers located in branch ductwork shall be closed individually or in groups, as identified on the plans.
- H. AHU and Mechanical Fan Shutdown Sequence:
1. The fire alarm system shall utilize addressable relays to de-energize all AHU motor controllers and mechanical fans. Coordinate other requirements with HVAC installer.
 2. The fire alarm system shall directly shut down the AHU or mechanical fan through the local HVAC control device (i.e., variable frequency drive or motor starter).
 3. Where a facility has more than one AHU or mechanical fan, each shall be shutdown individually based on input from initiation devices in the area served by the unit or designated for each air distribution system.
- I. Fire Door Release Sequence:
1. The fire alarm system shall utilize an addressable relay to signal the fire door or curtain to close. Once the alarm is cleared, the addressable relay shall allow the door to open.
 2. Where a facility has more than one fire door, each shall release individually based on input from initiation devices in the vicinity of each door and noted specifically for door closure.
- J. Power-Operated Fire Doors Sequence:
1. The fire alarm system shall utilize an addressable relay to signal or disconnect power to the power-operated fire door, allowing automatic closing and latching of the door. Once the alarm is cleared, the addressable relay shall allow the door to open.
 2. Door holders shall release individually based on initiation devices in the vicinity of the door and noted specifically for door closure.
- K. Door Holder Release Sequence:
1. The fire alarm system shall utilize an addressable relay to open the power connection to integral and magnetic door holders.
 2. The fire alarm system shall utilize an addressable relay to open the 'hold' switch circuitry, integral to the power door.
 3. Door holders shall release individually based on initiation devices in the vicinity of the door and noted specifically for door closure.
- L. Elevator Recall Sequence:
1. Elevator recall sequences shall meet the requirements of ASME/ANSI A17.1 and NFPA 72.
 2. Upon signal from a smoke detector in the machine room, hoistway, or any elevator lobby other than the "designated level" the fire alarm shall utilize an addressable relay to signal the elevator to recall to the designated level as determined by the Authority Having Jurisdiction.
 3. Upon signal from a smoke detector in the elevator lobby of the "designated level," the fire alarm system shall utilize an addressable relay to signal the elevator to recall to the "alternate level" as determined by the Authority Having Jurisdiction.
 4. All elevators, throughout the building, shall be recalled simultaneously.

M. Firefighter's Cab Visual Alarm Sequence:

1. Upon signal from a detector in the machine room or elevator hoistway, the fire alarm system shall utilize an addressable relay to signal the elevator controller to illuminate and flash the firefighters cab visual alarm.

N. Elevator Shutdown Sequence:

1. Elevator shutdown shall meet the requirements of ASME/ANSI A17.1.
2. All elevators that share the same hoistway, machine room, or lobby shall be shut down simultaneously. Elevators served by different machine rooms, hoistways, and lobbies shall continue to operate.
3. The fire alarm system shall utilize an addressable relay to energize the shunt trip of the main elevator breaker, disconnecting power to the elevator.
4. The fire alarm system shall utilize an addressable relay to de-energize the relay on the elevator power module, disconnecting power to the elevator.
5. Heat detector operation in elevator machine room will shut down the elevator.

O. Sound Masking Paging System Shutdown Sequence:

1. The fire alarm system shall utilize addressable relays or RS-485 interface to disconnect the signal source or de-energize the amplifiers to shut down all sound masking paging systems. Coordinate with masking paging system supplier to provide necessary interface at all sound system equipment locations.
2. The fire alarm interface and associated relays, etc. shall not induce any noise onto the audio system and shall not affect the performance or audio-quality of the system during normal use.

P. Ceiling Fan Shutdown Sequence:

1. The fire alarm shall utilize an addressable relay to de-energize the ventilation ceiling fan and controller. Coordinate the connection to the fan shutdown contacts on the fan controller or interrupt the power circuit with the addressable relay.

3.2 INSTALLATION

A. Install system in accordance with manufacturer's instructions and referenced codes.

B. Fire Alarm Control Panel:

1. Install the control panel where shown on the drawings.
2. All expansion compartments, if required, shall be located at the control panel.
3. Install the voice command center and fire command center in the location as indicated on the drawings. This location should be primary fire department "attack" location. Coordinate with the local fire department prior to submitting shop drawings.
4. The fire alarm voice prerecorded messages shall be verified by the Contractor, as approved by the Owner, prior to the shop drawing submittal process.

C. Devices:

1. General:

- a. All ceiling-mounted devices shall be located where shown on the reflected ceiling and floor plans. If not shown on the reflected ceiling or reflected floor drawings, the devices shall be installed in the relative locations shown on the floor drawings in a neat and uniform pattern.
- b. All devices shall be coordinated with luminaires, diffusers, sprinkler heads, piping and other obstructions to maintain a neat and operable installation. Mounting locations and spacing shall not exceed the requirements of NFPA 72.
- c. Where the devices are to be installed in a grid type ceiling system, the detectors shall be centered in the ceiling tile.
- d. The location of all fire alarm devices shall be coordinated with other devices mounted in the proximity. Where a conflict arises with other items or with architectural elements that will not allow the device to be mounted at the location or height shown, the Contractor shall notify the Architect/Engineer to coordinate a different acceptable location adjust location of device so that new location meets all requirements in NFPA 72 and all applicable building codes.

2. Per the requirements of NFPA, detector heads shall not be installed until after the final construction cleaning unless required by the local Authority Having Jurisdiction (AHJ). If detector heads must be installed prior to final cleaning (for partial occupancy, to monitor finished areas or as otherwise required by the AHJ), they shall not be installed until after the fire alarm panel is installed, with wires terminated, ready for operation. Any detector head installed prior to the final construction cleaning shall be removed and cleaned prior to closeout.

3. Protection of Fire Alarm System:

- a. A smoke detector shall be installed within the vicinity of the main fire alarm panel and every NAC extender panel per NFPA 72. A heat detector may be substituted when a smoke detector is not appropriate for the environment of installation.

4. Analog Smoke and Heat Detectors:

- a. In elevator shafts and elevator equipment rooms, provide a heat detector for elevator shutdown within 2' of every sprinkler head. Coordinate with fire protection contractor.

5. Duct-type Analog Smoke Detectors:

- a. Duct-type analog smoke detectors shall be installed on the duct where shown on the drawings and details. The sampling tubes shall be installed in the respective duct at the approximate location where shown on the electrical drawings to meet the operation requirements of the system.
- b. All detectors shall be accessible.
- c. Duct-type detectors shall be installed according to the manufacturer's instructions.

6. In-Duct Analog Smoke Detectors:

- a. In-duct analog smoke detectors shall be installed in the duct where shown on the drawings and details. The devices shall be installed in the respective duct at the approximate location where shown on the electrical drawings to meet the operation requirements of the system.

- b. All detectors shall be accessible.
- 7. Manual Pull Stations:
 - a. Stations shall be located where shown and at the height noted on the drawings.
- 8. Addressable Relays and Monitor Modules:
 - a. Modules shall be located as near to the respective monitor or control devices as possible, unless otherwise indicated on the drawings.
 - b. All modules shall be mounted in or on a junction box in an accessible location.
 - c. Where not visible from a floor standing position, a remote indicator shall be installed to allow inspection of the device status from a local floor standing location.
- 9. SLC Loop Isolation Modules:
 - a. Isolation modules shall be installed to limit the number of addressable devices that are incapacitated by a circuit fault.
 - b. Install all Isolation Modules within the fire alarm control panel, unless otherwise indicated on the drawings. Refer to the fire alarm riser diagram for requirements. Refer to the floor plans for areas served by separate isolation modules.
- 10. Notification Appliance Devices:
 - a. Devices shall be located where shown on the drawings.
 - b. Wall-mounted audio, visual and audio/visual alarm devices shall be mounted as denoted on the drawings.
 - c. Where ceiling mounted visual alarm devices or combination audio/visual alarm devices are shown where the ceiling is greater than 30'-0" high, they shall be stem mounted so that the entire unit is below 30'-0". This does not apply to audio-only alarm devices.
- D. Annunciators:
 - 1. Color Graphics Annunciation System: The annunciator shall be installed with custom graphics software showing the floor plan of the entire building and shall include a close approximation of the location of all devices in the system. The annunciator shall be located approximately where shown on the drawings as directed by the Owner. Each smoke compartment zone, (Refer to architectural drawings) as a minimum, shall be on a single screen. A screen shall be created depicting an overall plan indicating the entire facility and the quantity of floors or zones that will clearly indicate the area(s) the alarm(s) are being reported.
 - 2. Remote Annunciators: The annunciators shall be located where shown on the drawings and approved by the fire marshal.
- E. Wiring:
 - 1. Fire alarm wiring/cabling shall be provided by the Contractor in accordance with the manufacturer's recommendations and pursuant to National Fire Codes.
 - 2. Wiring shall be installed in conduit. Refer to Identification Section 26 05 13 for color and identification requirements.
 - 3. All junction boxes with SLC and NAC circuits shall be identified on cover. Refer to Identification Section 26 05 13 for color and identification requirements.

4. Partial evacuation or relocation of occupants is the standard operating procedure for this facility in the event of an alarm. Therefore, all notification appliance circuits (NAC), including circuits serving NAC extender panels (NEP) and other network communication circuits, must be installed and protected in accordance with the "circuit survivability" requirements described in NFPA 72. The contractor shall maintain the following:
 - a. NACs serving separate evacuation signaling zones shall be routed separately such that they are no less than 4 feet apart when run horizontally and 1 foot apart when run vertically. They may come simultaneously only within 10 feet of the control panel. Evacuation signaling zones are identified on the drawings.
 - b. NACs passing through other evacuation signaling zone(s) shall be installed in conduit and routed through the 2-hour fire-rated chase(s) or enclosure(s) identified on the drawings.
 5. Fire Alarm Power Branch Circuits: Building wiring as specified in Section 26 05 13.
 6. Notification Appliance Circuits shall provide the features listed below. These requirements may require separate circuits for visual and audible devices.
 - a. Fire alarm temporal audible notification for all audio appliances.
 - b. Synchronization of all visual devices where two or more devices are visible from the same location.
 - c. Ability to silence audible alarm while maintaining visual device operation.
 - d. Emergency communication alert and textual visible appliance notification.
 7. Notification Appliance Circuits shall not span floors or smoke compartments. Refer to architectural drawings for smoke compartments.
 8. Signal line circuits connecting devices shall not span floors or two-hour smoke compartments.
 9. No wiring other than that directly associated with fire alarm detection, alarm or auxiliary fire protection functions shall be in fire alarm conduits. Wiring splices shall be avoided to the extent possible, and if needed, they shall be made only in junction boxes, and enclosed by plastic wire nut type connectors. Transposing or changing color coding of wires shall not be permitted. All conductors in conduit containing more than one wire shall be labeled on each end, in all junction boxes, and at each device with "E-Z Markers" or equivalent. Conductors in cabinets shall be carefully formed and harnessed so that each drops off directly opposite to its terminal. Cabinet terminals shall be numbered and coded, and no unterminated conductors are permitted in cabinets or control panels. All controls, function switches, etc. shall be clearly labeled on all equipment panels.
- F. Fire Alarm Cabling Color Code: Provide circuit conductors with insulation color coding as follows, or using colored tape at each conductor termination and in each junction box.
1. Power branch circuit conductors: In accordance with Section 26 05 53.
 2. Signaling line circuit: Overall red jacket with black and red conductors.
 3. DC power supply circuit: Overall red jacket with violet and brown conductors.
 4. Notification appliance circuit: Overall red jacket with blue and white conductors.
 5. Door release circuit: Gray conductors.
 6. Central station trip circuit: Orange conductors.
 7. Central station fire alarm loop: Black and white conductors.
- G. Devices surface mounted in finished areas shall be mounted on surface backboxes furnished by fire alarm equipment supplier. Backboxes shall be painted to match device, shall be the same shape and size as the device shall not have visible knockouts.

- H. Make conduit and wiring connections to door release devices, sprinkler flow and pressure switches, sprinkler valve monitor switches, fire suppression system control panels, duct analog smoke detectors and all other system devices shown or noted on the Contract Documents or required in the manufacturer's product data and shop drawings.

3.3 FIELD QUALITY CONTROL

- A. Field inspection and testing will be performed under provisions of Section 26 05 00.
- B. Test in accordance with NFPA 72, Chapter 14 and local fire department requirements. Submit documentation with O & M manuals in accordance with Section 14.6 of the Code.
- C. Contractor shall test and adjust the fire alarm system as follows:
 - 1. Speaker taps shall be adjusted to the lowest tap setting which achieves a sound level higher than or equal to the greatest of the following:
 - a. 70dBA.
 - b. 15 dBA above ambient levels as indicated in NFPA 72 Table A.18.4.3.
 - c. 15 dBA above measured ambient. 5 dBA above the maximum measured sound level with duration of more than 60 seconds.
 - d. As specified on the drawings.
 - 2. Sound level measurement procedure shall meet the following requirements:
 - a. All measurements shall use the 'A' weighted, dBA, sound measurement scale.
 - b. All measurements shall be taken after furnishings, wall coverings and floor coverings are in place.
 - c. All measurements shall be taken after fixed equipment (HVAC units, etc.) producing ambient noise is installed and is in operation.
 - d. Final ambient sound measurements shall be taken during occupancy and the units shall be re-adjusted at that time, if necessary.
 - e. All sound level measurements shall be taken at a height of 5' above the finished floor level.
 - f. Measurements shall be taken in every unique room. If there are multiple rooms, which have the identical dimensions and function, 10%, or a minimum of 2 rooms shall be tested. The results from the rooms tested shall be averaged and the remaining rooms may be adjusted per the average.
 - g. Measurements shall be taken on a 20' x 20' grid and the results for all points taken shall be averaged. If the room is smaller than 20' x 20' a minimum of two measurements are required.
 - h. Measurements shall be taken halfway between speakers or halfway between a speaker and the wall. No measurements shall be taken at the extreme edges of the room, nor directly under speakers.

- D. Additionally, test the voice alarm communication system intelligibility per IEC 60849:
1. The following acoustically distinguishable spaces shall be tested: All unique rooms shall be tested. If there are multiple rooms with the identical dimensions and function, 10%, or a minimum of two (2) rooms, shall be tested. The results from the rooms tested shall be averaged, and the remaining rooms may be adjusted per the average.
 2. Utilize equipment designed to test per IEC 60849 per the equipment manufacturer's instructions. This equipment includes a signal generator, which is input to the fire alarm system and a portable measurement device. This equipment is available from Simplex Grinnell or Gold Line.
 3. Testing equipment that can simulate 'crowd babble' shall be used in rooms with occupancy of greater than 200.
 4. Wide-area notification intelligibility shall be tested in acoustically distinguishable spaces and areas as designated by the Owner.
 5. When testing for intelligibility, the quantity and location of the measurement points shall be the same as the points used for measurement of dBA level.
 6. Provide a room by room report, showing the average dBA level and STI for each room tested, the number and location of. The report shall be presented to the Architect/Engineer in an Excel .xls file.

3.4 MANUFACTURER'S FIELD SERVICES

- A. Provide manufacturer's field services under provisions of Section 26 05 00.
- B. Include services of the manufacturer's software programmer to write initial custom-user program (for Color Graphics Annunciation System).
- C. Include services of certified technician to supervise installation, adjustments, final connections, and system testing.
- D. Note that room numbers depicted on the architectural/engineering drawings will not necessarily reflect the actual room (signage) numbers that the Owner selects. The Contractor and fire alarm manufacturer shall coordinate the actual room numbers as the Owner directs to identify each device. This list shall be a part of the floor plan record drawing to be turned in at the project closeout.
- E. Include the services to train up to three of the Owner's staff in operation, maintenance, and programming of the fire alarm system at the manufacturer's factory. Airfare and lodging expenses for the Owner's staff will be by the Owner.
- F. System occupancy adjustments: When requested by Owner within 12 months of date of Substantial Completion, provide on-site system adjustments to suit actual occupied conditions. For this purpose, provide up to two (2) site visits, 4 hours each visit, outside normal occupancy hours.

3.5 SYSTEM TRAINING

- A. System training shall be performed under provisions of Section 26 05 00.
- B. Minimum on-site training times shall be:
 - 1. System Operators: One (1) day.
 - 2. GUI Operation and Editing: One (1) day.
 - 3. Emergency Communication System: Four (4) hours.
- C. Custom training to be described here.

END OF SECTION

SECTION 31 10 00

SITE CLEARING

1. PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Remove surface debris.
- B. Remove indicated paving, curbs, and hardscape.
- C. Clear site of plant life and grass.
- D. Remove trees and shrubs.
- E. Remove root system of trees and shrubs.
- F. Erosion and sedimentation control measures.

1.2 REGULATORY REQUIREMENTS

- A. Conform to applicable code for dust control and disposal of debris.
- B. Coordinate clearing Work with utility companies.
- C. Obtain required permits from authorities.
- D. Do not close or obstruct roadways and sidewalks without permits.

1.3 DEFINITIONS

- A. Remove: Removal of existing construction and legally dispose of items off-site.
- B. Disposal: Removal off-site of demolition waste and subsequently deposit in landfill acceptable to authorities having jurisdiction.
- C. Existing to Remain: Items of construction that are not to be removed and that are not indicated to be removed.

1.4 SUBMITTALS

- A. Preclearing Photographs: Show conditions of existing adjacent construction and site improvements that might be misconstrued as damaged by clearing operations. Submit before work begins.
- B. Record Documents: Submit under provisions of Section 01 77 00. Accurately record locations of capped utilities and other subsurface conditions.

1.5 QUALITY ASSURANCE

- A. Perform best management practice techniques for given site conditions as defined in Section 3 of the Stormwater Best Management Practice Handbook (BMP Handbook), Construction Edition, as published by the California Storm Water Quality Association.
- B. Coordinate work of this section with permit provisions of State Water Resources Control Board Order No. 2010-0014-DWQ and the Storm Water Pollution Prevention Plan.
- C. Comply with City of Oxnard Dust Control Ordinance.

2. PART 2 PRODUCTS

NOT USED

3. PART 3 EXECUTION

3.1 EXAMINATION

- A. Correlate existing conditions with requirements indicated.
- B. Inventory and record condition of items to be removed and salvaged.
- C. Execute predemolition photographs.

3.2 PREPARATION

- A. Verify that existing plant life and features designated to remain are tagged or identified.

3.3 EROSION AND SEDIMENTATION CONTROL

- A. Provide erosion and sedimentation control measures to prevent soil erosion and discharge of soil-bearing water runoff or airborne dust to adjacent properties and walkways, according to requirements of Storm Water Pollution Prevention Plan.
- B. Inspect, repair, and maintain erosion and sedimentation control measures during clearing operations.

3.4 PROTECTION

- A. Protect utilities that remain, from damage.
- B. Protect trees, plant growth, and features designated to remain as final landscaping.
- C. Protect bench marks and existing structures from damage or displacement.

3.5 CLEARING

- A. Clear areas required for access to site and execution of Work.
- B. Remove trees and shrubs indicated. Remove stumps, main root ball, and large roots.
- C. Clear undergrowth and deadwood without disturbing subsoil.
- D. Remove debris, rock, and extracted plant life.
- E. Remove paving, curbs, and other items as indicated. Neatly saw cut edges at right angle to surface.

3.6 RECYCLING OF DEMOLITION MATERIALS

- A. Place, grade, and shape stockpiles to drain surface water. Cover to prevent wind blown dust.
- B. Do not store materials within drip line of trees.
- C. Transport recyclable materials that are not indicated to be reused off Owner's property to recycling receiver or processor.
- D. Recycled incentives received for building demolition materials shall be equally shared between Contractor and Owner.
- E. Asphalt: Break up and transport asphalt paving to asphalt recycling facility.
- F. Concrete: Break up and transport to concrete-recycling facility.

- G. Concrete Reinforcement: Remove reinforcement from concrete and sort with other metals.

3.7 DISPOSAL OF DEMOLISHED MATERIALS

- A. Except for items indicated to remain, remove demolished materials from Project site and legally dispose of them in an EPA – approved landfill.
- B. Do not burn or bury materials on site.

3.8 CLEANING

- A. Clean adjacent structures and improvements of dust, dirt and debris caused by clearing.
- B. Return adjacent areas to condition existing before clearing operations began.
- C. Leave site in a clean condition.

END OF SECTION

SECTION 31 20 00

EARTH MOVING

1. PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Top soil excavation.
- B. Site rough grading.
- C. Building excavation, backfill and compaction.
- D. Excavation for pavements and site structures.
- E. Consolidation and compaction.
- F. Fill for overexcavation.
- G. Utility trenches, backfill and compaction.
- H. Subgrade preparation of pavement areas.
- I. Finish grading.
- J. Erosion and sedimentation control measures.

1.2 REFERENCES

- A. CBC - California Building Code, Title 24, Part 2, Chapter 18A and Appendix J.
- B. City of Oxnard Grading Standards.
- C. City of Oxnard Dust Control Ordinance.
- D. Storm Water Quality Association - Stormwater Best Management Practice Handbook (BMP Handbook) Construction Edition.
- E. State Water Resources Control Board Order No. 2010-0014-DWQ.
- F. ASTM C136 - Method for Sieve Analysis of Fine and Coarse Aggregates.
- G. ASTM D448 - Sizes of Aggregate for Roadway and Bridge Construction.
- H. ASTM D1556 - Test Method for Density of Soil in Place by the Sand-Cone Method.
- I. ASTM D1557 - Test Methods for Moisture-Density Relations of Soils and Soil-Aggregate Mixtures Using 10 lb. Rammer and 18 inch Drop.
- J. ASTM D2922 – Test Methods for Density of Soil and Soil-Aggregate in Place by Nuclear Methods. (Shallow Depth).
- K. ASTM D2937 – Test Method for Density of Soil in Place by the Drive-Cylinder Method.
- L. ASTM D3017 – Standard Test Method for Water Content of Soil and Rock in Place by Nuclear Methods (Shallow Depth).

1.3 SUBMITTALS

- A. Submit samples under provisions of Section 01 33 00.
- B. Submit 10 lb. sample of each type of fill to testing laboratory in air-tight containers.
- C. Submit name of imported materials source. Provide materials from same source throughout the work. Change of source requires Architect's approval.
- D. Submit test reports under provisions of Section 01 45 29.

1.4 PROJECT RECORD DOCUMENTS

- A. Submit documents under provisions of Section 01 77 00.
- B. Accurately record location of utilities remaining, rerouted utilities, new utilities by horizontal dimensions, elevations or inverts, and slope gradients.

1.5 QUALITY ASSURANCE

- A. Comply with California Building Code (CBC), Title 24, Part 2, Chapter 18A and Appendix J.
- B. Comply with City of Oxnard Grading Standards.
- C. Comply with City of Oxnard Dust Control Ordinance.
- D. Perform best management practice dust control techniques for given site conditions as defined in Section 3 of the Storm Water Best Management Practice Handbook, (BMP Handbook) Construction Edition.
- E. Coordinate work of this section with Permit provisions of State Water Resources Control Board Order No. 2010-0014-DWQ and the Storm Water Pollution Prevention Plan.

1.6 FIELD CONDITIONS

- A. Verify that survey benchmark and intended elevations for the work areas are as indicated.
- B. Notify Architect of unexpected subsurface conditions and discontinue work in area affected until notified to resume work.
- C. Perform site assessment to identify any contaminated soils which may occur on site.

1.7 PROTECTION

- A. Protect trees, shrubs, lawns, and other features remaining as portion of final landscaping.
- B. Protect bench marks, fences, roads, sidewalks, paving, and curbs.
- C. Underpin adjacent structures, including utilities and pipe chases, which may be damaged by excavation work.
- D. Protect above or below grade utilities which are to remain.
- E. Barricade open excavations and post warning lights. Operate lights from dusk to dawn.
- F. Protect facilities from damage caused by settlement, lateral movement, undermining, washout, and other hazards created by earthwork operations.
- G. Repair or replace all damage.

2. PART 2 PRODUCTS

2.1 SOIL MATERIALS

- A. Existing Subsoil: Excavated and re-used material, graded free of lumps and rocks larger than 3 inches in any dimension.
- B. Imported Subsoil: Non-expansive predominantly granular soils such as a silty sand, free of lumps and rocks larger than 3 inches in any dimension, and debris. Expansion index less than 20, and no more than 50 percent of the material shall pass a No. 200 sieve. Material shall contain sufficient fines (binder) to result in a stable subgrade.
- C. Existing Topsoil: Excavated and re-used material, graded free of roots, rocks larger than one inch, subsoil, debris and large weeds.
- D. Imported Topsoil: Friable loam, free of subsoil, roots, grass, excessive amounts of weeds, stones and foreign matter; acidity range (ph) of 5.5 to 7.5; containing an amount of organic matter normal to the region.
- E. Sand: Natural river or bank sand: Free of silt, clay, loam, friable or soluble materials or organic matter, graded in accordance with ASTM C136, all passing the No. 4 sieve and only 5 percent passing the No. 200 sieve.
- F. Gravel: Coarse aggregate; free of clay, shale and organic matter; ASTM D448, grading size 6 with 100 percent passing a 1 inch sieve and not more than 5 percent passing a No. 4 sieve.
- G. Pea Gravel: Natural Stone; washed, free of clay, slate, organic matter, graded in accordance with ASTM C136, 1/4 inch to 5/8 inch.
- H. Drainage Fill: Washed, evenly graded mixture of crushed stone, or crushed or uncrushed gravel, graded in accordance with ASTM C136, with 100 percent passing a 1-1/2 inch sieve and not more than 5 percent passing a No. 4 sieve.
- I. Crushed Stone Base: Permeable base meeting California Department of Transportation 3/4 inch Permeable Class II Base designation according to the following gradation:

Mesh Size	% Passing
1 inch	100
3/4 inch	90-100
3/8 inch	40-100
#4	25-40
#8	18-33
#30	5-15
#50	0-7
#200	0-3

- J. Concrete: Structural concrete conforming to Section 03 30 00 with a compressive strength of 2,000 psi for fill to correct over-excavation.
- K. Materials (existing and import) shall be free of any toxic materials listed (by the federal or state EPA or federal or state health agencies) as hazardous material.
- L. Materials (existing and import) are subject to the approval of the Soils Engineer for use in the project.

- M. Provide imported materials when sufficient satisfactory soil materials are not available from on site sources.

2.2 ACCESSORIES

- A. Permeable Geotextile Fabric: Conforming to the Standard Specifications Section 96-1.02B - Class C (Caltrans 2015).
- B. Impermeable Geotextile Fabric: Reinforced liner, 20 mils thick; Hercuscrim 20 Fabric manufactured by In-Line Plastics, LC, www.in-lineplastics.com.
- C. Substitutions: Under provisions of Section 01 25 13.

2.3 EQUIPMENT

- A. Equipment: Capable of excavating subsoil, mixing and placing materials, wetting, consolidation, grading, and compaction of material.

3. PART 3 EXECUTION

3.1 INSPECTION

- A. Verify agreement of existing site conditions with indicated conditions.
- B. Notify Architect of discrepancies found.
- C. Beginning work of this Section constitutes acceptance of existing conditions.

3.2 PREPARATION

- A. Identify required lines, levels, contours, and datum.
- B. Identify known below grade utilities. Stake and flag locations.
- C. Identify and flag above grade utilities.
- D. Maintain and protect existing utilities remaining which pass through work area.
- E. Notify utility company and pay all costs to remove and relocate utilities.
- F. Upon discovery of unknown utility or concealed conditions, discontinue affected work; notify Architect.

3.3 EROSION AND SEDIMENTATION CONTROL

- A. Provide erosion and sedimentation control measures to prevent soil erosion and discharge of soil-bearing water runoff or airborne dust to adjacent properties and walkways according to requirements of the Storm Water Pollution Prevention Plan.
- B. Inspect, repair, and maintain erosion and sedimentation control measures during earthwork operations.

3.4 TOPSOIL EXCAVATION

- A. Excavate topsoil from areas to be further excavated, relandscaped, or regraded.
- B. Stockpile in area designated on site.
- C. Stockpile topsoil to depth not exceeding 8 feet. Place, grade, and shape stockpile for proper drainage.

3.5 GRADING

- A. Uniformly grade areas within limits of grading including adjacent transition areas.

- B. Make such cuts or fills as may be required to bring subgrade to elevations shown and to tolerances specified.
- C. Plow or otherwise break up sloped surfaces steeper than 1 vertical to 4 horizontal so that fill material will bond to existing surface.
- D. Where grades are not indicated, grade uniformly level or slope between points for which elevations are given.
- E. In absence of more specific grading information, slope ground away from building for a distance of 20 feet at 2 percent.
- F. Make grade changes gradual. Blend slope into level areas.
- G. Compact each layer of fill to required density.

3.6 EXCAVATION FOR STRUCTURES

- A. Excavate subsoil required to accommodate building foundation, site structures and construction operations.
- B. Conform to elevations and dimensions shown within a tolerance of plus or minus 0.10 foot.
- C. Extend a sufficient distance from footings and foundations to permit placing and removal of formwork, installation of services, other construction, and for inspection.
- D. Overexcavate a minimum depth of four feet beneath all footings or six feet below existing grade, whichever is deeper.
- E. Extend overexcavation a minimum distance of five feet horizontally beyond exterior face of footings.
- F. Hand trim excavation. Remove loose matter.
- G. Remove lumped subsoil, boulders and rock up to 1/3 cu yd measured by volume. Replace with approved fill material and compact as specified.
- H. Do not disturb bottom of excavations intended for bearing surface.
- I. Scarify bottom of excavation to a depth of 12 inches, moisture-condition to optimum moisture content and compact as specified.

3.7 EXCAVATION FOR PAVEMENTS

- A. Cut surface under pavements to comply with cross-sections, elevations, and grades as shown, to subgrade elevations required and to grade tolerances specified.
- B. Overexcavate a minimum depth of 24 inches beneath subgrade for all slabs-on-grade or 3 feet below existing grade, whichever is deeper.
- C. Overexcavate a minimum depth of 24 inches beneath subgrade for all paving or 3 feet below existing grade, whichever is deeper..
- D. Scarify subgrade beneath slabs-on-grade to a depth of 12 inches, moisture-condition to optimum moisture content and compact as specified.
- E. Scarify subgrade beneath paving to a depth of 12 inches, moisture-condition to optimum moisture content and compact as specified.

3.8 TRENCH EXCAVATION

- A. Excavate subsoil required to accommodate storm sewer, sanitary sewer, water, gas, electric and telephone conduits, and piping to municipal or private utilities.

- B. Excavate trenches to uniform width, sufficiently wide to provide ample working room and a minimum of 8 inch clearance on both sides of the pipe.
- C. Excavate trenches to depth indicated or required to establish indicated slope and invert elevations.
- D. Depth of excavations on the exterior of the building shall provide for the minimum coverage above the top of the pipe, conduit, or tank measured from the lowest adjacent finish grade, as follows unless otherwise indicated on the Drawings:
 - 1. Steel Pipe and Conduit 24 inches
 - 2. Copper Water Tube 18 inches
 - 3. Cast-Iron, Pressure Pipe 36 inches
 - 4. Plastic Pipe (other than waste) 30 inches
 - 5. Plastic Waste Pipe 24 inches
 - 6. Soil, Sewer & Storm Drain 18 inches
 - 7. Irrigation Pipe (pressure) 24 inches
 - 8. Irrigation Pipe (non-pressure) 12 inches
- E. For pipe or conduit less than 4 inches in nominal size, do not excavate beyond indicated depths. Hand-excavate bottom to accurate elevations and support pipe or conduit on undisturbed soil.
- F. For pipe or conduit, 4 inches and larger, carry excavation 4 inches below required elevation and backfill with sand bedding to support pipe or conduit.
- G. Hand trim excavation. Remove loose material.
- H. Excavation cut not to interfere with bearing splay of foundations.
- I. At each pipe joint dig bell hole to relieve pipe bell of loads and to ensure continuous bearing of pipe on bearing surface.
- J. Remove lumped subsoil, boulders and rock up to 1/3 cu yd measured by volume. Replace with sand bedding material and compact as specified.

3.9 STORAGE OF EXCAVATED MATERIALS

- A. Stockpile excavated materials in designated on-site area.
- B. Segregate excavated materials based upon intended use.
- C. Place, grade, and shape stockpile for proper drainage.
- D. Locate stockpile away from edge of excavations.
- E. Do not stockpile materials within drip line of trees.

3.10 UNAUTHORIZED EXCAVATION

- A. Correct unauthorized excavation at no cost to Owner.
- B. Backfill excavation to correct elevation with concrete or approved fill material compacted as specified.

3.11 STABILITY OF EXCAVATIONS

- A. Comply with local codes, ordinances, and requirements of agencies having jurisdiction.
- B. Machine slope banks to angle of repose or less.
- C. Maintain sides and slopes of excavations in safe condition until completion of backfilling.
- D. Shore and brace where sloping is not possible because of space restrictions or stability of material excavated.
- E. Provide shoring and bracing in good serviceable condition.
- F. Extend shoring and bracing as excavation progresses.
- G. Maintain shoring and bracing in excavations regardless of time period excavation will be open.
- H. Provide permanent steel sheet piling wherever subsequent removal of piling would permit lateral movement of soil under adjacent structures. Cut off top of piling 2'-6" below finish grade and leave permanently in place.
- I. Design and Calculations: Provide by licensed California engineer in accordance with requirements of the California Building Code and Safety Orders of the State of California, Division of Industrial Safety; Title 8, Division 1, Chapter 4, Subchapter 4, Article 6.

3.12 DEWATERING

- A. Prevent surface water and subsurface or ground water from flowing into excavations and from flooding project site and surrounding area.
- B. Grade top perimeter of excavations to prevent surface water from draining into excavations.
- C. Do not allow water to accumulate in excavations.
- D. Remove water to prevent softening of foundation bottoms and soil changes detrimental to stability of subgrades.
- E. Provide and maintain pumps, well points, sumps, suction and discharge lines and other components necessary to convey water away from excavations.
- F. Establish and maintain temporary drainage ditches and other diversions to convey rain water and water removed from excavations to runoff areas.
- G. Do not use trench excavations as temporary ditches.

3.13 BEDDING OF TRENCHES

- A. Support pipe and conduit during placement and compaction of bedding fill.
- B. Place a minimum of 4 inches of sand bedding beneath all piping and conduit 4 inches in diameter and larger.
- C. Place a minimum of 12 inches of sand bedding above all piping and conduit.
- D. Compact sand bedding to density required.

3.14 BACKFILLING

- A. Backfill excavations as promptly as work permits, but not until the following has been completed:
 - 1. Acceptance of subgrade.
 - 2. Construction below grade, where applicable, for waterproofing.

3. Inspection, testing, approval and record documentation of location of underground utilities.
 4. Removal of concrete formwork.
 5. Removal of shoring and bracing if not to be left in place.
 6. Backfill of voids in subgrade with satisfactory materials.
 7. Removal of trash and debris.
 8. Installation of bedding material.
 9. Permanent or temporary bracing of horizontally supported walls.
- B. Compact subgrade to density requirements for subsequent backfill.
 - C. Backfill to contours and elevations required.
 - D. Place geotextile fabric over drainage fill prior to placing backfill.
 - E. Systematically backfill to allow maximum time for natural settlement. Do not backfill over porous, wet, frozen or spongy subgrade surfaces.
 - F. Place and compact fill material in continuous layers not exceeding specified compacted depth for each layer.
 - G. Employ a placement method that does not disturb or damage foundation perimeter drainage, foundation waterproofing, protective cover, and utilities in trenches.
 - H. Before placing successive layers, all ruts, and other hollows more than 6 inches in depth shall be regraded and compacted.
 - I. Maintain optimum moisture content of backfill materials.
 - J. Backfill against supported foundation walls.
 - K. Backfill simultaneously on each side of unsupported foundation walls.
 - L. Backfill trenches with concrete where excavation is less than 3 feet below bottom of footing. Place concrete to level of bottom of adjacent footing. Width of concrete backfill to match width of footing and be full width of trench. Maintain minimum 6 inch encasement on sides, top, and bottom.
 - M. Place 4 inch thick concrete base slab then backfill trenches with concrete for piping or conduit where top of piping or conduit is less than 30 inches below finished elevation of paving or 18 inches below finished grade. Minimum 6 inches of encasement on sides and top.
 - N. Remove and replace or scarify and air dry subgrade or fill material that is too wet to permit compaction to required density.

3.15 PLACING TOPSOIL

- A. Eliminate uneven areas and low spots. Remove debris, roots, branches, stones, in excess of one inch in size.
- B. Remove subsoil contaminated with petroleum products.
- C. Scarify subgrade to depth of 12 inches where topsoil is scheduled. Scarify in areas where equipment used for hauling and spreading topsoil has compacted subsoil. Remove all rocks larger than one inch in size.
- D. Use topsoil in relatively dry state. Place during dry weather.
- E. Fine grade topsoil eliminating rough or low areas. Maintain levels, profiles, and contours of subgrade.

- F. Remove stones, roots, grass, weeds, debris, and foreign material while spreading.
- G. Manually spread topsoil around trees, plants, and building to prevent damage.
- H. Lightly compact placed topsoil compacted to 85% in landscape areas.
- I. Place compacted topsoil thicknesses for the following various locations:
 - 1. Planter Boxes: To within 3 inches of box rim.

3.16 COMPACTION

- A. Control soil compaction during construction providing density specified for each area classification.
- B. Place and compact fill materials in continuous layers of not more than 8 inch thick compacted depth.
- C. Provide not less than the specified percentages of density of soil material compacted at optimum moisture content, for each layer of soil material in place.
- D. When existing ground surfaces have a density less than that specified for a particular area classification, scarify existing surface to a depth of 12 inches, moisture-condition to optimum moisture content and compact to required percentage of maximum density.
- E. Maintain optimum moisture content of fill materials to attain required compaction density.
- F. Moisture content shall be uniform throughout all layers. Add necessary moisture or aerate soil material at borrow source if it is not possible to obtain uniform moisture content at soil surface at time of placement.
- G. When moisture content and condition of each soil layer is satisfactory compact soils to specified density.
- H. Compaction of free draining material such as gravel shall be by treads of crawler type tractor, surface vibrator, smooth or pneumatic roller, hand or power tampers.
- I. Compaction of soils by use of water jetting or puddling is not an acceptable procedure.
- J. Correct improperly compacted areas or layers as directed by Architect if soil density tests indicate inadequate compaction.

3.17 DISPOSAL OF EXCESS AND WASTE MATERIAL

- A. Remove waste materials, including unacceptable excavated material, trash, and debris, and dispose of legally off site.
- B. Remove surplus backfill materials from site and dispose of legally off site.
- C. Remove surplus topsoil materials from site and dispose of legally off site.
- D. Leave material stockpile areas completely free of excess materials.

3.18 PROTECTION OF WORK

- A. Protect finished work under provisions of Section 01 61 00.
- B. Protect excavations by methods required to prevent cave-in or loose soil from falling into excavation.
- C. Protect bottom of excavations from freezing, water saturation, and disturbance.

3.19 FIELD QUALITY CONTROL

- A. Field inspection and testing will be performed under provisions of Section 01 45 29.

- B. Allow testing service to inspect, test, and approve each subgrade and fill layer before further backfill or construction work is performed
- C. Laboratory tests and analysis of fill material will be performed in accordance with ASTM D1557 and with Section 01 45 29.
- D. In place site tests and analysis of fill material will be performed in accordance with ASTM D1556, ASTM D2937 or ASTM D2922, and with Section 01 45 29.
- E. In place site moisture tests will be performed in accordance with ASTM D3017.
- F. If tests indicate Work does not meet specified requirements, remove Work, replace and retest at no cost to Owner.

3.20 GRADING TOLERANCES

- A. Lawn or Unpaved Areas: Finish areas to receive topsoil to within not more than 0.10 foot above or below required subgrade elevation.
- B. Walks: Shape surface of areas under walks to line, grade, and cross-section, with finish surface not more than 0.10 foot above or below required subgrade elevation.
- C. Pavements: Shape surface of areas under pavement to line, grade, and cross-section, with finish surface not more than 1/2 inch above or below required subgrade elevation.
- D. Building Slab: Grade smooth and even, free of voids, to required subgrade elevation. Final grade tolerance to be within 1/2 inch when tested with a 10 foot straightedge.

3.21 MAINTENANCE

- A. Protect newly graded areas. Keep free of trash and debris.
- B. Provide erosion control methods to prevent erosion.
- C. Repair and reestablish grades in settled, eroded, and rutted areas to specified tolerances and density.
- D. Where completed areas are disturbed by subsequent construction operations or adverse weather, scarify surface, reshape, and compact to required density prior to further construction.
- E. Where settling occurs, remove surface (pavement, lawn, or other finish), add backfill material, compact, and replace surface treatment. Restore appearance, quality, and condition of surface finish to match adjacent work and eliminate evidence of restoration.

3.22 PLACEMENT SCHEDULE

- A. Interior Crawl Space:
 - 1. Subsoil fill, existing or import, to required subgrade, compacted to 95 percent.
- B. Interior Slab-On-Grade:
 - 1. Existing or imported subsoil fill to subgrade elevation compacted to 95 percent.
 - 2. Compact to 95 percent.
- C. Exterior Side of Foundation Walls:
 - 1. Existing or imported subsoil fill, to subgrade elevation, compacted to 95 percent.

- D. Fill Under Footings:
 - 1. Existing or imported subsoil fill, to subgrade elevation, compacted to 95 percent.
- E. Retaining Walls:
 - 1. Existing or imported subsoil fill, to subgrade elevation, compacted to 95 percent.
- F. Grass Areas:
 - 1. Subsoil fill, existing or import, to subgrade elevation, compact to 90 percent.
 - 2. Cover with topsoil, existing or import, to finish grade elevation, compact to 90 percent.
- G. Planted Areas:
 - 1. Subsoil fill, existing or import, to subgrade elevation, compact to 90 percent.
 - 2. Cover with topsoil, existing or import, to finished grade elevation, lightly tamped.
- H. Asphalt Paving:
 - 1. Subsoil fill, existing or import, to subgrade elevation, compact to 95 percent.
 - 2. Cover with aggregate base specified under Section 32 12 16.
- I. Concrete Paving:
 - 1. Subsoil fill, existing or import, to subgrade elevation, compact to 95 percent.
 - 2. Cover with aggregate base specified under Section 32 13 13.
- J. Concrete Walks, Curbs, and Gutters:
 - 1. Subsoil fill, existing or import, to subgrade elevation, compact to 90 percent.
 - 2. Base to subgrade required, compact to 90 percent.
- K. Fill to Correct Overexcavation:
 - 1. Lean concrete of minimum compressive strength as specified.
 - 2. Fill, to required elevation, compact to 95 percent.
- L. Drainage Pipe:
 - 1. Drainage fill, to 12 inches above pipe, compact to 90 percent.
 - 2. Wrap drainage fill with geotextile fabric.
 - 3. Remaining fill of subsoil fill, existing or import, to subgrade elevation, compact to 95 percent.
- M. Utility Trenches on Interior of Building:
 - 1. Sand bedding to 12 inches above pipe, compact to 95 percent.
 - 2. Existing or imported subsoil fill, compact to 95 percent.
 - 3. Cover with gravel fill, 6 inches thick, compact to 95 percent.

N. Utility Trenches on Exterior of Building:

1. Sand bedding to 12 inches above pipe, compact to 90 percent.
2. Existing or imported subsoil fill, compact to 90 percent.

O. Underground Tanks:

1. Peagravel fill to centerline of tank radius, compact to 90 percent.
2. Remaining fill of subsoil, existing or import, to required subgrade, compact to 95 percent.

END OF SECTION

SECTION 31 63 26

DRILLED CAISSONS

1. PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Machine drilled shaft.
- B. Placement of casing, if necessary.
- C. Cleaning of caisson hole.
- D. Dewatering of caisson hole, if necessary.
- E. Removal and disposal of drilling spoil.
- F. Placing concrete and reinforcement.

1.2 UNIT PRICES

- A. Design Caisson Quantity: Determined by quantity indicated on drawings.
- B. Actual Caisson Quantity: Determined by quantity indicated in Project Record Documents.
- C. Design Caisson Length: Determined by length indicated on drawings.
- D. Actual Caisson Length: Determined by length indicated in Project Record Documents.
- E. Adjustment of Contract Sum: Unit cost overrun or underrun indicated on the bid form will be applied to establish any extra due the Contractor or credit due the Owner. Adjustment in the Contract sum will be made by change order upon completion of all caisson work.
- F. Detailed explanation: Refer to Section 01 20 00.

1.3 REFERENCES

- A. ACI 336.1 - Construction of End Bearing Drilled Piers.
- B. ASTM A283 - Welded and Seamless Steel Pipe Piles.
- C. AWS D1.1 - Structural Welding Code - Steel.
- D. CBC - California Building Code, (CCR) California Code of Regulations, Title 24, Part 2, Chapter 18A.

1.4 SUBMITTALS

- A. Drilling log to be submitted under the provisions of Section 01 33 00.
- B. Drilling log shall be filed by the Owner's Testing Laboratory under provisions of Section 01 45 29.
- C. Drilling log shall contain as a minimum the following information:
 - 1. Identification mark.
 - 2. Shaft diameter.
 - 3. Design bottom elevation.
 - 4. Actual bottom elevation.

5. Top elevation.
6. Deviation from plan location and plumb.
7. Overrun or Underrun.
8. Bearing strata description and condition of bearing strata.
9. Seepage of water and still water at time of drilling and concrete placement.
10. Length and location of casing used.
11. Nature and locations of obstructions.
12. Unusual occurrences during drilling, reinforcement on concrete placement, or casing removal.

1.5 QUALITY ASSURANCE

- A. Perform work in accordance with ACI 336.1 and as specified herein.
- B. Where provisions of above standard conflict with regulatory requirements in effect for this project, the regulatory requirements shall govern, but only to establish minimum requirements.
- C. Employ a registered surveyor to perform layout to lines and levels required before excavation.
- D. Perform work of this section only in the presence of the Owner's testing laboratory.

1.6 QUALIFICATIONS

- A. Installer: Company specializing in the application of the work of this section with minimum five years documented experience.
- B. Installer to have successfully completed no less than three projects with similar soil conditions, shaft sizes, depths and volumes of work as contained on this project.

1.7 REGULATORY REQUIREMENT

- A. Conform to applicable provisions of (CBC) California Building Code and (CCR) California Code of Regulations, Title 24, Part 2.

1.8 PRE-INSTALLATION CONFERENCE

- A. Convene a conference two weeks prior to commencing work of this Section, under provisions of Section 01 31 00.
- B. Require attendance of parties directly affecting the work of this Section.
- C. Review installation procedures and verify availability of required materials and equipment.

1.9 SUBSURFACE CONDITIONS

- A. Data on subsurface conditions is as specified under Section 00 31 32.
- B. Indicated subsurface conditions are not intended as a representation or warranty of the continuity of conditions.
- C. Subsurface data is made available for the convenience of the Contractor and is not a guarantee of conditions that may be encountered.
- D. Owner will not be responsible for interruptions or conclusions drawn therefrom by Contractor.

- E. Additional test borings or other exploratory operations may be made by Contractor at no additional cost to Owner.

1.10 PROTECTION OF UTILITIES

- A. Locate existing underground utilities before starting caisson excavation operations.
- B. If utilities are to remain in place, provide protection from damage during caisson operations.
- C. Should uncharted or incorrectly charted piping, or utilities be encountered during excavation, consult Architect immediately for direction as to procedure.
- D. If such lines are found to be abandoned and not in use, remove affected portions without extra cost.
- E. If such lines are found to be in use, cooperate with Owner and Utility Company in keeping services and facilities in operation.
- F. Do not interrupt existing utilities except when permitted in writing by Owner and only after acceptable temporary utility services have been provided.
- G. Contractor is solely responsible for a locating and protection of existing utilities in vicinity of work of this section and shall pay the entire cost for repair of any damage. Repair damaged utilities to the satisfaction of the Utility Owner.

1.11 PROTECTION OF EXCAVATION

- A. Immediately pump or bail out water found in caissons.
- B. Caissons shall be kept free from water to the maximum extent possible.
- C. Provide all equipment and labor necessary to control the flow, drainage and accumulation of water required to permit completion of the work on this section.

2. PART 2 PRODUCTS

2.1 MATERIALS

- A. Shaft Liner: ASTM A252, Grade 2; plain ends of diameter indicated. Wall thickness of sufficient strength to withstand handling stresses, concrete pressure and surrounding earth pressure. Weld standard lengths to form reburied lengths with full-penetration welds according to AWS D1.1.
- B. Reinforcing Steel: Specified in Section 03 20 00.
- C. Concrete Materials and Mix: Specified in Section 03 30 00.
- D. Equipment: Appropriate to excavate and dewater shaft.

3. PART 3 EXECUTION

3.1 EXAMINATION

- A. Verify site conditions under provisions of Section 01 31 00.
- B. Verify that site conditions will support equipment for performing caisson drilling.

3.2 PREPARATION

- A. Locations of caissons shall be staked out and maintained. Locations shall be cross-staked so that all centerlines are retained after drilling.
- B. Protect adjacent and affected structures near the work from damage.

3.3 EXCAVATION

- A. Construct piers in accordance with ACI 336.1 and as specified herein.
- B. Drill holes for caissons to required bearing strata or elevations shown on drawings.
- C. Drill holes for closely spaced caissons and those occurring in fragile or sand strata, only after adjacent holes are filled with concrete and have been allowed to set.
- D. If required, install casings as excavation proceeds so that earth walls are maintained without spilling into shaft. The use of mud slurry to lubricate casings or seal off water will be allowed only with prior approval of Architect.
- E. Clean shaft and bottom of excavation of loose material.
- F. Allow inspection of shaft prior to placement of reinforcement and concrete.
- G. Material removed during drilling operations shall not be used for fill. Materials shall be removed from site and shall be legally disposed of.

3.4 DEPTH OF BEARING

- A. If indicated depth of shaft is reached without developing required stratum bearing capacity, suspend operations and notify Architect.
- B. Where changes in indicated depth or dimension is required or additional soil borings are required proceed with such work when directed by Architect in writing.
- C. No additional cost will be allowed for extra length when caisson shafts are drilled to a greater depth than required or authorized. Fill extra depth with concrete. Overexcavated shafts will be measured to original design or authorized depth.

3.5 DEWATERING

- A. Provide and maintain pumping equipment to keep excavations free of water before placing concrete.
- B. Direct water to general site run-off ditches and disposal areas with discharge lines.

3.6 REINFORCING STEEL

- A. Fabricate and erect reinforcing cages in shafts as one continuous unit using inner ring steel.
- B. Place reinforcement accurately and symmetrically about axis of hole and hold securely in position during concrete placement.
- C. Use templates to set anchor bolts, leveling plates, and other accessories. Provide blocking and holding devices to maintain required position during concrete placement.
- D. Protect exposed ends of extended reinforcing dowels, or anchor bolts from mechanical damage and exposure to weather.

3.7 CONCRETE PLACEMENT

- A. Fill caissons with concrete immediately after inspection and approval of caisson shaft.
- B. Use protection sheets, cut out to receive concrete, over excavated openings, extending at least 2'-0" beyond edge.
- C. Place concrete in smooth and continuous flow without segregating for full height of caisson.
- D. Place concrete by means of bottom discharge bucket, flexible drop chute, elephant trunk hopper or tremie.

- E. Use chutes or tremies for placement where drop is more than 20'-0", or pump concrete into place.
- F. Provide mechanical vibration for consolidation for top 25 feet of shaft.
- G. Place concrete in-the-dry unless reasonable attempts to dewater caisson excavation have failed. Do not deposit concrete in more than 3 inches of water.
- H. Stop concrete placement at cut-off elevation required, screed level, and apply a scoured, rough finish.
- I. Where cut-off elevation is above ground elevation, form top section above grade and extend shaft to required elevation.
- J. Enlargement or mushrooming of top of caisson is not allowed.

3.8 CASING REMOVAL

- A. Coordinate withdrawal of temporary steel casings with concrete placement.
- B. Casings may be left in place only with prior approval of Architect.
- C. Pull temporary casing with a slow and smooth vertical motion maintaining plumb position.
- D. Casing shall not be pulled until concrete has been placed a minimum of 5 feet above external water level.
- E. During pulling, maintain concrete level a minimum of 5 feet above bottom of casing.
- F. Vibrate top 5 feet of caisson after temporary casing is removed.

3.9 TOLERANCES

- A. Maximum permissible variation of location not more than 1/24 of shaft diameter or 3 inches, whichever is less.
- B. Shafts out of plumb not more than 1.5 percent of length or exceeding 12.5 percent of shaft diameter or 15 percent, whichever is less.
- C. Shaft diameter within plus 1 inch, minus 0 inch of required diameter.
- D. Concrete cut-off elevation, plus 1 inch to minus 3 inches.
- E. Reinforcing placing to comply with Section 03 20 00.
- F. If tolerances are exceeded, provide corrective construction to compensate for excessive eccentricity. Submit proposed corrective methods to Architect for review before proceeding.

3.10 FIELD QUALITY CONTROL

- A. Field inspection will be performed under provisions of Section 01 45 29.
- B. Drilling log to be submitted to Architect as specified herein.

3.11 UNACCEPTABLE PIERS (CAISSONS)

- A. Caissons that fail, are placed out of position, are below elevation, or are damaged.
- B. Provide additional caissons to compensate for those identified as failing to conform to specified requirements.
- C. Submit proposed corrective methods to Architect for review before proceeding.

END OF SECTION

SECTION 32 12 16

ASPHALT PAVING

1. PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Weed Killer.
- B. Prepared base.
- C. Headers and stakes.
- D. Asphaltic concrete paving.
- E. Surface sealer.
- F. Pavement striping.
- G. Concrete wheel stops.

1.2 REFERENCES

- A. ASTM D979 - Standard Practice for Sampling Bituminous Paving Mixtures.
- B. ASTM D2041 - Standard Test Method for Theoretical Maximum Specific Gravity and Density of Bituminous Paving Mixtures.
- C. ASTM D2726 - Standard Test Method for Bulk Specific Gravity and Density of Non-Absorptive Compacted Bituminous Mixtures.
- D. ASTM D2950 - Standard Test Method for Density of Bituminous Concrete In Place by Nuclear Methods.
- E. ASTM D3549 - Standard test Method for Thickness or Height of Compacted Bituminous Paving Mixture Specimens.
- F. Southern California Chapter, American Public Works Association - Standard Specifications for Public Works Construction.
- G. Redwood Inspection Service - Standard Specifications for Grades of California Redwood Lumber.
- H. Storm Water Quality Association - Storm Water Best Management Practice Handbook (BMP Handbook) Construction Edition.
- I. TAI (The Asphalt Institute) - Manual Series No. 2 (MS-2).

1.3 QUALITY ASSURANCE

- A. Perform work in accordance with Standard Specifications for Public Works Construction.
- B. Mixing Plant: Conform to State of California standards.
- C. Obtain materials from same source throughout.

1.4 REGULATORY REQUIREMENTS

- A. Conform to applicable City of Oxnard standards for paving work on public property.

1.5 ENVIRONMENTAL REQUIREMENTS

- A. Do not place asphalt when base surface temperature is less than 40 degrees F.
- B. Perform asphalt paving waste management techniques as defined in Section 4 of the Storm Water Best Management Practice Handbook, (BMP Handbook) Construction Edition.

2. PART 2 PRODUCTS

2.1 AGGREGATES

- A. Provide aggregates consisting of crushed stone, gravel, sand, or other sound, durable mineral materials processed and blended, and naturally combined.
- B. Granular base aggregate: In accordance with Section 200-2.2 of Standard Specifications for Public Works Construction.
- C. Granular base aggregate maximum size:
 - 1. Base courses over 6 inch thick: 1-1/2 inches.
 - 2. Other base courses: 3/4 inches.
- D. Aggregates for asphaltic concrete paving: In accordance with Section 203.6.2.2. of Standard Specifications for Public Works Construction.

2.2 WEED KILLER

- A. Commercial chemical for weed control, registered by EPA. Dry, free-flowing, dust-free chemical compound, nonflammable, not creating a fire hazard when applied in accordance with the manufacturer's recommendations, soluble in water, and capable of being spread dry or in solution.
- B. Weed Killer products:
 - 1. Oust: E.I. Dupont de Nemours and Co., www.dupont.com.
 - 2. Casoron 4G: Uniroyal Chemical Co., Inc., www.cromptoncorp.com.
 - 3. Substitutions: Under provisions of Section 01 25 13.

2.3 HEADERS AND STAKES

- A. Headers: Construction heart grade redwood in compliance with the Standard Specifications for Grades of California Redwood Lumber.
- B. Stakes: Redwood of grade specified for headers.
- C. Nails: Common, galvanized, 12d minimum.

2.4 CONCRETE WHEEL STOPS

- A. Prefabricated 5-1/2 inch high x 7-1/2 inch wide x 48 inch long, 3,500 psi concrete wheel stop.
- B. Chamfer corners and provide holes for anchoring to substrate.
- C. Dowels: Galvanized steel, 1/2 inch diameter, minimum 18 inch length.
- D. Substitutions: Under provisions of Section 01 25 13.

2.5 PAVEMENT STRIPING PAINT

- A. Vinyl emulsion type, white color, except at accessible parking spaces, provide blue color. Blue color to be equal to Color 15090 in accordance with Federal Standard 595C.
- B. Striping products:
 - 1. W801 Vin-L-Stripe Traffic Paint, manufactured by Dunn-Edwards, www.dunnedwards.com.
 - 2. Substitutions: Under provisions of Section 01 25 13.

2.6 ASPHALTS

- A. Comply with provisions of Standard Specifications for Public Works Construction, Section 203-1:
 - 1. Paving asphalt : PG-64-10
 - 2. Tack coat : SS-1h

2.7 ASPHALTIC PAVING MIX

- A. Provide hot plant mixed asphaltic concrete paving materials in accordance with Section 203-6 of Standard Specifications for Public Works Construction:
 - 1. Base Course Mix : B
 - 2. Parking and Drive Area Mix : C2
 - 3. Hardscape Play Area Mix : D2
 - 4. Binder Course - Running Track : C2
 - 5. Top Course - Running Track : D2
- B. Asphalt concrete paving mix to have 5 to 7 percent asphalt cement content by weight in accordance with TAI Publication MS-2.

2.8 SEAL COAT

- A. Hardscape Play Areas: Guardtop high performance sealcoat, www.guardtop.com.
- B. Parking Lot and Drive Areas: Emulsified asphalt and mineral aggregate mix complying with Section 203-9 of Standard Specifications for Public Works Construction, using Type SS-1h asphalt emulsion.
- C. Substitutions: Under provisions of Section 01 25 13.

3. PART 3 EXECUTION

3.1 INSPECTION

- A. Verify compacted subgrade is dry and ready to support paving and imposed loads.
- B. Verify gradients and elevations of base are correct.
- C. Beginning of installation means acceptance of substrate.

3.2 PREPARATION

- A. Apply weed killer to entire area to be paved. Follow manufacturer's application directions.
- B. Install headers and stakes to achieve arrangement of paving shown on the Drawings.

3.3 PLACEMENT OF GRANULAR BASE COURSE

- A. Spread granular base material to compacted thickness shown on the Drawings. Compact according to Section 31 20 00 to 95 percent.
- B. Thickness tolerance: Minus 0.0 inch to plus 0.5 inch.
- C. Smoothness tolerance: 3/8 inch in 10 feet.
 - 1. Deviations: Correct by removing materials, replacing with new materials, and reworking and recompacting as required.
- D. Smoothness tolerance: Running Track
 - 1. 1/4 inch in 10 feet.
 - 2. Deviations: Correct by removing materials, replacing with new materials and reworking and recompacting as required.
- E. Moisture content: Only the amount needed to achieve the specified compaction.

3.4 PLACEMENT OF ASPHALTIC CONCRETE FINISHED PAVING

- A. Remove all loose materials from compacted base.
- B. Adjust frames and covers, if so required, to meet final grades.
- C. Tack Coat:
 - 1. Apply tack coat at the rate of 0.05 to 0.10 gallon per square yard to all existing pavement, curbs, gutters, manholes, and the like immediately before asphalt concrete is placed.
 - 2. Avoid smearing adjacent surfaces. Remove spillage and clean affected areas.
- D. Spreading Asphaltic Concrete Materials:
 - 1. Spread material in a manner which requires the least handling.
 - 2. Spread asphalt concrete to compacted thickness shown on drawings.
 - 3. Where thickness of asphalt concrete paving will be 3 inches or less, spread in one layer.
 - 4. Where thickness of asphalt concrete paving will be more than 3 inches, spread in two layers. Surface course shall be a minimum of 1 inch thick.
 - 5. Spread binder course for running tack in a 2-1/2 inch minimum thickness.
 - 6. Spread top course of running track in a 1-1/2 inch minimum thickness.
 - 7. Prime asphalt surface between layers.
 - 8. Offset layers of paving a minimum of 6 inches.
- E. Rolling:
 - 1. After material has been spread to proper depth, roll until the surface is hard, smooth, unyielding, and true to the thickness and elevations shown.
 - 2. Roll in at least two directions until no roller marks are visible.

F. Compacting:

1. Average density according to ASTM D2041 to be 92 percent but not less than 90 percent and not more than 96 percent.

3.5 TOLERANCES

- A. Free from birdbaths.
- B. Flatness, Parking Lot, and Drive Areas: Maximum variation of 1/8 inch in 6 feet.
- C. Flatness, Hardscape Play Areas and Running Track: 1/8 inch in 10 feet.
- D. Compacted Thickness: Within 1/4 inch.
- E. Variation from True Elevation: Within 1/2 inch.

3.6 REPAVING

- A. Where existing pavement is cut, removed, or disturbed, existing pavement shall be saw cut.
- B. Where excavations are 12 inches or less in width, existing pavement to be cut 12 inches greater in length and width of excavation.
- C. Where excavations are greater than 12 inches in width, existing pavement to be cut 24 inches greater in length and width of excavation.
- D. Where existing pavement being cut is to be overlaid, pavement cutting outside limits of excavation is not required.
- E. Backfill shall conform to requirements of Section 31 20 00.
- F. Repaving shall match existing paving, but shall not be less than 3 inches of asphalt concrete placed upon 12 inches of crushed aggregate base in compliance with Section 200-2.2 of the Standard Specifications for Public Works Construction.

3.7 SEAL COAT

- A. Apply seal coat to hardscape play areas and parking and drive areas in accordance with manufacturer's instructions in two separate coats. Do not apply seal coat until 30 days after initial placement of asphaltic concrete paving.

3.8 PAVEMENT STRIPING

- A. Layout line markings and other painting in accordance with Drawings. Lines shall be 4 inches wide. Line width of play pad markings shall be as indicated.
- B. Clean surfaces to be painted. Apply paint in accordance with manufacturer's directions only when weather conditions permit proper application. Machine apply paint in as many coats as are required to provide opaque markings.

3.9 WHEEL STOPS

- A. Place wheel stops at all parking stalls as indicated.
- B. Anchor permanently in place with two steel rods.

3.10 FIELD QUALITY CONTROL

- A. Field inspection and testing of granular base and of asphalt concrete paving mix will be performed under provisions of Section 01 45 29.

- B. Testing firm to take samples and perform tests in accordance with TAI MS-2 and as specified.
- C. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.
- D. Thickness: In-place compacted thickness of hot-mix asphalt courses will be determined according to ASTM D3549.
- E. Surface Smoothness: Finished surface of each hot-mix asphalt course will be tested for compliance with smoothness tolerances.
- F. In-Place Density: Testing agency will take samples of uncompacted paving mixtures and compacted pavement according to ASTM D979.
- G. Reference maximum theoretical density will be determined by averaging results from four samples of hot-mix asphalt-paving mixture delivered daily to site, prepared according to ASTM D2041, and compacted as specified.
- H. In-place density of compacted pavement will be determined by testing core samples according to ASTM D2726.
 - 1. One core sample will be taken for every 1000 sq. yd. or less of installed pavement, with no fewer than 3 cores taken.
 - 2. Field density of in-place compacted pavement may also be determined by nuclear method according to ASTM D2950 and correlated with ASTM D2726.
- I. Remove and replace or install additional hot-mix asphalt where test results or measurements indicate that it does not comply with specified requirements.

3.11 PROTECTION

- A. Immediately after placement, protect pavement under provisions of Section 01 61 00 from mechanical injury for 2 days.
- B. Protect all new placed pavement from landscape irrigation overspray and planter area soil erosion.

3.12 FLOOD TEST

- A. Perform flood test of finished paving by use of water tank truck.
- B. Where water ponds to a depth of more than 1/8 inch, fill or otherwise correct to provide proper drainage.
- C. Feather and smooth edge of fill so that joint between fill and original surface is invisible.

END OF SECTION

SECTION 32 13 13

CONCRETE PAVING

1. PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Concrete sidewalks, seat/planter walls, curbs, gutters, utility slabs, parking areas, driveways, driveway aprons and approaches.
- B. Expansion, control and isolation joints.
- C. Finishing concrete pavements.
- D. Surface treatment with sealer and slip resistant coatings.
- E. Aggregate base course.
- F. Concrete pavement striping.
- G. Concrete wheel stops.
- H. Steel reinforcement.
- I. Fibrous secondary reinforcement.

1.2 REFERENCES

- A. 2010 Americans with Disabilities Act (ADA) Standards for Accessible Design.
- B. ACI 301 - Specifications for Structural Concrete for Buildings.
- C. ACI 117 - Standard Specification for Tolerances for Concrete Construction and Materials.
- D. ASTM A82 - Specification for Steel Wire, Plain, for Concrete Reinforcement.
- E. ASTM A185 - Welded Steel Wire Fabric for Concrete Reinforcement.
- F. ASTM A184 - Specification for Fabricated Deformed Steel Bar Mats for Concrete.
- G. ASTM D1751 - Preformed Expansion Joint Fillers for Concrete Paving and Structural Construction.
- H. ASTM A615 - Deformed and Plain Billet-Steel for Concrete Reinforcement.
- I. ASTM C33 - Concrete Aggregates.
- J. ASTM C94 - Ready Mixed Concrete.
- K. ASTM C150 - Portland Cement.
- L. ASTM C260 - Air-Entraining Admixtures for Concrete.
- M. ASTM C289 - Potential Reactivity of Aggregates.
- N. ASTM C309 - Liquid Membrane-Forming Compounds for Curing Concrete.
- O. ASTM C494 - Chemical Admixtures for Concrete.
- P. ASTM C618- Standard Specification for Coal Fly Ash and Raw or Calcined Natural Pozzolan for Use as a Mineral Admixture for Concrete.

- Q. ASTM C979 - Pigments for Integrally Colored Concrete.
- R. ASTM C1116 - Specification for Fiber-Reinforced Concrete and Shotcrete.
- S. ASTM C1602 - Standard Specification for Mixing Water Used in the Production of Hydraulic Cement Concrete.
- T. CBC - California Building Code, (CCR) California Code of Regulations, Title 24, Part 2, California State Accessibility Standards.
- U. DSA/AC - Division of State Architect/Access Compliance.
- V. National Ready Mix Concrete Association - Plant Certification Program.
- W. Southern California Chapter, American Public Works Association - Standard Specifications for Public Works Construction.
- X. Stormwater Best Management Practice Handbook (BMP Handbook), Construction Edition, as published by the California Storm Water Quality Association.

1.3 QUALITY ASSURANCE

- A. Perform work in accordance with ACI 301.
- B. Obtain materials from same source throughout.

1.4 QUALIFICATIONS

- A. Manufacturer: Manufacturer of ready-mix concrete products complying with ASTM C94 requirements for production facilities and equipment. Certified according to National Ready Mix Concrete Association's Plant Certification Program.
- B. Pavement Installer: Company who has completed pavement work similar in material, design, and extent to that indicated for this project.
- C. Detectable Warning Pavement Installer: Company specializing in applying the work of this section with a minimum of 5 years experience and approved by manufacturer of the detectable warning products used.

1.5 REGULATORY REQUIREMENTS

- A. Conform to applicable code for paving work on public property.
- B. Conform to (CBC) California Building Code, (CCR) Title 24, Part 2, and the 2010 ADA Standards for Accessible Design for access requirements for individuals with disabilities.

1.6 ENVIRONMENTAL REQUIREMENTS

- A. Provide concrete curing, finishing, and waste management techniques as defined in Section 4 of the Storm Water Best Management Practice Handbook, (BMP Handbook) Construction Edition.

1.7 SUBMITTALS

- A. Submit product data under provisions of Section 01 33 00.
- B. Include data on joint filler, admixtures and curing compounds.
- C. Submit proposed mix design to testing laboratory and to Architect for review prior to commencement of work.
- D. Submit manufacturer's instructions under provisions of Section 01 33 00.

1.8 MOCKUP

- A. Provide mockup of colored pavement finish under provisions of Section 01 43 00.
- B. Construct mockup area under conditions similar to those which will exist during actual placement, with coatings applied.
- C. Locate where directed.
- D. Mockup may remain as part of the work.

1.9 WARRANTY

- A. Provide five year warranty under the provisions of Section 01 77 00 for detectable warning pavement.
- B. Warranty: Shall indicate compliance with standards required by CBC, California Building Code, (CCR) California Code of Regulations, Title 24, Part 12, Section 12-11B.209. Warranty coverage shall include durability criteria which indicates that the shape, color fastness, sound-on-cane acoustic quality, resilience, and attachment will not degrade significantly for at least five years after original installation. As used in this Article, "not degrade significantly" means that the product maintains at least 90 percent of its approved design characteristics, as determined by the Division of The State Architect.

2. PART 2 PRODUCTS

2.1 CONCRETE MATERIALS

- A. Cement: ASTM C150 Normal-Type I or Type II Portland type, gray color, from single source throughout project.
- B. Fine and Coarse Aggregates: ASTM C33, non-reactive when tested in accordance with ASTM C289 and Appendix X-1 of ASTM C33.
- C. Water: ASTM C1602, clean and not detrimental to concrete.

2.2 BASE MATERIALS

- A. Aggregate Base: Crushed rock conforming to Section 200-2.2 of the Standard Specifications for Public Works Construction.

2.3 FORM MATERIALS

- A. Conform to ACI 301.

2.4 REINFORCEMENT

- A. Reinforcing Steel: ASTM A615; 60 ksi yield grade; deformed billet steel bars, uncoated finish.
- B. Welded Steel Wire Fabric: Plain type, ASTM A185; in coiled rolls or flat sheets; uncoated finish.
- C. Fabricated Bar Mats: ASTM A184; welded or clip-assembled steel bar mats of ASTM A615, Grade 60 steel bars.
- D. Tie Wire: ASTM A82, annealed steel, minimum 16 gage size.
- E. Dowels: ASTM A615; 40 ksi yield grade, plain steel, uncoated finish.
- F. Supports: Chairs, spacers, dowel bar supports and other devices for spacing, supporting and fastening reinforcing bars, welded wire fabric, and dowels in place.

2.5 ACCESSORIES

- A. Curing Compound: ASTM C309, Type 1-D, Class B.
- B. Preformed Joint Filler: ASTM D1751, 1/2 inch thick.
- C. Colored Sealer: Type recommended by manufacturer of colored concrete pigment.
- D. Surface Retarder: Top cast of type recommended by manufacturer of colored concrete pigment.
- E. Joint Sealers: As specified in Section 07 92 00.
- F. Rock Salt: Commercial standard packaged rock crystals, No. 2 size, free of fines.

2.6 ADMIXTURES

- A. Air Entrainment: ASTM C260.
- B. Fly Ash: ASTM C618, Class F.
- C. Water Reducing Admixture: ASTM C494, Type A.
- D. Colored Concrete Pigment: ASTM C979 of color selected.

2.7 FINISH MATERIALS

- A. Aggregate: Natural river gravel; angular; 1/4 inch minimum size to 3/8 inch maximum size; clean washed type. No reactive or iron bearing aggregate permitted. Grey color from single source throughout.
- B. Slip Resistant Aggregate: 95 percent minimum fused homogeneous aluminum oxide.
- C. Integral Color Concrete Pigment:
 - 1. Powder Pigments as manufactured by Davis Colors, www.daviscolors.com.
 - 2. SG Granular Color as manufactured by Solomon Colors, Inc., www.solomoncolors.com.
 - 3. Integral color SG as manufactured by Scofield, www.scofield.com.
 - 4. Substitutions: Under provisions of Section 01 25 13.

2.8 DETECTABLE WARNING PAVEMENT

- A. Surface applied detectable warning system meeting nominal dimensional and color contrast requirements of the CBC, California Building Code, (CCR), California Code of Regulations, Title 24, Part 2, Section 11B-705 and be approved by DSA/AC.
- B. Detectable warning pavement to be constructed using the Vitrified Polymer Composite Armor-Tile System manufactured by Engineered Plastics, Inc., www.armor-tile.com.
- C. Color of pavement shall be of contrasting yellow color conforming to Color 33538 in accordance with Federal Standard 595C.
- D. Substitutions: Under provisions of Section 01 25 13.

2.9 CONCRETE MIX

- A. Mix concrete in accordance with ASTM C94, Alternative No. 3.
- B. Provide concrete of the following characteristics:

1. Driveways, aprons and approaches: Compressive strength of 3,500 psi at 28 days.
 2. Sidewalks, seat/planter walls, curbs, gutters and utility slabs: Compressive Strength of 3,000 psi at 28 days.
 3. Slump: 4 to 6 inches.
 4. Maximum aggregate size: 1 inch (50:50 aggregate: sand mix).
 5. Maximum aggregate size (exposed aggregate finish): ½ inch (60:40 aggregate: sand mix).
 6. Cement Content: Minimum 540 lbs/cu. yd.
 7. Fly Ash: Maximum 25 percent by weight.
 8. Air Entrainment: 2 to 4 percent.
 9. Water Cement Ratio: 0.50.
 10. Fibrous Reinforcement: 1.5 to 1.6 lbs/cu. yd. of polypropylene fibers or 1 lb/cu.yd. of nylon and cellulose fibers in all mix designs except for curb and gutters.
 11. Integral Coloring: Where integral color is designated provide 5 pounds of colored pigment per sack of cement.
- C. When automatic machine placement is used, determine mix design and obtain laboratory test results that comply with or exceed requirements.

2.10 PAVEMENT STRIPING PAINT

- A. Vinyl emulsion type, yellow color, except at accessible parking spaces, blue color. Blue color to be equal to Color 15090 in accordance with Federal Standard 595C. Color of fire lane curb marking to be red with white letters.
- B. Acceptable products:
1. W801 Vin-L-Stripe Traffic Paint, manufactured by Dunn-Edwards, www.dunnedwards.com.
 2. 506 Traffic Line Paint-Vinyl, manufactured by Frazee, www.frazeepaint.com.
- C. Substitutions: Under provisions of Section 01 25 13.

2.11 CONCRETE WHEEL STOPS

- A. Prefabricated 5-1/2 inch high x 7-1/2 inch wide by 48 inch long 3,500 psi concrete wheel stops.
- B. Chamfer corners and provide holes for anchoring to substrate.
- C. Dowels: Galvanized steel, 1/2 inch diameter, minimum 18 inch length.

3. PART 3 EXECUTION

3.1 INSPECTION

- A. Verify compacted subgrade is ready to support paving and imposed loads.
- B. Verify gradients and elevations of base are correct.
- C. Beginning of installation means acceptance of existing conditions.

3.2 BASE

- A. Prepare and compact base materials in accordance with provisions of Section 31 20 00 .

3.3 PREPARATION

- A. Moisten base to minimize absorption of water from fresh concrete.
- B. Coat surfaces of adjacent curbs, gutters, manholes, catch basins, inlets, light pole bases and other fixed objects with form release agent to form isolation joint and prevent bond with paving.
- C. Notify Architect minimum 24 hours prior to commencement of concreting operations.

3.4 FORMING

- A. Place and secure forms to correct location, dimension, and profile.
- B. Assemble formwork to permit easy stripping and dismantling without damaging concrete.
- C. Place joint fillers vertical in position, in straight lines. Secure during concrete placement.

3.5 REINFORCEMENT

- A. Place reinforcement at mid-height of slabs-on-grade.
- B. Lap adjoining pieces of welded wire fabric one full mesh and lace splice with wire. Offset laps of adjoining sheets.
- C. Place fabricated bar mats in lengths as long as practical. Overlap adjacent mat 2 inches.
- D. Interrupt reinforcement at expansion joints.
- E. Place secondary fiber reinforcement in concrete mix in quantities as specified for concrete pavements.
- F. Place reinforcement to achieve slab and curb alignment as detailed.
- G. Provide doweled joints at interruption of concrete with one end of dowel set in capped sleeve to allow longitudinal movement.
- H. Where joining existing concrete pavement, drill and set new dowels with epoxy grout into existing paving. Set opposite end of dowel in capped sleeve to allow for longitudinal movement.

3.6 PLACING CONCRETE

- A. Place concrete in accordance with ACI 301.
- B. Hot and Cold Weather Placement: ACI 301.
- C. Place concrete formwork on public property in conformance with applicable City of Oxnard code.
- D. Ensure reinforcement, inserts, embedded parts, and formed joints are not disturbed during concrete placement.
- E. Place concrete continuously between predetermined construction joints and expansion joints.
- F. Do not push or drag concrete into place or use vibrators to move concrete into place.
- G. Place concrete to pattern indicated in strip sequence.
- H. Curb and Gutter: For automatic machine placement, produce curbs and gutters to required cross section, lines, grades, finish and jointing.

- I. Slip - Form Paving: For automatic machine placement, produce paving to required thickness, line, grade, finish and jointing.

3.7 JOINTS

- A. Review locations of joints when indicated and make recommendations for any additional joints or suggestions for new locations. Lack of joints or misplacement of joints will not constitute justification of pavement cracking.
- B. Place expansion joints at not to exceed 20 foot intervals to correct elevation and profile. Align curb, gutter, and sidewalk joints.
- C. Place joint filler at expansion joints and building or other appurtenances.
- D. Provide control joints at not to exceed 5 foot intervals.
- E. Saw cut control joints 3/16 inch wide at an optimum time after finishing. Cut 1/3 into depth of slab.
- F. Provide keyed joints as indicated.
- G. Use form release agent at isolation joints where paving abutts curbs, gutters, manholes, catch basins, inlets, light pole bases, and other fixed objects to prevent bonding with pavement.
- H. Where joining existing pavement, align new expansion, control and isolation joints with previously placed joints.

3.8 FINISHING

- A. Uniformly spread, screed and consolidate concrete. Do not spread concrete by vibration.
- B. Smooth Form Finish:
 - 1. Coordinate as necessary to secure form construction using smooth, hard, uniform surfaces, with number of seams kept to a practical minimum and in a uniform, orderly pattern.
 - 2. Patch tie holes and defects.
 - 3. Trowel to smooth even finish.
 - 4. Use for curbs, gutters, and mowstrips.
- C. Medium Broom Finish:
 - 1. Float surface and trowel to smooth even finish.
 - 2. While surface is still plastic draw a soft fiber bristle broom uniformly over surface in perpendicular direction to traffic.
 - 3. Use for sidewalks outside perimeter (Wireworks) fencing, utility slabs, parking areas, driveways, drive aprons which have a slope of 6 percent or less and areas indicated.
- D. Slip Resistant Heavy Broom Finish:
 - 1. Float surface and trowel to smooth even finish.
 - 2. While concrete is still plastic, uniformly broadcast aluminum oxide particles onto surface at the rate of 25 pounds per 100 sq. ft.
 - 3. Trowel particles into surface of concrete to provide embedment. Do not force below surface.

4. While surface is still plastic, draw a stiff fiber bristle broom uniformly over surface in perpendicular direction of traffic.
 5. Use for ramps with slope of 6 percent or greater, stair treads, and areas indicated.
- E. Exposed Aggregate Finish:
1. Top Cast level 100 finish per Section 32 13 51.
 2. Provide at all locations indicated as exposed aggregate finish on site plans.
- F. Top Cast Sand Finish:
1. Top Cast level 05 finish per Section 32 13 51.
 2. Provide at all colored concrete paving and at standard concrete paving within perimeter (Wireworks) fencing.
- G. Apply colored concrete sealer to sandblasted and colored concrete surfaces in accordance with manufacturer's instructions.

3.9 DETECTABLE WARNING PAVEMENT

- A. Install detectable warning pavement on curb ramps and other areas indicated on the drawings.
- B. Install detectable warning pavement in accordance with manufacturer's requirements and the 2010 ADA Standards for Accessible Design and CBC, Title 24, Part 2, Section 11B-705 requirements.

3.10 CURING

- A. Cure concrete surfaces in accordance with ACI 301.
- B. Apply curing compound on finished slab surfaces in accordance with manufacturer's instructions.

3.11 PAVEMENT STRIPING

- A. Lay out line markings and other painting in accordance with Drawings. Lines shall be 4 inches wide.
- B. Clean surfaces to be painted.
- C. Apply paint in accordance with manufacturer's directions.
- D. Apply only when weather conditions permit proper application.
- E. Machine apply paint in as many coats as are required to provide opaque markings.
- F. Allow for 600 linear feet of fire lane curb marking.

3.12 CONCRETE WHEEL STOPS

- A. Place wheel stops at all parking stalls as indicated.
- B. Anchor permanently in place with two steel rods.

3.13 FIELD QUALITY CONTROL

- A. Field inspection and testing will be performed under provisions of Section 01 45 29.
- B. Owner's Inspector will take cylinders and perform slump and air entrainment tests in accordance with ACI 301 and will arrange for pick-up of cylinders by Testing Laboratory.

- C. Three concrete test cylinders will be taken for every 50 or less cu yds of each class of concrete placed each day.
- D. One slump test will be taken for each set of test cylinders taken.
- E. Maintain records of placed concrete items. Record date, location of pour, quantity, air temperature, and test samples taken.

3.14 TOLERANCES

- A. Provide tolerances under provisions of Section 01 43 00 in accordance with ACI 117.
- B. Maximum Variation of Surface Flatness: 1/4 inch in 10 feet.
- C. Maximum Variation from True Position: 1/4 inch.
- D. Variation of Pavement Thickness: Plus 3/8 inch, minus 1/4 inch.
- E. Maximum Variation of Pavement Joints: 1/8 inch vertical alignment.

3.15 PROTECTION

- A. Immediately after placement, protect concrete under provisions of Section 01 61 00 from premature drying, excessive hot or cold temperatures, and mechanical injury.
- B. Do not permit traffic over pavement for 7 days after finishing.
- C. Maintain pavement free of stains, discoloration, dirt and other foreign materials. Remove surface stains and spillage of material as they occur.

3.16 REPAIR

- A. Remove and replace pavement that is broken, damaged, defective or does not comply with requirements of this Section.
- B. Refinishing pavement that is broken, damaged, or defective is not acceptable.
- C. Remove pavement in complete sections from joint to joint.
- D. Recycle pavement debris under provisions of Section 01 74 19.

END OF SECTION

SECTION 32 13 51

TOP CAST CONCRETE FINISHES

Part 1 – GENERAL

1.01 Summary

- A. Section includes: **Micro Finished and Exposed Coarse Aggregate Concrete** produced through the use of a chemical surface retarder to expose the sand and fine aggregates of a concrete mix

- B. Related Sections: Refer to the following sections for related work

Section: 07 92 00: "Joint Sealants"

Section :32 13 13: "Concrete Paving"

1.02 References

- A. American Concrete Institute (ACI)
B. American Society for Testing and Materials (ASTM)

C 31 Practices for Making and Curing Concrete Test Specimens in the Field

C 33 Specification for Concrete Aggregates

1.03 Submittals

- A. General: Submit the following items in accordance with the Conditions of Contract and Section 01 33 00, "Submittal Procedures".
B. Product Data: Submit product data for the following materials and items.
C. Chemical Surface Retarders
D. Patching Compounds
E. Sealants

1.04 Quality Assurance

- A. Codes and Standards: Comply with provisions of the following, except as otherwise indicated:
1. ACI 301 "Specifications for Structural Concrete for Buildings "
 2. ACI 304 "Guide for Measuring, Mixing, Transporting and Placing Concrete "
 3. ACI 305 "Hot Weather Concreting "
 4. ACI 306 "Cold Weather Concreting "
 5. ACI 308 "Standard Practice for Curing Concrete "
 6. CRSI "Manual of Standard Practice "
 7. SP-66 "ACI Detailing Manual "
- B. **Mock-up Panels:** Prepare one mock-up panel at the project site to demonstrate proficiency of the contractor as well as determine the best procedures and degree of sand or aggregate exposure. Mock- up panels shall be a minimum of 4' x 4'. Contractor shall use the methods and materials proposed for use on the final installation. Uniformity in appearance of each panel shall be the responsibility of the contractor. The approved mock-up panel shall serve as a standard of appearance for the final work to be produced. Manufacturer's Technical Representative, whenever possible, shall be present and or involved with the mock up to review proper preparation, application and removal processes.
- C. Quality Control Testing During Construction: Per requirements of Sections 01 43 00 & 32 13 13.

Part 2 – PRODUCTS

2.01 Acceptable Manufacturers:

- A. Top Cast Surface Retarders and Top Cast SS-100 distributed by Dayton Superior Corporation. (www.daytonsuperior.com) (888-977-9600).
- B. Substitutions: Under provisions of Section 01 25 13.

2.02 Concrete Surface Retarder and Finishing Aids

- A. Spray Applied, film forming top surface retarder designed for specific sized aggregates and finish requirements. Color Coded to allow for ease of application and verification of etch level being used as well as even and complete coverage
 - 1. Acceptable Material: **Top Cast Surface Retarders by GCP Applied Technologies.**
- B. Spray Applied and film forming protective coating for adjacent masonry and concrete surfaces
 - 1. Acceptable Materials: **Top Cast SS-100 by GCP Applied Technologies.**

PART 3 EXECUTION

3.01 Placing Concrete: Coordinated with requirements of Section 32 13 13.

- A. Notify owner's representative 24 hours in advance prior to placement.
- B. Filed Inspection: Do not place concrete until forms and reinforcing steel have been inspected and approved.
 - 1. Place Ready-Mix concrete within specified time after batching.
 - a. Below 40 degrees F (4 degrees C) See Cold Weather Placing
 - b. 40 – 85 degrees F (4-29 degrees C) 90 minutes
 - c. 86 – 90 degrees F (30-32 degrees C) 75 minutes
 - d. Above 90 degrees F (32 degrees C) 60 minutes

* Concrete exceeding delivery times may be rejected by the owner's representative

 - 2. Adding Water: Do not add water after initial introduction of mixing water for batch except when slump of concrete is less than specified upon jobsite arrival and the maximum water/cement ratio has not been exceeded.
 - a. Notify owner's representative prior to adding any additional water.
 - b. Add only water enough to bring concrete slump within the specified limits. Turn drum at least 30 additional revolutions at maximum mixing speed. Do not add water to batch at any later time.
 - c. Insure that concrete strength meets or exceeds specified requirements, and water does not exceed maximum amount specified in the approved CONCRETE MIX DESIGN.
- C. General: Comply with ACI 304, as specified herein.
 - 1. Place concrete continuously or in layers of such thickness that the concrete will not be placed on a preceding layer which has hardened sufficiently to cause formation of seams or planes of weakness.

2. If section cannot be placed continuously, provide construction joints. Deposit concrete as nearly as practicable to its final location to avoid segregation.
- D. Placing Concrete in Forms:
1. Consolidate placed concrete by high frequency mechanical vibrating equipment, supplemented as necessary by hand spading, rodding or tamping. Use equipment and procedures for consolidation of concrete in accordance with ACI 309.
 - a. Do not use vibrators to transport concrete inside forms.
 - b. Insert and withdraw vibrators vertically at uniformly spaced locations not further visible effectiveness of the machines being used. Generally, 16-20" apart.
 - c. At each insertion, limit duration of vibration time necessary to consolidate concrete and complete embedment of reinforcement and other embedded items without causing segregation of mix.
- E. Placing Concrete Slabs: Deposit and consolidate concrete slabs in continuous operation, within the limits of construction joints, until placement of panel or section is completed. Maintain reinforcing in proper position during concrete placement operations
- F. Placing Concrete Sidewalks: Place concrete in forms in one (1) layer of such thickness that when consolidated and finished, sidewalks will be of thickness indicated.
- G. Cold Weather Placing: Protect concrete work from physical damage or reduced strength caused by frost, freezing actions, or low temperatures, comply with ACI 306.
- H. Hot Weather Placing: When hot weather conditions exist that would seriously impair the quality and strength of concrete place concrete in accordance with ACI 305 and as herein specified.

3.02 Concrete Finishing

- A. Exposed Coarse Aggregate finishes: Do not use tools that may force the aggregate away from the surface creating a non-uniform surface after exposure
1. Protect all areas, aluminum trim, curbs, borders and adjacent concrete and masonry surfaces, pavers, stones etc. that are not to receive retarder finish prior to concrete placement and retarder application using
GCP Applied Technologies Top Cast SS 100 Surface Protectant. Distributed by Dayton Superior.
 2. Place concrete in the manner prescribed previously. Screed or strike off the surface in two (2) directions using a wooden or metal straight edge to achieve the proper elevation in a sawing motion back and forth.
 3. Allow the bleed water to evaporate the surface. It can then be floated using a wooden hand float or a bull-float preferably wooden to close the surface and surround the coarse aggregate with cement paste. Do not overwork the surface, as this tends to drive the aggregate down away from the surface to be exposed. Float to a uniform appearance.
 4. To reduce the rate of evaporation of moisture from the concrete use AquaFilm® J74RTU during the finishing process, his reduction of moisture loss allows time for proper finishing.

- B. Exposed Sand Finishes: The use of a rolling tamper, jitterbug or rolling jitterbug shall be considered when producing micro etched concrete surfaces. This will enable the finisher to create a denser surface paste with no obstruction due to the appearance of coarse aggregate, allowing for a uniform sand texture.
1. Protect all areas, aluminum trim, curbs, borders and adjacent concrete and masonry surfaces, pavers, stones etc. that are not to receive retarder finish prior to concrete placement and retarder application using **GCP Applied Technologies Top Cast SS 100 Surface Protectant. Distributed by Dayton Superior**
 2. Place concrete in the manner prescribed previously. Screed or strike off the surface in two (2) directions using a wooden or metal straight edge to achieve the proper elevation in a sawing motion back and forth.
 3. Allow the bleed water to evaporate the surface. It can then be floated using a wooden hand float or a bull-float preferably wooden to close the surface and surround the coarse aggregate with cement paste. Float to a uniform appearance. Follow float operations with hand trowels or Fresno steel trowels to create tight dense smooth surface. (This may require two or three passes depending upon mix design and or desired finish to be achieved)
 4. To reduce the rate of evaporation of moisture from the concrete use AquaFilm® J74RTU during the finishing process, his reduction of moisture loss allows time for proper finishing.

NOTE: Do not burnish the surface or allow the micro etched surface to prematurely dry prior to the application of Top Cast.

C. Concrete Surface Retarders

Spray Applied, film forming top surface retarder, designed for specific sized aggregates and finish requirements. Color coded to allow for ease of application and verification of grade being used as well as even and complete coverage.

Number / Aggregate Size to Expose / Color

Sand Finish	05 / Sand Texture Finish / Lt. Blue
Exposed Agg. Finish	100 / 3/8" to 1/2" agg. / grey

1. Soon after the final seal finish has been completed spray **GCP Applied Technologies "Top Cast"** surface retarder using a low-pressure sprayer with a 0.5gpm tip at a rate of 200—350 sq./ft. per gallon in a full hiding coat.
 - a. Once dry **GCP Applied Technologies "Top Cast"** will yield a coating that provides intermittent rain protection. Once completely dry it can be covered to protect the surface if heavy extended rains are predicted.
2. Wash surface with water rinse using stiff brooms and water hose or by high pressure washing with power equipment as early as 4-16 depending on weather conditions. Retarder removal intervals are dependent upon strength of the concrete mix, aggregate size and desired washing techniques. Earlier washing on the light etches may be necessary. Verify in accordance with the mock-up approval detailed herein.
3. Rinse water and cement matrix removal shall be in accordance with local codes and should not be allowed to be washed or flow down to arroyos, storm sewers, ponds, streams or sanitary sewers by precipitation or other surface flows.
4. Prior to completion of the project, remove wash water residue from the site to location approved by the local district.
5. Seal concrete per Section 32 13 13.

3.07 Concrete Surface Repairs

- A. Patching Defective Areas: Immediately cut out honeycomb, rock pockets and voids over $\frac{1}{4}$ inch (6mm) in any dimension as well as holes left by tie rods, bolts etc. down to solid concrete but, in no case to a depth less than 1 inch (25mm).
 - 1. Cut edges perpendicular to concrete surface.
 - 2. Thoroughly clean, dampen with water, and brush coat area to be patched with neat cement grout or proprietary bonding agent before placing cement mortar or proprietary patching compound.
- B. Remove and replace concrete with defective surfaces if defects cannot be repaired to the satisfaction of the owner's representative.
 - 1. Surface defects include color and texture irregularities, cracks, spalls, air bubbles, honeycombs, rock pockets, fins and other projections on the surface as well as stains and other discolorations that cannot be removed by cleaning.
 - a. Dampen concrete surfaces in contact with patching concrete and brush with neat cement grout or apply concrete bonding agent.
 - b. Mix Patching concrete of same materials to provide concrete of same type of class as original concrete.
 - c. Place, compact and finish to blend with adjacent finished concrete. Cure in same manner as adjacent concrete.

END OF SECTION

SECTION 32 17 23

ARTIFICIAL GRASS FIELD TURF-CMAS

PART 1 - GENERAL

1.01 SUMMARY

- A. The work under this section shall consist of furnishing all labor, materials, and equipment necessary to install, in place, all synthetic turf and other materials as indicated on the plans and as specified herein. The installation of all new materials shall be performed in strict accordance with these specifications, the turf provider's instructions and in accordance with all details and shop drawings.
 - 1. Acceptance of prepared sub-base.
 - 2. Coordination with related trades to ensure a complete, integrated, and timely installation which shall include but not limited to:
 - a. Aggregate base course, sub-base material (tested for permeability),
 - b. grading and compacting,
 - c. piping and drainage components (when required); as provided under its respective trade section.
- B. Related Requirements:
 - 1. Division 01 - General Requirements.
 - 2. Section 01 60 00 – Product Requirements
 - 3. Section 01 33 00 – Submittal Procedure.
 - 4. Section 12 93 00 – Site Furnishing.

1.02 SCOPE OF WORK:

- A. It shall be the responsibility of the synthetic grass manufacturer to provide all labor, materials, equipment and tools necessary for the complete installation of the synthetic grass turf fields as indicated on the plans and as specified herein. The installation of all materials shall be performed in strict accordance with the manufacturer's installation instructions and in accordance with all approved shop drawings.
- B. Perimeter edge details required for the system shall be as detailed and recommended by the Manufacturer, and as approved by the Owner. Supply and installation of these details and the entire sub-surface base drainage system will be under the scope of work of the **general contractor**, not that of the synthetic grass manufacturer / Installer.

1.03 PRODUCT REQUIREMENT:

- A. A vertical drainage sub-base system constructed by the General Contractor per the contract drawings (Refer to the Civil Engineers Drainage Plans indicating the sub-surface drainage for the Football Field).

- B. FieldTurf Elite FT-Core 2.5" CoolPlay synthetic turf. Owner to purchase direct under separate contract. Fieldturf and its installation are not part of the bid. Fieldturf product and installation will be purchased direct via separate CMAS contract.

1.04 SUBMITTALS:

- A. Comply with Section 01 33 00, Submittals Procedures. Submit for approval prior to fabrication.
- B. Shop Drawings:
 - 1. Indicate field layout; field marking plan and details for the specified sports; i.e., NCAA Football; roll/seaming layout; methods of attachment, field openings and perimeter conditions.
 - 2. Show installation methods and construction indicating field verified conditions, clearances, measurements, terminations, drainage.
 - 3. Provide joint submission with related trades when requested by Architect.
- C. Product Data:
 - 1. Submit manufacturer's catalog cuts, material safety data sheets (MSDS), brochures, specifications; preparation and installation instructions and recommendations; storage, handling requirements and recommendations.
 - 2. Submit fiber manufacturer's name, type of fiber and composition of fiber.
 - 3. Submit data in sufficient detail to indicate compliance with the contract documents.
 - 4. Submit manufacturer's instructions for installation.
 - 5. Submit manufacturer's instructions for maintenance for the proper care and preventative maintenance of the synthetic turf system, including painting and markings.
- D. Samples: Submit a synthetic turf sample, 12 x 12 inches, representing the turf carpet portion of the product proposed for this project.
- E. Product Certification:
 - 1. Submit manufacturer's certification that products and materials comply with requirements of the specifications.
 - 2. Submit test results indicating compliance with Reference Standards.
- F. Project Record Documents: Record actual locations of seams, drains and other pertinent information in accordance with Specifications, General Requirements.
- G. Warranties: Submit warranty and ensure that forms have been completed in Owner's name and registered with approved manufacturer.
- H. Testing data to the Owner to substantiate that the finished field meets the required shock attenuation, as per ASTM F1936.
- I. Submit Bills of Lading/Material Delivery Receipts for synthetic turf infill materials. Bills of lading shall bear the name of the project/delivery address, quantity of materials delivered, source/location of origin of infill materials and/or manufacturer, and date of delivery.
- J. Testing Certification: Submit certified copies of independent (third-party) laboratory reports on ASTM testing:
 - 1. Pile Height, Face Weight & Total Fabric Weight, ASTM D5848.
 - 2. Primary & Secondary Backing Weights, ASTM D5848.

3. Tuft Bind, ASTM D1335.
4. Grab Tear Strength, ASTM D1682 or D5034.
5. Water Permeability, ASTM D4491

1.05 DELIVERY, STORAGE, AND HANDLING

- A. Comply with Section 01 60 00, Product Requirements.
- B. Prevent contact with materials that may cause dysfunction.
- C. Deliver and store components with labels intact and legible.
- D. Store materials/components in a safe place, under cover, and elevated above grade.
- E. Protect from damage during delivery, storage, handling and installation. Protect from damage by others.
- F. Inspect all delivered materials and products to ensure they are undamaged and in good conditions.

1.06 SEQUENCING AND SCHEDULING:

- A. Coordinate the work with installation of work of related trades as the work proceeds.
- B. Sequence the work in order to prevent deterioration of installed system.

1.07 MAINTENANCE SERVICE:

- A. Contractor shall train the owner's facility maintenance staff in the use of the turf manufacturer's recommended maintenance equipment.
- B. Manufacturer must provide maintenance guidelines and a maintenance video to the facility maintenance staff.

PART 2 - MATERIALS

2.01 GENERAL CONTRACTOR QUALIFICATIONS

- A. Installers of the sub-surface drainage base system for the fields shall be required to comply with and supply proof/reference to the Owner ten (10) days prior to the bid the following information:
 1. General Contractor constructing the drainage base system must have an installation team possessing a Class A California Engineering Contractor's License
 2. Have prior direct experience in preparing a minimum of 10 drainage base sub-surface systems for synthetic turf sports fields as is proposed for this project and must have installed a minimum of 10 synthetic turf projects the past 3 years in California.

2.02 FIELD GROOMER & SWEEPER:

- A. Supply field groomer as part of work.
 - 1. Field Groomer shall include a towing attachment compatible with a field utility vehicle.
 - 2. Field Groomer shall be a FieldTurf GroomRight.
 - 3. Field Sweeper shall include a towing attachment compatible with a field utility vehicle.
 - 4. Field Sweeper shall be a FieldTurf SweepRight.

PART 3 – EXECUTION

3.01 EXAMINATION:

- A. Verify that all sub-base leveling is complete prior to installation.
- B. Installer shall examine the surface to receive the synthetic turf and accept the sub-base planarity in writing prior to the beginning of installation.
 - 1. Acceptance is dependent upon the Owner's test results indicating compaction and planarity are in compliance with the manufacturer's specifications.
 - 2. The surface shall be accepted by the Installer as "clean" as installation commences and shall be maintained in that condition throughout the process.
- C. Compaction of the aggregate base shall be 95% in accordance with ASTM D1557 (Modified Proctor procedure); and the surface tolerance shall not exceed 0 -1/4 inch over 10 feet and 0 -1/2 inch from design grade.
- D. Correct conditions detrimental to timely and proper completion of work.
- E. Do not proceed until unsatisfactory conditions are corrected.
- F. Beginning of installation means acceptance of conditions installed, prepared and turned over prior to commencement of installing synthetic turf per contract drawings.

3.02 PREPARATION

- A. Prior to the beginning of installation, inspect the sub-base for tolerance to grade.
- B. Sub-base acceptance shall be subject to receipt of test results (by others) for compaction and planarity that sub-base is in compliance with manufacturer's specifications and recommendations.

- C. Dimensions of the field and locations for markings shall be measured by a registered surveyor to verify conformity to the specifications and applicable standards. A record of the finished field as-built measurements shall be made.
- D. When requested by Architect, installed sub-base shall be tested for porosity prior to the installation of the monofilament turf. A subbase that drains poorly is an unacceptable substrate.

3.03 INSTALLATION - GENERAL

- A. The installation shall be performed in full compliance with approved Shop Drawings.
- B. Only trained technicians, skilled in the installation of athletic caliber synthetic turf systems working under the direct supervision of the approved installer supervisors, shall undertake any cutting, sewing, gluing, shearing, topdressing or brushing operations.
- C. The designated Supervisory personnel on the project must be certified, in writing by the turf manufacturer, as competent in the installation of this material, including sewing seams and proper installation of the Infill mixture.
- D. Designs, markings, layouts, and materials shall conform to all currently applicable National Collegiate Athletic Association rules, NFHS rules, and/or other rules or standards that may apply to this type of synthetic grass installation. Designs, markings and layouts shall first be approved by the Architect or Owner in the form of final shop drawings. All markings will be in full compliance with final shop drawings.

3.04 FIELD LINING AND MARKINGS

- A. The field will have the following lines tufted or inlaid as specified according to NCAA standards".
 - a. Soccer lines and marking shall be as shown on the contract drawings. Colors shall be yellow, except where noted. The lines/markings shall consist of the following:
 - i. Side lines
 - ii. End lines
 - iii. Goal box
 - iv. 6 -yard box
 - v. Corner Kick markings
 - vi. Center circle markings
 - vii. Penalty kick markings
 - b. Football lines and marking shall be as shown on the contract drawings. Colors shall be white, except where noted. The lines/markings shall consist of the following:
 - i. Side lines
 - ii. End lines
 - iii. 5-yard lines
 - iv. Goal lines
 - v. Coach's box
 - vi. 10 -yard numbers and arrows

- vii. 1 -yard hash markings
- viii. Inbound hash markings
- ix. Extra point lines
- x. Kick-off markings
- xi. Limit lines.

- B. If applicable, the center field logo will be inlaid according to artwork submitted by the Architect to Fieldturf a minimum of two (2) months in advance of the commencement of the installation of the field and the choice of graphics, special accent colors, or markings).
- C. If applicable, endzone letters per contract drawings
- D. Striping layouts shall be accurately measured by the Contractor before installation of inlaid field markings.
- E. Architect shall provide the Turf manufacturer with final electronic versions of artwork and all pantone matching systems color codes at least two (2) months in advance of the commencement of the installation of the field

3.05 ADJUSTMENT AND CLEANING RECOMMENDATIONS:

- A. Do not permit traffic over un-protect surface. Protect installed FieldTurf from subsequent construction operations.
- B. Do not permit traffic over unprotected field surface.
- C. General Contractor shall provide the labor, supplies, and equipment as necessary for final cleaning of surfaces and installed items.
- D. All usable remnants of new material shall become the property of the Owner.
- E. The General Contractor shall keep the area clean throughout the project and clear of debris.
- F. Surfaces, recesses, enclosures, and related spaces shall be cleaned as necessary to leave the work area in a clean, immaculate condition ready for immediate occupancy and use by the owner.

3.06 FIELD PERFORMANCE TESTING

- A. The Manufacturer is responsible for delivering a project the meets all required testing and for providing all test results to the ARCHITECT for review and approval.

- B. G-max Testing: Shall be performed at construction completion and during each year of the life of the Warranty. Initial g-max testing for shock attenuation on completed field shall be a maximum average of 80-100 per ASTM F1936.
1. Testing shall be performed at the locations required by ASTM F1936, and in addition testing shall be performed at the center field, at the goal locations for all sports, and at ten yards inside the corners, resulting in a total of 19 test locations.
 2. Testing shall consist of shock attenuation per ASTM F1936 and testing equipment shall conform to ASTM Standard F355 – Procedure A. G-max shall not change more than 10% at any one location per year over the life of the Warranty, however, at no time during the life of the warranty shall the g-max be less than 165. In cases where the results of the g-max testing exceed the specified values, the condition shall be corrected by the manufacturer. The manufacturer shall provide adequate information to confirm that the mitigation measures were effective. At no time in the life of the Warranty shall the g-max be 165 or greater at any one point on the field. Results of this testing shall be provided to the OWNER, ARCHITECT and Commissioning Agent each year after testing.
 3. If non-compliant areas are located as part of the yearly assessment, the extent of these areas shall be determined by performing the g-max test towards each end zone and each sideline until tests meeting requirements are obtained. The point at which the results meet the requirements of this specification shall represent the limit of non-compliant turf and shall be remedied to be in-compliance with the requirements.
- C. Surface Ball and Surface Player Performance Testing: During the first year of installation the field will be tested to the Surface Ball and Surface Player Performance Testing FIFA standards indicated on Article 1.04, "System Description", paragraph "Performance Requirements". Testing shall be performed at the same ten designated test points for the ASTM F1936 tests. Where deviation from these values exists, the field shall be brought into compliance. This is not intended to require FIFA Certification. Testing shall be completed after infill settlements which may impact performance of the system.
- D. Infill Depth Measurements for Uniformity and Consistency: Prior to acceptance of the field by the OWNER the infill depth will be field measured by an independent testing's agency and recorded. The measurements shall be made at five-yard intervals along the length of the field with five measurement points even spaced across the field. Measurements shall be made by depth gauge method and be to an accuracy of +/- 1 mm. The test point data shall be summarized in a report listing average depth and range. In cases where the average depth is outside of the indicated range the field shall be brought into compliance by the manufacturer.

3.07 PROJECT CLOSEOUT:

- A. FieldTurf to supply a field groomer, per specifications. The field groomer shall be model GroomRight or approved equal by the manufacturer. Contact phone number :800-724-2969.
- B. FieldTurf to supply a field sweeper per specifications. The field sweeper shall be model SweepRight or approved equal by the manufacturer. Contact phone number: 800-724-2969.

- C. FieldTurf will train the Owner's facility maintenance staff in the use of the Turf Manufacture's recommended Groomer and Sweeper within three (3) months after completion of the installation process.

3.08 FINAL GROOMING

- A. The manufacturer shall perform a final grooming of the synthetic turf field in conjunction with the maintenance training session to bring the field to a game ready condition.

END OF SECTION

SECTION 32 18 23

SYNTHETIC TRACK SURFACING - CMAS

PART 1 GENERAL

1.01 SUMMARY:

- A. The synthetic surfacing contractor shall furnish all labor, materials, equipment, supervision and services necessary for the proper completion of the Synthetic Track Surfacing System and related work indicated on the drawings and specified herein.
- B. The synthetic surfacing contractor shall refer to the drawings for the required locations of synthetic track surfacing to be installed. All quantities and dimensions shall be field verified by the synthetic surfacing contractor.
- C. The contract work to be performed under this section consists of the furnishing of all required labor and materials necessary for the repair and patching of the existing synthetic running track.
- D. Related Requirements:
 - 1. Division 01 - General Requirements.
 - 2. Section 31 2333 - Excavation and Fill.
 - 3. Section 32 1313 - Site Concrete Work.
 - 4. Section 32 8413 - Potable Water Irrigation.
 - 5. Section 33 4000 - Storm Drainage Utilities.
 - 6. Section 32 1723 – Synthetic Sports Field Surfacing

1.02 SPECIFIC SCOPE OF WORK:

- A. It shall be the responsibility of the synthetic track surfacing manufacturer to provide all labor, materials, equipment and tools necessary for the complete installation of the synthetic track surfacing system as indicated on the plans and as specified herein. The installation of all materials shall be performed in strict accordance with the manufacturer's installation instructions and in accordance with all approved shop drawings.
- B. Perimeter edge details required for the system shall be as detailed and recommended by the Manufacturer, and as approved by the Owner. Supply and installation of these details will be under the scope of work of the general contractor, not that of the synthetic track surfacing manufacturer / Installer.

The system shall consist of, but not necessarily be limited to, the following:

- 1. An acceptable subbase including asphalt paving, base rock, concrete curbs and a drainage system to drain the impermeable track surfacing system constructed by the General Contractor per the contract drawings.
- 2. Beynon BSS 300 Polyurethane Sandwich Track Surfacing System – Impermeable.
Owner has purchased direct under separate contract.
Beynon and its installation are not part of this bid.

1.03 SUBMITTALS AND SUBSTITUTIONS:

The following submittals must be received with bid submittal:

- A. Standard printed specifications of the synthetic track surfacing system to be installed on this project.
- B. An affidavit attesting that the synthetic track surfacing material to be installed meets the requirements defined by the manufacturers currently published specifications and any modifications outlined in those technical specifications.
- C. A synthetic track surfacing system sample, 12" x 12" in size, of the same synthetic track surfacing system to be installed on this project.
- D. A list of completed facilities, including the installing supervisor, of the exact synthetic track surfacing system.

1.05 APPROVALS:

- A. Surface and base material compaction shall be inspected by a certified Soils Engineer. In the event the compacted base material or running track surface fails to meet the required compaction in accordance with these specifications, then the contractor shall make the necessary corrections the material at no additional cost to the district.
- B. Prior to commencement of work the contractor shall submit to the architect a sample of the track material for recommended approval.

1.06 SUBMITTALS:

- A. Request for substitutions from the specifications for any material specified or noted within the construction documents shall be submitted to the architect and/or district, in writing, within seven (7) days of bid date.
- B. Complete product data including material sample, application rates, mixing instructions shall be sent to the architect and/or district for review and recommended approval.
- C. Manufacturer's standard installation instructions
- D. Three 6"x6" samples of finished product.
- E. MSDS for all materials to be used.
- F. Sample Warranty
- G. Striping information sheets
- H. Alternates will be allowed only by written addendum.

1.07 SITE CONDITIONS:

- A. Environmental Conditions: Materials are not to be placed when:
 - 1. Ambient air temperature is below 50 degrees F.
 - 2. Material temperatures are below 50 degrees F.
 - 3. Surfaces are wet or damp.
 - 4. Precipitation is falling or pending (including fog).
 - 5. Conditions exist or are pending that will be unsuitable for the installation of the system. These conditions will be determined by the synthetic surfacing contractor on a day to day basis.
- B. Site – while surfacing and striping are being done; sprinkler systems must be curtailed, shut off or controlled so that no water falls on the track or event surfacing. Other trades, School District personnel must stay off the wet or curing surface.

- C. Do not apply rubberized topping when base surface temperature is less than 50 degrees F.
- D. Provide temporary barriers as required to prevent public entry to construction area and to protect adjacent properties from damage during construction operation.
- E. Keep all personnel, other than employees of track installer a minimum of 100 feet from equipment and workers.

PART 2 - GENERAL CONTRACTOR QUALIFICATIONS FOR INSTALLING THE DRAINAGE BASE:

- A. Installers of the subsurface base system and AC paving for the tracks shall be required to comply with and supply proof/references to the Owner 10 days post award the following information:
 - 1. General Contractor installing the base system must have a Class A California Engineering Contractor's License.
 - 2. General Contractor and or AC paving contractor must have prior direct experience in preparing a drainage base for synthetic running tracks and must have installed a minimum of 10 such base systems in California during the past 3 years, with a minimum size of 60,000 SF per track and event areas.

PART 3 – SYNTHETIC TRACK SURFACING MATERIAL

3.01 INSPECTION:

- A. Verify agreement of existing site conditions with indicated conditions.
- B. Notify Architect of discrepancies found.
- C. Beginning work of this Section constitutes acceptance existing conditions.

3.02 EXAMINATION: - ASPHALT/CONCRETE:

- A. The surfacing contractor will verify asphalt concrete paving for planarity, and surface preparation. Notify owner of any deficiencies.
- B. It is the responsibility of the paving contractor to water flood the surface with the use of a water truck. If after 30 minutes on a 70-degree F day, "bird bathes" are evident in a depth more than 1/8" the paving contractor, track surfacing contractor and the Owner's representative will determine the best method of correction.
- C. It is the responsibility of the general contractor to keep the asphalt base clean and free of all dirt, oil, grease or any other foreign matter while it is curing prior to synthetic surfacing.
- D. Minimum curing time for base prior to beginning of surfacing is 14 days for new asphalt paving (no fog or slurry seals are allowed) and 28 days for new concrete (No concrete curing compounds are allowed).
- E. Beginning installation stipulates track installer "accepts" existing conditions. Adhesion to the existing asphalt is the surfacing contractor's responsibility.

3.03 BEYNON BSS 300 POLYURETHANE SANDWICH SYSTEM:

- A. Mason Farnsworth: 559-237-2590. Beynon and its installation have been purchased direct via CMAS contract been.

3.04 TRACK MARKINGS:

- A. Standard NFSHSA and CIF line markings on track oval and event areas are included as well as lettering of school name or nickname on one straight. Minor modifications to the above will be reviewed with owner and will be free of charge. Large logos or extra lettering may be subject to additional charges.

3.05 CLEANING RECOMMENDATIONS

- A. Protect installed track surfacing from subsequent construction operations.
- B. Do not permit traffic over unprotected track surface.
- C. General Contractor shall provide the labor, supplies, and equipment as necessary for final cleaning of surfaces and installed items.
- D. General contractor shall keep the area clean throughout the project and clear of debris, Surface, recesses, enclosures, etc., shall be cleaned as necessary to leave the work areas in a clean, immaculate conditions ready for immediate occupancy and use by the Owner.

3.06 PROJECT CLOSEOUT:

- A. Beynon will train the Owner's facility-maintenance staff in the maintenance and care of the new track surfacing.

END OF SECTION

SECTION 32 18 23.53

CUSHIONED TENNIS COURT SURFACING

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Concrete tennis court cushioned surface color coating system.

1.2 RELATED REQUIREMENTS

- A. Section 03 30 00 – Cast-in-Place Concrete.

1.3 REFERENCE STANDARDS

- A. American Sports Builders Association (ASBA).
- B. United States Tennis Association (USTA) Rules of Tennis.
- C. International Tennis Federation (ITF).

1.4 SUBMITTALS

- A. Comply with Section 01 33 00 – Submittal Procedures.
- B. Product Data: Submit manufacturer's product data, including surface and crack preparation and application instructions.
- C. Samples: Submit manufacturer's color samples of color coating.
- D. Test Reports:
 - 1. Submit independent test results for solar reflectance index.
 - 2. Submit independent test results for 2000 Hour ASTM G154, accelerated weathering UV test, to demonstrate long-term durability and fade resistance.
 - 3. Submit independent test results for 2000 Hour, accelerated weathering ASTM G155 Xenon Arc test, to demonstrate long-term fade resistance and quality of pigment.
- E. Manufacturer's Certification: Submit manufacturer's certification that materials comply with specified requirements and are suitable for intended application.
- F. Manufacturer's Project References: Submit manufacturer's list of successfully completed concrete tennis court cushioned surface color coating system projects, including project name, location, and date of application.
- G. Applicator's Project References: Submit applicator's list of successfully completed concrete tennis court cushioned surface color coating system projects, including project name, location, type and quantity of color coating system applied, and date of application.
- H. Warranty Documentation: Submit manufacturer's standard warranty.
- I. Authorized Installer Certificate: Submit manufacturer's authorized installer certificate.

1.5 QUALITY ASSURANCE

- A. Manufacturer's Qualifications:
 - 1. Manufacturer regularly engaged, for past 5 years, in manufacture of concrete tennis court surface color coating systems of similar type to that specified.
 - 2. United States owned company.
 - 3. Member: ASBA.
 - 4. Manufacturer has surfaces that are classified by the ITF's (International Tennis Federation) pace classification program.
- B. Applicator's Qualifications:
 - 1. Applicator regularly engaged, for past 3 years, in application of concrete tennis court cushioned surface color coating systems of similar type to that specified.
 - 2. Employ persons trained for application of concrete tennis court cushioned surface color coating systems.
 - 3. Applicator must be authorized installer of the surfacing brand used.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Delivery and Acceptance Requirements: Deliver materials to site in manufacturer's original, unopened containers and packaging, with labels clearly identifying product name and manufacturer.
- B. Storage and Handling Requirements:
 - 1. Store and handle materials in accordance with manufacturer's instructions.
 - 2. Keep materials in manufacturer's original, unopened containers and packaging until application.
 - 3. Store materials in clean, dry area indoors.
 - 4. Store materials out of direct sunlight.
 - 5. Keep materials from freezing.
 - 6. Protect materials during storage, handling, and application to prevent contamination or damage.
 - 7. Close containers when not in use.
 - 8. Retain manufacturer batch codes on each container and application dates, for warranty purposes.

1.7 AMBIENT CONDITIONS

- A. Do not apply concrete tennis court cushioned surface color coating system when air or surface temperatures are below 50°F (10°C) during application or within 24 hours after application.
- B. Do not apply concrete tennis court cushioned surface color coating system when rain is expected during application or within 24 hours after application.

PART 2 PRODUCTS

2.1 MANUFACTURER

- A. SportMaster Sport Surfaces, PO Box 2277, 2520 South Campbell Street, Sandusky, Ohio 44870. Toll Free 800-326-1994. Fax 877-825-9226. Website www.sportmaster.net. E-mail moreinfo@sportmaster.net.
- B. Substitutions: Under provisions of Section 01 25 13.

2.2 MATERIALS

- A. Concrete Tennis Court Cushioned Surface Color Coating System: SportMaster ProCushion System – Premium.
- B. Crack Sealant: SportMaster "Crack Magic".
 - 1. 100 percent acrylic emulsion elastomeric crack sealant.
 - 2. Seals cracks up to 1/2 inch wide in concrete pavement.
 - 3. Weight per Gallon at 77 Degrees F: 8.8 lbs., plus or minus 0.5 lbs.
 - 4. Non-Volatile Material: 61 percent, plus or minus 5 percent.

- C. Crack Filler: SportMaster "Acrylic Crack Patch".
 - 1. 100 percent acrylic emulsion trowel-grade crack filler.
 - 2. Fills cracks in concrete pavement up to 1 inch wide.
 - 3. Chemical Characteristics, by Weight, Minimum:
 - a. Acrylic Emulsion: 10.0 percent.
 - b. Hiding Pigment: 0.2 percent.
 - c. Mineral Inert Fillers: 78.0 percent.
 - d. Film Formers, Additives: 1.8 percent.
 - e. Water: 8.5 percent.
 - 4. Weight per Gallon at 77 Degrees F: 15.2 lbs., plus or minus 1.0 lbs.
 - 5. Non-Volatile Material: 80 percent, plus or minus 5 percent.
 - 6. Color: To be selected by architect from manufacturer's standard range of colors.
- D. Patch Binder: SportMaster "Acrylic Patch Binder".
 - 1. 100 percent acrylic emulsion liquid binder.
 - 2. Mix on-site with sand and cement.
 - 3. Levels and repairs low spots and depressions up to 3/4 inch deep in concrete pavement.
 - 4. Weight per Gallon at 77 Degrees F: 8.8 lbs., plus or minus 0.5 lbs.
- E. Adhesion Promoter: SportMaster "Acrylic Adhesion Promoter".
 - 1. Acrylic emulsion primer.
 - 2. Primes concrete surface and promotes adhesion of cushioned color coating system materials.
 - 3. Weight per Gallon at 77 Degrees F: 8.7 lbs., plus or minus 0.5 lbs.
- F. Filler Course: SportMaster "Acrylic Resurfacer".
 - 1. 100 percent acrylic emulsion resurfacer.
 - 2. Mix on-site with silica sand.
 - 3. Apply to adhesion promoter or previously colored acrylic surfaces in preparation of cushioned color coating system.
 - 4. Chemical Characteristics, by Weight, Minimum:
 - a. Acrylic Emulsion: 44.0 percent.
 - b. Hiding Pigment: 2.0 percent.
 - c. Mineral Inert Fillers: 5.0 percent.
 - d. Film Formers, Additives: 0.2 percent.
 - e. Water: 45.0 percent.
 - 5. Weight per Gallon at 77 Degrees F: 8.5 lbs., plus or minus 0.5 lbs.
 - 6. Non-Volatile Material: 27.5 percent, plus or minus 5.0 percent.
 - 7. Color: To be selected by architect from manufacturer's standard range of colors.
- G. Base Cushion: CushionMaster II
 - 1. 100 percent acrylic emulsion coating.
 - 2. Mix on-site with water.
 - 3. Coating with coarse rubber particles for higher cushion build.
 - 4. Weight per gallon at 77 Degrees F: 9.59 lbs., plus or minus 5 lbs.
 - 5. Non-Volatile Material: 55.92 percent, plus or minus 5 percent.
- H. Finish Cushion: CushionMaster I
 - 1. 100 percent acrylic emulsion coating
 - 2. Mix on-site with water.
 - 3. Coating with fine rubber particles for smooth texturing.
 - 4. Weight per gallon at 77 Degrees F: 9.59 lbs., plus or minus 5 lbs.
 - 5. Non-Volatile Material: 55.92 percent, plus or minus 5 percent.
- I. Color Coating: SportMaster "Flexible Concentrate ColorPlus System".
 - 1. 100 percent acrylic emulsion coating.
 - 2. Mix on-site with silica sand and water.
 - 3. Color coats tennis courts.
 - 4. Weight per Gallon at 77 Degrees F: 9.2 lbs., plus or minus 0.5 lbs.
 - 5. Color: To be selected by architect from manufacturers standard range of colors (18 Minimum).

- J. Line Markings Primer: SportMaster "Stripe-Rite".
 - 1. 100 percent acrylic emulsion primer, clear drying.
 - 2. Primes line markings and prevents bleed-under for sharp lines.
 - 3. Chemical Characteristics, by Weight, Nominal:
 - a. Acrylic Emulsion: 38.0 percent.
 - b. Hiding Pigment: 0.0 percent.
 - c. Mineral Inert Fillers: 7.0 percent.
 - d. Film Formers, Additives: 1.5 percent.
 - e. Water: 50.0 percent.
 - 4. Weight per Gallon at 77 Degrees F: 8.9 lbs., plus or minus 0.5 lbs.
 - 5. Non-Volatile Material: 29 percent, plus or minus 5 percent.

- K. Line Paint: SportMaster "Textured Line Paint".
 - 1. Pigmented, 100 percent acrylic emulsion line paint.
 - 2. Line marking on concrete tennis courts.
 - 3. Chemical Characteristics, by Weight, Nominal:
 - a. Acrylic Emulsion: 25.89 percent.
 - b. Pigment: 14.90 percent.
 - c. Mineral Inert Fillers: 13.12 percent.
 - d. Additives: 4.73 percent.
 - e. Water: 41.36 percent.
 - 4. Weight per Gallon at 77 Degrees F: 10.65 lbs., plus or minus 0.75 lbs.
 - 5. Non-Volatile Material: 45.17 percent, plus or minus 5 percent.
 - 6. Color: To be selected by architect from manufacturer's standard range of colors.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Examine concrete tennis court surfaces to receive cushioned color coating system.

- B. Verify:
 - 1. Suitable vapor barrier beneath concrete slab.
 - 2. Perimeter drainage to prevent moisture accumulation beneath concrete surface.
 - 3. Curing compounds have not been used on concrete surface.
 - 4. Concrete tennis courts meet ASBA requirements.

- C. Notify Architect of conditions that would adversely affect application or subsequent use.

- D. Do not begin surface preparation or application until unacceptable conditions are corrected.

3.2 SURFACE PREPARATION

- A. Protection of In-Place Conditions: Protect adjacent surfaces and landscaping from contact with concrete tennis court surface color coating system.

- B. Prepare surfaces in accordance with manufacturer's instructions.

- C. New Concrete:
 - 1. Cure new concrete surfaces a minimum of 28 days before application of concrete tennis court cushioned surface color coating system.
 - 2. Provide medium broom finish or similar roughened texture.
 - 3. Do not steel trowel finish.
 - 4. Acid etch with phosphoric or muriatic acid and rinse thoroughly prior to application of cushioned color coating system.

- D. Existing Concrete:
 - 1. Sandblast, shotblast, or scarify smooth concrete surfaces to roughened texture similar to medium broom finish. If shot blasting, a shot blast profile of CSP3 or CSP4 is recommended.
 - 2. If existing concrete is uncoated, acid etch with phosphoric or muriatic acid and rinse thoroughly prior to application of color coating system
- E. Remove dirt, dust, debris, oil, grease, sealers, curing compounds, vegetation, loose coatings, loose materials, and other surface contaminants which could adversely affect application of concrete tennis court cushioned surface color coating system. Pressure wash entire surface.
- F. Repair cracks, depressions, and surface defects in accordance with manufacturer's instructions before application of color coating.
- G. Repair spalled areas and level depressions 1/8 inch and deeper with patch binder in accordance with manufacturer's instructions.
- H. Apply 1 coat of adhesion promoter over entire concrete surface in accordance with manufacturer's instructions.
- I. Ensure surface repairs are flush and smooth to adjoining surfaces.

3.3 APPLICATION

- A. Apply concrete tennis court cushioned surface color coating system in accordance with manufacturer's instructions at locations indicated on the Drawings.
- B. Mix materials in accordance with manufacturer's instructions.
- C. Apply Filler Course, Cushion Layers, and Color Coating with a 50-60 durometer, soft rubber squeegee.
- D. Filler Course: Apply 1 coat on new concrete or existing acrylic surfaces.
- E. Cushion Layers: Apply 5 coats of the base layer (coarse granule) cushion, followed by 2 coats of the finish layer (fine granule) cushion in accordance with the manufacturer's instructions.
- F. Color Coating: Apply a minimum of 2 coats of color coating to prepared surfaces in accordance with manufacturer's instructions.
- G. Allow material drying times in accordance with manufacturer's instructions before applying other materials or opening completed surface to foot traffic.

3.4 LINE MARKINGS

- A. Lay out tennis court line markings in accordance with USTA Rules of Tennis.
- B. Apply line markings primer, after masking tape has been laid, to seal voids between masking tape and tennis court surface to prevent bleed-under when line paint is applied.
- C. Apply a minimum of 1 coat of line paint in accordance with manufacturer's instructions.

3.5 PROTECTION

- A. Allow a minimum of 24 hours curing time before opening tennis courts for play.
- B. Protect applied concrete tennis court cushioned surface color coating system to ensure that, except for normal weathering, coating system will be without damage or deterioration at time of Substantial Completion.

END OF SECTION

SECTION 32 18 24

ATHLETIC FIELD SURFACING

PART 1 - GENERAL

1.01 SECTION INCLUDES:

- A. Natural Clay/Decomposed Granite, pervious construction.
- B. Softball sport surfaces, pervious construction.
- C. Equipment movement

1.02 Related Work Specified Elsewhere:

Concrete Formwork	Section 03 11 00
Athletic Field Equipment	Section 11 68 33.2
Landscape Planting	Section 32 93 00

1.03 Quality Assurance:

- A. The Contractor shall provide at least one person who shall be present at all times during execution of this portion of the work, who shall be thoroughly familiar with the type of materials being installed and the proper materials and methods conforming to U.S.T.C. & T.B.A.'s (U.S. Tennis Court & Track Builders) and (C.I.F.) standards for track construction.
- B. CAS/CAR – California Accessibility Statutes and California Accessibility Regulations.

1.04 Approvals:

- A. Surface and base material compaction shall be inspected by a certified Soils Engineer selected by the district. In the event the compacted base material or running track surface fails to meet the required compaction in accordance with these specifications, then the contractor shall make the necessary corrections the material at no additional cost to the district.

1.05 Submittal:

- A. Request for substitutions from the specifications for any material specified or noted within the construction documents shall be submitted to the architect and/or district, in writing, with in seven (7) days of bid date. Submit three samples of each material.
- B. Complete product data including material sample, application rates, mixing instructions shall be sent to the architect and/or district for review and recommended approval.
- C. Provide Product Data: Provide characteristics of surfacing system, description of materials, thickness.
- D. Baseball / Softball Surface:
 - 1. Shop drawing indicating race marker layout, temporary lane marking options and detail.
 - 2. Complete list of infields mix materials.
 - 3. Certification, signed by licensed civil engineer that field layout complies with specification, approved submittals, and referenced standards.

1.07 Material Handling:

A. Delivery and Storage:

- (1) Deliver surface material to job site and stockpile in designated area as approved by the district for review prior to placement.

1.08 Site Conditions:

- A. Weather - surfacing shall not be done when rain is imminent or gusty winds are occurring.

PART 2 - MATERIALS

All materials shall conform to the requirements of Section 212 of the Standard Specifications, except as modified herein.

2.01 Manufacturer/Supplier:

- A. Gail Materials, Corona CA
- B. Stabilizer Solutions Inc., Arizona
- C. TMT Enterprises, San Luis Obispo

2.02 Event Surface Materials:

A. Surface Course: Baseball/ Softball Field-Infield

1. Surface course of combined silt and clay content shall be 25% with the maximum not to exceed 30%, with the following gradation: 95% minimum particles passing through the 2.0 mm sieve. All remaining particles shall fall under the classifications of sand. The USDA soil classification shall be a sandy loam-sandy clay loam. Surface Material shall be **STABILIZER PRO GOLD INFIELD MIX** by Gail Materials or approved equal.
2. The color of the material shall be reddish gold.
3. Stabilizer as distributed by Stabilizer Solutions Inc. (800)-335-2468 shall be blended at a minimum rate of .3% by weight with the maximum rate not to exceed .4% by weight. All blending shall be done with a pug mill that includes a weight belt feeder in order to insure the proper ratio and the uniform blending of stabilizer.

B. Surface Course: Baseball/Softball Field Warning Track & Perimeter Non-Playing Areas

1. Surface course of combined silt and clay content shall be 25% with the maximum not to exceed 30%, with the following gradation: 95% minimum particles passing through the 2.0 mm sieve. All remaining particles shall fall under the classifications of sand. The USDA soil classification shall be a sandy loam-sandy clay loam. Surface Material shall be **STABILIZER PRO GOLD WARNING TRACK MIX** by Gail Materials or approved equal.
2. The color of the material shall be reddish gold.
3. Stabilizer as distributed by Stabilizer Solutions Inc. (800)-335-2468 shall be blended at a minimum rate of .3% by weight with the maximum rate not to exceed .4% by weight. All blending shall be done with a pug mill that includes a weight belt feeder in order to insure the proper ratio and the uniform blending of stabilizer.

C. Surface Course: Baseball/Softball Field Warning Track & Perimeter Non-Playing Areas

1. Surface course of combined silt and clay content shall be 25% with the maximum not to exceed 30%, with the following gradation: 95% minimum particles passing through the 2.0 mm sieve. All remaining particles shall fall under the classifications of sand. The USDA soil classification shall be a sandy loam-sandy clay loam. Surface Material shall be **HILLTOPPER POLYMER COATED SOIL MIX** by Gail Materials or approved equal.
2. The color of the material shall be reddish gold.
3. Stabilizer as distributed by Stabilizer Solutions Inc. (800)-335-2468 shall be blended at a minimum rate of .3% by weight with the maximum rate not to exceed .4% by weight. All blending shall be done with a pug mill that includes a weight belt feeder in order to insure the proper ratio and the uniform blending of stabilizer.

2.03 Equipment:

- A. Equipment shall be capable of excavating existing track surface and subsoil, mixing, and placing materials, wetting, consolidation, grading, and compaction of materials.

PART 3 - EXECUTION

3.01 Slope Requirement:

- A. All excavating, filling, compaction, grading and leveling work required in this section shall be performed so that the finishes surface slopes not more than one (1) foot in each one hundred (100) feet in a lateral direction from outside to inside and not more than one (1) foot in each one thousand (1000) feet in the running direction.
- B. Baseball/Softball Fields: Drainage as shown on Civil Engineers Drawings.

3.03 Base Construction:

- A. Base Course: Base Course of crushed stone or gravel shall be installed over compacted native subgrade.
- B. Exact thickness of base course shall meet local soil and climatic conditions but in no case shall it be less than six (6) inches after compaction by rolling. Surface of base course as compacted shall be smooth and even and not more that 3/8 –inch above or below base elevation as noted on drawings.

3.04 Surface Course- Baseball / Softball Field:

- A. Install Surface Course over excavated compacted native material, compacted thickness of six (6)-inches meeting the following requirements: Finish surface shall not vary from specified finished grade more than one-eighth (1/8) –inch in ten (10) feet measured in any direction.
- B. For each two (2) inch lift evenly spread the material over entire area. Thoroughly water entire area so that entire depth of material is moist. After the final lift, roll entire area with approximately 1000 – 3000 lbs. Of weight. Allow for the material to dry and spike drag the area to obtain desired finish. It should be noted that for a level surface it is recommended to grade the area with a laser or equal.

3.08 Clean Up:

- A. For the duration of work in this section, debris shall be removed as it accumulates. Accumulation of debris will not be permitted. Removal of debris shall be at the contractor's expense and shall be removed off-site in a legal manner.

END OF SECTION

SECTION 32 31 00

WIREWORKS PLUS FENCE/GATE SYSTEM

PART 1 - GENERAL

1.01 WORK INCLUDED

A. The contractor shall provide all labor, materials and appurtenances necessary for installation of the commercial welded wire architectural fence/gate system and a steel roll gate system defined herein at Del Sol High School.

1.02 RELATED WORK

Section 31 20 00 - Earthwork

Section 03 30 00 - Concrete

1.03 SYSTEM DESCRIPTION

A. The manufacturer shall supply a total commercial welded wire architectural fence system of the Ameristar® WireWorks Plus® design. The system shall include all components (i.e., panels, brackets, posts, gates and hardware) required.

B. The manufacturer shall supply a total roll gate system of Ameristar® PassPort® Commercial with WireWorks Plus® welded wire panel design. The system shall include all components (i.e., rails, gate uprights, wheels and hardware) required.

1.04 QUALITY ASSURANCE

The contractor shall provide laborers and supervisors who are thoroughly familiar with the type of construction involved and materials and techniques specified.

1.05 REFERENCES

- ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy Coated (Galvannealed) by the Hot-Dip Process.
- ASTM B117 - Practice for Operating Salt-Spray (Fog) Apparatus.
- ASTM D523 - Test Method for Specular Gloss.
- ASTM D714 - Test Method for Evaluating Degree of Blistering in Paint.
- ASTM D822 - Practice for Conducting Tests on Paint and Related Coatings and Materials using Filtered Open-Flame Carbon-Arc Light and Water Exposure Apparatus.
- ASTM D1654 - Test Method for Evaluation of Painted or Coated Specimens Subjected to Corrosive Environments.
- ASTM D2244 - Test Method for Calculation of Color Differences from Instrumentally Measured Color Coordinates.
- ASTM D2794 - Test Method for Resistance of Organic Coatings to the Effects of Rapid Deformation (Impact).
- ASTM D3359 - Test Method for Measuring Adhesion by Tape Test.
- ASTM F2453/F 2453M – Standard Specification for Welded Wire Mesh Fence Fabric

1.06 SUBMITTAL

The manufacturer's submittal package shall be provided prior to installation.

1.07 PRODUCT HANDLING AND STORAGE

Upon receipt at the job site, all materials shall be checked to ensure that no damages occurred during shipping or handling. Materials shall be stored in such a manner to ensure proper ventilation and drainage, and to protect against damage, weather, vandalism and theft.

PART 2 - MATERIALS

2.01 MANUFACTURER

A. The fence system shall conform to Ameristar WireWorks Plus design by Ameristar Fence Products, Inc. in Tulsa, Oklahoma.

B. The steel roll gate system shall conform to Ameristar PassPort Commercial Ornamental design series, with WireWorks Plus® welded wire panel infill configuration manufactured by Ameristar Fence Products, Inc. in Tulsa, Oklahoma.

C. Substitutions: Under provisions of Section 01 25 13.

2.02 MATERIAL

A. Fence/Gate System

1. Steel material for fence posts shall be galvanized prior to forming in accordance with the requirements of ASTM A653/A653M, with minimum yield strength of 45,000 psi (310 MPa). The steel shall be hot-dip galvanized to meet the requirements of ASTM A653/A653M with a minimum zinc coating weight of 0.60 oz/ft², Coating Designation G-60. Fence posts and gate posts shall meet the minimum size requirements of Table 1.
2. Steel wire mesh fence panels shall be welded by resistance welding per ASTM A185 using 6 gauge (0.192 inch) pre-galvanized steel wire, welded at each crossing to form rectangles. Vertical 6ga. (0.192) wires shall be spaced at 2 inches; horizontal 6ga. (0.192) wires shall be spaced at 6 inches. The cold rolled wire shall have a tensile strength of at least 70,000 PSI and 74,000 PSI weld shear strength. Wire strand shall be galvanized before welded (GBW), .050 ounces per square foot zinc coating conforming to the ASTM A641.

B. Roll Gate System

1. Steel material for roll gate components (i.e. pickets, rails, diagonals and uprights), shall be commercial steel with a minimum yield strength of 45,000 psi (344 MPa).
2. Steel wire mesh gate infill panels shall be welded by resistance welding per ASTM A185 using 6 gauge (0.192 inch) pre-galvanized steel wire, welded at each crossing to form rectangles. Vertical 6ga. (0.192) wires shall be spaced at 2 inches; horizontal 6ga. (0.192) wires shall be spaced at 6 inches. The cold rolled wire shall have a tensile strength of at least 70,000 PSI and 74,000 PSI weld shear strength. Wire strand shall be galvanized before welded (GBW), .050 ounces per square foot zinc coating conforming to the ASTM A641. Material for top rails, uprights and diagonals rails shall be 2" square x 12 Ga. Material for the bottom rail shall be 2" x 4" x 11 Ga. Posts shall be a minimum of 4" square x 11 Ga

2.03 FABRICATION

A. Fence/Gate System

1. Panels and posts shall be pre-cut to specified lengths. Panels shall have a number of structural folds based on the specified panel height as follows:
 1. 96" height x 96" width panel – 4 horizontal panel folds
2. The manufactured panels and posts shall be subjected to an inline electro-deposition coating (E-Coat) process consisting of a multi-stage pretreatment/wash (with zinc phosphate), followed by a duplex application of an epoxy primer and an acrylic topcoat. The minimum cumulative coating thickness of epoxy and acrylic shall be 2 mils (0.058 mm). The color shall be Black. The coated panels and posts shall be capable of meeting the performance requirements for each quality characteristic shown in Table 2.
3. Swing gates shall be fabricated using 2" x 12ga square rails and gate ends. Gates that exceed 6' in width will have a 2" sq. x 12ga. intermediate upright. All rail, upright, and gate end intersections shall be joined by welding. Steel gussets (1/4" x 2") shall be welded at each rail to gate end intersection and rail to intermediate intersections (4 gussets per gate bay). Gusset shall be punched to accept gate trussing cable and turnbuckle.

B. Roll Gate System

1. Rails, uprights and posts shall be pre-cut to specified lengths. Diagonals shall be pre-cut to specified lengths and angles. Frame materials shall be joined by welding. Welded wire mesh infill panels shall be face welded to roll gate frame.
2. The manufactured roll gates and bolt-on panels (if applicable) shall be subjected to the PermaCoat® thermal stratification coating process (high-temperature, in-line, multi-stage, multi-layer) including, as a minimum, a six-stage pre-treatment/wash (with zinc phosphate), an electrostatic spray application of an epoxy base, and a separate electrostatic spray application of a polyester finish. The base coat shall be a thermosetting epoxy powder coating (gray in color) with a minimum thickness of 2 mils (0.0508mm). The topcoat shall be a "no-mar" TGIC polyester powder coat finish with a minimum thickness of 2 mils (0.0508mm). The color shall be Black. The stratification-coated framework shall be capable of meeting the performance requirements for each quality characteristic shown in Table 2.
3. Completed gates shall be capable of supporting a 200 lb. load applied at midspan without permanent deformation.

PART 3 - EXECUTION

3.01 PREPARATION

All new installation shall be laid out by the contractor in accordance with the construction plans.

3.02 FENCE INSTALLATION

A. Fence post shall be spaced according to Table 3, plus or minus 1/4". Fence panels shall be attached to posts with brackets supplied by the manufacturer. Posts shall be set in concrete footers having a minimum depth of 36" (Note: In some cases, local restrictions of freezing weather conditions may require a greater depth). The "Earthwork" and "Concrete" sections of this specification shall govern material requirements for the concrete footer. Posts setting by other methods such as plated posts or grouted core-drilled footers are permissible only if shown by engineering analysis to be sufficient in strength for the intended application. Typical wind load data in Table 4 is to be used as a guideline. Table 4 is not to be used for specific application without engineering evaluation.

B. Gateposts shall be set in accordance with the spacing's shown in the construction plans. The "Earthwork" and "Concrete" sections of this specification shall govern post base material requirements. 6" wheels shall be bolted to the gate (between the wheel plates welded near the ends of the gate bottom rail). The gate shall be set upright with the V-grooved wheels positioned over the pre-installed steel V-track that traverses the gate opening. Roller guides shall be affixed to the gateposts at a height even with the gate top rail to hold the gate in a vertical position. Gate stops shall be welded to the end of the gate or track so gate cannot pass rollers in either direction.

3.03 FENCE INSTALLATION MAINTENANCE

When cutting/drilling rails or posts adhere to the following steps to seal the exposed steel surfaces; 1) Remove all metal shavings from cut area. 2) Apply zinc-rich primer to thoroughly cover cut edge and/or drilled hole; let dry. 3) Apply 2 coats of custom finish paint matching fence color. Failure to seal exposed surfaces per steps 1-3 above will negate warranty. Ameristar spray cans or paint pens shall be used to prime and finish exposed surfaces; it is recommended that paint pens be used to prevent overspray. Use of non-Ameristar parts or components will negate the manufactures' warranty.

3.04 GATE INSTALLATION

Gate posts shall be spaced according to the manufacturers' gate drawings, dependent on standard out-to-out gate leaf dimensions and gate hardware selected. Type and quantity of gate hinges shall be based on the application; weight, height, and number of gate cycles. The manufacturers' gate drawings shall identify the necessary gate hardware required for the application. Gate hardware shall be provided by the manufacture of the gate and shall be installed per manufacturer's recommendations.

3.05 ROLL GATE INSTALLATION

Gateposts shall be set in accordance with the spacing's shown in the construction plans. The "Earthwork" and "Concrete" sections of this specification shall govern post base material requirements. 6" wheels shall be bolted to the gate (between the wheel plates welded near the ends of the gate bottom rail). The gate shall be set upright with the V-grooved wheels positioned over the pre-installed steel V-track that traverses the gate opening. Roller guides shall be affixed to the gateposts at a height even with the gate top rail to hold the gate in a vertical position. Gate stops shall be welded to the end of the gate or track so gate cannot pass rollers in either direction.

3.06 CLEANING

The contractor shall clean the jobsite of excess materials; post-hole excavations shall be scattered uniformly away from posts.

Table 1 – Minimum Sizes for WireWorks Plus Posts		
Fence Posts	Panel Height	
2" Sq. x 16 Ga.	Up to 6' Height	
2.5" Sq. x 16 Ga.	8' Height	
Gate Leaf	Gate Height	
	Up to & Including 6'	Over 6' Up to & Including 8'
Up to 4'	2-1/2" x 12Ga.	3" x 12 Ga.
4'1" to 6'	3" x 12Ga.	3" x 12 Ga.
6'1" to 10'	4" x 11 Ga.	6" x 3/16"
10'1" to 16'	6" x 3/16"	6" x 3/16"

Table 2 – Coating Performance Requirements		
Quality Characteristics	ASTM Test Method	Performance Requirements
Adhesion	D3359 – Method B	Adhesion (Retention of Coating) over 90% of test area (Tape and knife test).
Corrosion Resistance	B117, D714 & D1654	Corrosion Resistance over 1,000 hours (Scribed per D1654; failure mode is accumulation of 1/8" coating loss from scribe or medium #8 blisters).
Impact Resistance	D2794	Impact Resistance over 60 inch lb. (Forward impact using 0.625" ball).
Weathering Resistance	D822 D2244, D523 (60° Method)	Weathering Resistance over 1,000 hours (Failure mode is 60% loss of gloss or color variance of more than 3 delta-E color units).

Table 3 – WireWorks Plus – Post Spacing		
Span	WireWorks Plus	
Post Size	2"	2-1/2"
Post Settings ± 1/4" O.C.	96-1/2"	96-1/2"

SECTION 32 31 13

CHAIN LINK FENCES AND GATES

1. PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Fence framework, fabric, and accessories.
- B. Privacy slats.
- C. Excavation for post bases.
- D. Concrete anchorage for posts and center drop for gates.
- E. Manual gates and related hardware.

1.2 REFERENCES

- A. ASTM A90 - Standards Test Method for Weight of Coating on Zinc-Coated (Galvanized) Iron or Steel Articles.
- B. ASTM A392 - Zinc-Coated Steel Chain Link Fence Fabric.
- C. ASTM A428 - Weight of Coating on Aluminum-coated Iron or Steel Articles.
- D. ASTM A491 - Aluminum-Coated Steel Chain Link Fence Fabric.
- E. ASTM F567 - Installation of Chain-Link Fence.
- F. ASTM A653 – Steel Sheet, Zinc Coated (Galvanized) or Zinc-Iron Alloy Coated (Galvannealed) by the Hot-Dip Process.
- G. ASTM F668 - Poly (Vinyl Chloride) (PVC) Coated Steel Chain Link Fence Fabric.
- H. ASTM F900 - Industrial and Commercial Swing Gates.
- I. ASTM A924 – General Requirements for Steel Sheet, Zinc-Coated (Galvanized) by the Hot-Dip Process.
- J. ASTM F 1043 - Standard Specification for Strength and Protective Coatings on Metal Industrial Chain Link Fence Framework.
- K. ASTM F1083 - Pipe, Steel, Hot-dipped Zinc-coated (Galvanized) Welded for Fence Structures.
- L. ASTM F1184 - Industrial and Commercial Horizontal Slide Gates.
- M. ASTM F1043 - Strength and Protective Coatings on Metal Industrial Chainlink Fence Framework.
- N. CBC - California Building Code, (CCR) California Code of Regulations, Title 24, Part 2, California State Accessibility and Egress Standards.

1.3 QUALITY ASSURANCE

- A. Manufacturer: Company specializing in commercial quality chain link fencing with five years documented experience.
- B. Installation: ASTM F567.

1.4 REGULATORY REQUIREMENTS

- A. Conform to disabled person access and emergency egress requirements of the CBC California Building Code, (CCR) California Code of Regulations, Title 24, Part 2.

1.5 SUBMITTALS

- A. Submit shop drawings and product data under provisions of Section 01 33 00.
- B. Include plan layout, grid, spacing of components, accessories, fittings, hardware, anchorages, and schedule of components.
- C. Submit manufacturer's installation instructions under provisions of Section 01 33 00.
- D. Submit samples under provisions of Section 01 33 00.
- E. Submit two samples 12 x 12 inches in size, illustrating fence fabric finish.
- F. Submit project record documents under provisions of Section 01 77 00.
- G. Accurately record actual locations of property perimeter posts relative to property lines and easements.

2. PART 2 PRODUCTS

2.1 MATERIALS

- A. Framework: ASTM F1083; Schedule 40 steel pipe, standard weight, one piece without joints, finish same as fabric.
- B. Acceptable Equivalent: ASTM F1043; Group 1A pipe with minimum yield strength of 30,000 pounds per square inch; SS40 as manufactured by Allied Tube and Conduit Fence Division, www.atcfence.com.
- C. Fabric: ASTM A392, Class 1, zinc coated wire fabric.

2.2 CONCRETE MIX

- A. Concrete: As specified in Section 32 13 13.

2.3 COMPONENTS

- A. Line Posts: 2 inch NPS steel pipe.
- B. Corner and Terminal Posts: 3 inch NPS steel pipe.
- C. Gate Posts: 3 inch NPS steel pipe.
- D. Top and Brace Rail: 1-1/4 inch NPS, plain end, sleeve coupled steel pipe.
- E. Fabric: 2 inch diamond mesh steel wire, interwoven, 9 gage thick, top and bottom selvage knuckle end closed.
- F. Caps: Cast steel or malleable iron, galvanized; sized to post dimension, set screw retained.
- G. Fittings: Sleeves, bands, clips, rail ends, tension bars, fasteners and fittings: Steel.
- H. Tension Wire: 7 gage thick steel, single strand.

- I. Swinging Gates: Constructed of tubular members welded at all corners in conformance with ASTM F900 and the following:
 - 1. Gate Posts: 3 inch NPS steel pipe for gates up to 6 foot for a single gate or a single leaf of a double gate. 4 inch NPS steel pipe for gates over 6 foot in width.
 - 2. Gate Frames: 1-1/4 inch NPS steel pipe, for welded fabrication with vertical intermediate brace at maximum 6 foot spacing and horizontal brace on all gates.
 - 3. Gate Fabric: To match adjacent fencing.
 - 4. Gate Hardware: Fork type latch with gravity drop and provision for padlock; center gate stop and drop rod; three 180 degree gate hinges per leaf.
 - 5. Accessible Gate Hardware: As specified in Section 08 71 00.
- J. Sliding Gates: ASTM F1184, Type II cantilever slide, Class 1 external rollers conforming to the following:
 - 1. Gate and Guide Posts: 3 inch NPS steel pipe for gates up to 12 feet in width. 4 inch NPS steel pipe for gates over 12 feet in width.
 - 2. Gate Frames: 2 inch NPS steel pipe for welded fabrication; 1-1/4 inch horizontal brace on all gates with vertical intermediate brace at maximum 6 foot spacing.
 - 3. Gate Fabric: To match adjacent fencing.
 - 4. Roller Assembly: ASTM F1184, Class 1 external roller assembly.
 - 5. Gate Hardware: Latches, stops and accessories of galvanized steel with provision for padlock.

2.4 PRIVACY SLATS

- A. Material: Polyethylene tubular slats, not less than 0.023 inch thick, manufactured from virgin polyethylene containing UV inhibitor, sized to fit mesh specified for direction indicated; with bottom lock strips.
- B. Color: As selected by Architect from manufacturer's full range.

2.5 FINISHES

- A. Galvanized: ASTM F1043; 1.8 oz/sq ft coating for schedule 40 pipe. ASTM A90; 1.0 oz/sq ft coating for Class 1A pipe.
- B. Accessories: Same finish as framing.

3. PART 3 EXECUTION

3.1 INSTALLATION

- A. Install framework, fabric, accessories and gates in accordance with ASTM F567.
- B. Provide fence of height indicated.
- C. Space line posts at intervals not exceeding 10 feet.
- D. Set terminal, gate and corner posts plumb, in 12 inch diameter concrete footings with top of footing 6 inches below finish grade. Slope top of concrete for water runoff. Footing depth below finish grade: 42 inches for gate and corner posts, 36 inches for line posts.
- E. Provide top rail through line post tops and splice with 7 inch long rail sleeves.

- F. Brace each gate and corner post back to adjacent line post with horizontal center brace rail and diagonal truss rods. Install brace rail, one bay from end and gate posts.
- G. Install center and bottom brace rail on corner and gate leaves.
- H. Stretch fabric between terminal posts or at intervals of 100 feet maximum whichever is less.
- I. Do not stretch fabric until concrete has cured 28 days.
- J. Position bottom of fabric 2 inches above finished grade.
- K. Fasten fabric to top rail, line posts, braces, and bottom tension wire with wire ties maximum 15 inches on centers.
- L. Attach fabric to end, corner, and gate posts with tension bars and tension bar clips.
- M. Install bottom tension wire stretched taut between terminal posts.
- N. Install gates with fabric to match fence. Install three hinges per leaf, latch, catches, drop bolt.
- O. Provide concrete center drop to foundation depth and drop rod retainers at center of double gate openings and at gate in 90 degree open position at all non-panic hardware gates.
- P. Install privacy slats in diagonal direction. Securely lock bottom in place.
- Q. Ground fencing that encloses electrical power distribution equipment as required by National Electric Safety Code, Article IEEE C2.
- R. Install accessible gate hardware in accordance with Section 08 71 00.
- S. Install 10 inch high smooth metal kickplate on each side of accessible gate. Mount 2 inches above finished grade.

3.2 ERECTION TOLERANCES

- A. Maximum Variation from Plumb: 1/4 inch.
- B. Maximum Offset from True Position: 1 inch.
- C. Components shall not infringe adjacent property lines.

END OF SECTION

SECTION 32 31 19

DECORATIVE METAL FENCES AND GATES

1. PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Decorative metal fencing.
- B. Gates.
- C. Hardware.

1.2 REFERENCES

- A. The 2010 Americans with Disabilities Act (ADA) Standards for Accessible Design.
- B. CBC - California Building Code, (CCR) California Code of Regulations, Title 24, Part 2, California State Accessibility Standards.
- C. ASTM A653 - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy Coated (Galvannealed) by the Hot-Dip Process.
- D. ASTM B117 - Practice for Operating Salt-Spray (Fog) Apparatus.
- E. ASTM D523 - Test Method for Specular Gloss.
- F. ASTM D714 - Test Method for Evaluating Degree of Blistering in Paint.
- G. ASTM D822 - Practice for Conducting Tests on Paint and Related Coatings and Materials using Filtered Open-Flame Carbon-Arc Light and Water Exposure Apparatus.
- H. ASTM D924 - General Requirements for Steel Sheet, Metallic-Coated by the Hot-Dipped Process.
- I. ASTM D1654 - Test Method for Evaluation of Painted or Coated Specimens Subjected to Corrosive Environments.
- J. ASTM D2244 - Test Method for Calculation of Color Differences from Instrumentally Measured Color Coordinates.
- K. ASTM D2794 - Test Method for Resistance of Organic Coatings to the Effects of Rapid Deformation (Impact).
- L. ASTM D3359 - Test Method for Measuring Adhesion by Tape Test.
- M. ASTM F2408 - Ornamental Fences Employing Galvanized Steel Tubular Pickets.

1.3 SYSTEM DESCRIPTION

- A. Basis of Design: Ameristar Montage II® Welded and Rackable Ornamental Steel Genesis™ design. The system shall include all components to include panels, posts, gates and hardware required.

1.4 SUBMITTALS

- A. Submit shop drawings under provisions of Section 01 33 00.
- B. Submit shop drawings indicating fencing components, attachments and hardware installation.
- C. Submit product data under provisions of Section 01 33 00.
- D. Submit product data for each type of fencing specified.
- E. Submit samples under provisions of Section 01 33 00.
- F. Submit two samples illustrating fencing finish.
- G. Submit manufacturer's certificate under provisions of Section 01 33 00 that products meet or exceed specified requirements.
- H. Submit manufacturer's installation instructions under provisions of Section 01 33 00.

1.5 QUALITY ASSURANCE

- A. Quality Assurance: Under provisions of Section 01 40 10.
- B. Perform work in accordance with manufacturer's printed instructions.
- C. Maintain one copy of document on site.

1.6 QUALIFICATIONS

- A. Manufacturer: Company specializing in the manufacture of products specified in this Section with minimum ten years documented experience.
- B. Installer: Company specializing in applying the work of this Section with minimum five years documented experience.

1.7 REGULATORY REQUIREMENT

- A. Conform to CBC - California Building Code, (CCR) California Code of Regulations, Title 24, Part 2.
- B. Conform to CBC - California Building Code, (CCR) California Code of Regulations, Title 24, Part 2, and the 2010 ADA Standards for Accessible Design for accessibility requirements.

1.8 DELIVERY, STORAGE, AND HANDLING

- A. Deliver, store and protect products to site under provisions of Section 01 61 00.
- B. Store and protect products under provisions of Section 01 61 00.
- C. Protect fencing materials from damage.

1.9 SEQUENCING AND SCHEDULING

- A. Schedule work under provisions of Section 01 32 16.
- B. Coordinate work under provisions of Section 01 31 00.

1.10 WARRANTY

- A. All rails, pickets, and posts shall be warranted by the manufacturer for a period of 20 years from date of Substantial Completion. Warranty shall cover any defects in material finish, including cracking, peeling, chipping, blistering or corroding.
- B. Reimbursement for labor necessary to restore or replace components that have been found to be defective under the terms of manufacturer's warranty shall be guaranteed for 5 years from date of Substantial Completion.

2. PART 2 PRODUCTS

2.1 MANUFACTURERS

- A. Basis of Design: Montage II® Welded and Rackable Ornamental Steel, Genesis™ design, 3-Rail style, extended picket, industrial swivel brackets, 8'-0" in height, manufactured by Ameristar Fence Products, Inc., www.ameristarfence.com.
- B. Other acceptable manufacturers:
 - 1. Beta Fence USA, www.betafenceusa.com.
 - 2. Master Halco, www.masterhalco.com.
- C. Substitutions: Under provisions of Section 01 25 13.

2.2 MATERIALS

- A. Steel Material for Fence Pickets, Rails and Posts: Galvanized prior to forming. Conform to requirements of ASTM A924, with a minimum yield strength of 45,000 psi. Hot-dip galvanized to meet requirements of ASTM A653 with a minimum zinc coating weight of 0.60 oz/ft², Coating Designation G-60.
- B. Fence pickets: 1 inch square x 14 Ga. tubing.
- C. Rails Steel channel, 1.75 x 1.75 x .105 inch. Picket holes in rail shall be spaced 4.715 inch o.c.
- D. Fence Posts: 3 inch x 12 gauge.
- E. Gate posts: Minimum size requirements below for gate width listed:
 - 1. 3'-0" to 8'-0": 6 inch x 3/16 inch thick
 - 2. 8'-1" to 14'-0": 6 inch x 3/16 inch thick
 - 3. 14'-1" to 16'-0": 6 inch x 3/16 inch thick

2.3 FABRICATION - FENCING

- A. Pickets, rails and posts shall be pre-cut to specified lengths. Rails shall be pre-punched to accept pickets.

- B. Pickets shall be inserted into pre-punched holes in rails and aligned to standard spacing using a calibrated alignment fixture. The aligned pickets and rails shall be joined at each picket-to-rail intersection by fusion welding.
- C. Fence system shall be capable of meeting the vertical load, horizontal load, and infill performance requirements for Industrial weight fences under ASTM F2408.

2.4 FABRICATION - SWINGING GATES

- A. Swinging gate system shall conform to Exodus design series as manufactured by Ameristar Fence Product, Inc. www.ameristarfence.com.

2.5 FABRICATION - ROLLING GATES

- A. Rolling gate system shall conform to Pass Port Commercial design series, manufactured by Ameristar Fence Products, Inc. www.ameristarfence.com.
- B. Design series to match adjacent fence design.
- C. Ornamental Pickets: 1 inch sq. x 14 ga. spaced at 4-5/8 inch on center.
- D. Top Rails, Uprights and Diagonals: 2 inch sq. x 12 ga.
- E. Bottom Rail: 2 inch x 4 inch x 11 ga.
- F. Posts: 4 inch sq. x 11 ga.
- G. Gate Accessories: Roller guides, V-grooved wheels, V-track and gate stops as required by manufactured system.
- H. Assembled gate to withstand a 200 lb. load applied at mid span of gate without permanent deformation.
- I. Gate height shall match adjacent fence height.

2.6 FACTORY FINISHING

- A. Panels and posts shall be subjected to an inline electro deposition coating (E-Coat) process consisting of a multi-stage pretreatment/wash with zinc phosphate, followed by a duplex application of an epoxy primer and an acrylic topcoat. The minimum cumulative coating thickness of epoxy and acrylic shall be 2 mils. The color shall be Black.
- B. The coated panels and posts shall be capable of meeting the performance requirements for each quality characteristic shown below:
 - 1. Adhesion - ASTM D3359- Method D: Adhesion over 90 percent of test area.
 - 2. Corrosion Resistance - ASTM B117, D714 & D1654: Resistance of over 1,500 hours.
 - 3. Impact Resistance - ASTM D2794: Impact resistance of over 60 inch lbs.
 - 4. Weathering Resistance - ASTM D822, D2244, & D523 (60 degree method): Weather Resistance of over 1,000 hours with color variance of no more than 3 delta - E color units.

2.7 GATE HARDWARE

- A. Swinging Gate Hardware: Fork type latch with gravity drop and provisions for padlock; center gate stop and drop rod for vehicular gates. Three 180 degree heavy duty gate hinges per leaf. Mammoth 180 Hinge / Closer as manufactured by Locinox, www.locinox.com.
- B. Rolling Gate Hardware: Manufacturer's standard rolling gate latch capable of padlock attachment.
- C. Accessible gate hardware:
 - 1. Cylinder lock keyed both sides: Schlage Commercial Latch No. L9066 x 06N, www.schlage.com.
 - 2. Panic bar exit device: Von Duprin AX-PA-99L x 996L-03 626, www.vonduprin.com.
 - 3. I/C Rim Cylinder 20-057-ICX 626 Schlage.
 - 4. I/C Core Cylinder 23-030 626 Schlage.
 - 5. Kickplate: Commercial quality cold rolled steel conforming to ASTM A653 galvanized to G60 coating class according to ASTM A924 with minimized spangle, 0.067 inch thick, with all edges hemmed. Finish to match fencing.
 - 6. Security Screen: 1 / 8 inch thick galvanized steel screen. 3 / 16 inch round holes on 1/4 inch centers, staggered. 51 percent open area. Finish to match fencing.
 - 7. Closer: LCN 4040XPSRI parallel arm closer.
 - 8. Mullion: Sargent L980A removable lockable mullion.

2.8 CONCRETE MIX DESIGN

- A. Concrete: As specified in Section 32 13 13.

3. PART 3 EXECUTION

3.1 EXAMINATION

- A. Verify that locations for fencing are ready to receive work.
- B. Verify field measurements are as shown on shop drawings.
- C. Verify that required utilities are available, in proper locations, and ready for use.
- D. Beginning of installation means installer accepts existing conditions.

3.2 FENCE INSTALLATION

- A. Erect in accordance with manufacturer's instructions.
- B. Space fence posts at a maximum spacing of 8'-0" o.c.
- C. Anchor posts and panels to walls where required using mechanical fasteners and brackets provided by manufacturer.

- D. Anchor panels to posts with brackets provided by manufacturer.
- E. Install posts in concrete footings as follows:
 - 1. Line Posts: 12 inch diameter x 3'-6" depth.
 - 2. Corner Post: 1'-6" diameter x 4'-6" depth.
 - 3. Gate Posts: 1'-6" diameter x 4'-6" depth.
 - 4. Finish top of footing smooth with adjacent grade. Slope top to drain.
- F. When installing fencing adhere to the following steps to seal cut or drilled steel surfaces:
 - 1. Remove all metal shavings from cut area.
 - 2. Apply zinc-rich primer to cut or drilled area.
 - 3. Apply 2 coats of custom finish paint matching fence color.
 - 4. Primer and touch up paint to be provided by fence manufacturer.
- G. Install V-track for rolling gate in 6 x 12 inch concrete mow strip.

3.3 TOLERANCES

- A. Maximum Post Spacing Variation: ½ inch maximum.

3.4 ADJUSTING

- A. Adjust work under provisions of Section 01 77 00.
- B. Adjust gates for smooth operation with operating force off swinging pedestrian gates not to exceed 5 lbs pressure.

3.5 CLEANING

- A. Clean work under provisions of Section 01 77 00.
- B. Clean fencing and remove any excess materials from site.

END OF SECTION

SECTION 32 84 00

LANDSCAPE IRRIGATION SYSTEM

PART 1 - GENERAL

1.01 RELATED DOCUMENTS:

The work of this Section shall conform to the "GREENBOOK Standard Specifications for Public Works Construction," latest edition, Section 212, except as modified herein.

1.02 SCOPE OF WORK:

Work of this Section includes the furnishing, adjusting, installing and testing of mains, laterals, risers and fittings, quick couplers, shut-off valves, sprinklers and emission devices, excavation and backfill, and all other work in accordance with the plans and specifications for a complete operating system. All work shall be in accordance with applicable City and County codes, and these plans/specifications.

1.03 RELATED WORK DESCRIBED ELSEWHERE:

A. Planting: Section 32 93 00

1.04 STANDARDS:

Materials and workmanship shall conform to the requirements of all applicable regulations and codes, except that requirements specified herein shall govern where they are greater. Refer and comply with the provisions of the following codes, specifications and standards, except as otherwise shown or specified:

A. National Electrical Code.

B. Electrical Safety Orders of the State of California, Division of Industrial Safety.

1.05 QUALITY ASSURANCE:

A. Conform to the requirements of the reference information listed below except where more stringent requirements are shown or specified in the most current set of construction documents: –

1. American Society for Testing Material (ASTM), for test methods specifically referenced in this section.
2. Underwriter's Laboratories (UL), for UL wires and cables.
3. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction.
4. Comply with requirements of local Water Purveyor for preventing backflow and back siphonage.
5. Comply with ASTM F 645, "Guide for Selection, Design, and Installation of Thermoplastic Water Pressure Piping Systems."
6. Comply with NFPA 70, "National Electrical Code," for electrical connections between wiring and electrically operated devices.
7. Furnish plastic pipe and fittings permanently marked with size, class, and type of pipe, working pressure at 73.4 degrees F, and National Sanitation Foundation (NSF) rating.

B. The Contractor shall maintain, continuously, a competent superintendent or foreman, who shall be present at all times during execution of this portion of the work and who shall be thoroughly familiar with the type of materials being installed and the materials manufacturer's recommended methods of installation, and who shall direct all work performed under this Section. The superintendent shall be authorized to represent the Contractor.

C. Prior to commencement of work, contractor shall verify drawing dimensions with actual field conditions, and exact location of irrigation water meter - point of connection provided by others. Verify existing pressure at point of connection, coordinate location and installation of new main line. Immediately report to the Landscape Architect and/or District Representative all conditions, which prevent proper execution of this work.

- D. All assemblies specified herein shall be installed in accordance with the respective details. In the absence of detail Drawings or specifications pertaining to the specific items required to complete the work, the Contractor shall perform such work in accordance with the best standard practice and to the satisfaction of the Landscape Architect.
- E. Irrigation Contractor is responsible for replacing or repairing any acts of theft or vandalism during construction and the maintenance period.
- F. The Contractor shall obtain and pay for all permits and inspections required by outside agencies.
- G. Code Requirements shall be those of State and Municipal Codes and Regulations locally governing this work, providing that any requirements of the Drawings and Specifications, not conflicting therewith but exceeding the Code Requirements shall govern, unless written permission to the contrary is granted by the Architect.
- H. Due to the scale of Drawings, it is not possible to indicate all offsets, fittings, sleeves, etc., which may be required. Carefully investigate the structural and finished conditions affecting all of this work and plan this work, accordingly, furnishing such fittings, etc., as may be required to meet such conditions. Drawings are generally diagrammatic and indicative of the work to be installed. The work shall be installed in such a manner as to avoid conflicts between irrigation systems, planting and architectural features.
- I. Work noted as "NIC." (Not In Contract) is not part of this section.
- J. Permission to shut off any irrigation lines must be obtained from the District Representative. Disruption of existing systems and services shall be kept to a minimum. Water shall not be turned off for a period longer than 48 hours which supplies plant material to remain and be protected in place, or contractor shall hand water material at contractor's expense.

1.06 SUBMITTALS:

- A. Product Data: Within five (5) days after award of the Contract, and before any materials of this Section have been delivered to the job site, submit to the Landscape Architect:
 - (1) A complete materials list of all items proposed to be furnished and installed under this Section-6 including but not limited to supplier, and cut sheets, colored copies spiral bound unless otherwise noted. PDF's emailed to all parties shall be accepted with prior approval by construction management/design team.
 - (2) The manufacturer's recommended methods of installation which, when recommended for approval by the Landscape Architect, shall become the basis for review and accepting or rejecting actual installation methods used on the work when not otherwise specified or detailed.
- B. Materials and Samples: The Contractor shall, prior to the installation of any irrigation work, submit for recommended approval by the Landscape Architect, a list of materials and equipment he proposes to use. The material and equipment list shall include, but not be limited to, polyvinyl chloride pipe, control valves, irrigation heads, quick coupler valves, backflow preventers, and controllers.
 - (1) Should the Contractor propose to use materials or equipment other than those listed on the plans, he shall submit samples of the make and type proposed. Samples shall be submitted a sufficient time in advance of the start of construction to allow a period of not less than seven (7) days for testing and recommended approval. Substitution of any product, material, or equipment without prior, written, recommended approval will not be permitted.
- C. Manufacturer's warranties: Shall not relieve the Contractor of his liability under the guarantee. Such warranties shall only supplement the guarantee.

1.07 PRODUCT HANDLING:

- A. Protection: Use all means necessary to protect the materials of this Section before, during, and after installation and to protect the work and materials of all other trades.
- B. Delivery: Polyvinyl chloride pipe shall be delivered to the work site in unbroken bundles or rolls packaged in such a manner as to provide adequate protection for the pipe ends, threaded or plain.
- C. Replacements: In the event of damage, immediately make all repairs and replacements necessary to the recommended approval of the Landscape Architect and at no additional cost to the District.

1.08 EQUIPMENT TO BE FURNISHED:

- A. Supply as a part of this contract the following:
 - (1) Two sets of wrenches for disassembling and adjusting of each type of head installed.
 - (2) One operating key shall be furnished for each five (or less) gate valves installed.
 - (3) Two quick coupler keys with matching swivels with globe valves.
 - (4) Two individually bound "Operating and Maintenance Manuals" detailing operation and maintenance requirements for irrigation systems. Include descriptions of all installed materials and systems in sufficient detail to permit maintenance personnel to understand, operate and maintain the equipment.
 - Provide the following in each manual:
 - a. Index sheet, stating Irrigation Contractor's name, address, telephone number and name of person to contact.
 - b. Duration of guarantee period, including all manufacturer's guarantees or warranties.
 - c. Equipment list providing the following for each item:
 - Manufacturer's name.
 - Make and model number.
 - Name and address of local manufacturer's representative
 - Spare parts list in detail.
 - Detailed operating and maintenance instructions for major equipment.
- B. The above-mentioned items shall be turned over to the District at the conclusion of the project, prior to final payment.
- C. In addition to the above-mentioned maintenance manuals, provide the District's maintenance personnel with instructions for major equipment and show evidence in writing to the Landscape Architect at the conclusion of the project that this service has been provided.
- D. Project Record Drawings: Provide separate and complete Project Record Drawings prepared in accordance with the provisions of Sub-section 3.14, following.

1.09 GUARANTEE:

The irrigation system shall be guaranteed for a period of one (1) year following formal issuance of substantial completion by District and Landscape Architect, in accordance with Sub-section 3.20, following.

PART 2 - MATERIALS

2.01 GENERAL:

All materials shall conform to Section 212 of the "Standard Specifications,"

2.02 PIPE:

Manufacture from virgin polyvinyl chloride compound in accord with ASTM 1785, 2241, 2672 or 3139.; hydrostatic design stress rating not less than 2,000 psi.

A. Pressure Supply Lines (Mainline):

1. Pressure Supply Line (Mainline) shall be determined as follows:
1" thru 1 1/2" shall be Schedule 40, solvent weld ASTM D1785 & D2665
2" to 3" shall be SDR13.5 (Class 315) solvent weld ASTM D22441
4" and larger shall be bell and gasketed pipe SDR21 (class 200) by JM Eagle model Ring-Tite Joint or approved equal. All fittings shall be Leemco self-restrained joint fittings.
2. All 2"-3" pressure supply lines shall have thrust blocks. All ends, corners, etc. on mainline which is 2"-3" pipe which would receive thrust from the mainline shall have a thrust block.

B. Non-pressure Lateral Lines:

1. Non-Pressure Lateral Lines: (downstream of electric remote-control valve) PVC Schedule 40, conforming to ASTM D1785-83.
2. Fittings: Standard weight, Schedule 40, injection molded PVC, complying with ASTM D1784 and D2466, cell classification 12454-B.
 - a. Threads- Injection molded type (where required).
 - b. Tees and Ells-side gated.
 - c. Threaded Nipples: ASTM D2464, Schedule 80 with molded threads.
 - d. Joint Cement and Primer: Type as recommended by manufacturer of pipe and fittings.

C. All pipe shall be continuously marked with: Manufacturers name, nominal size, PVC type, pressure rating, SDR, NSF seal, and date of extrusion.

D. Seamless copper water tube, ACT B88, Type "L", drawn temper per Irrigation Booster installation, Type "K" for all other applications.

E. Brass screwed pipe shall be red brass conforming to Federal Specification #WW-P-351.

F. All pressure supply lines under vehicular paving to be installed with a PVC Schedule 40 sleeve, the sleeve shall be a minimum of twice the irrigation line diameter and shall extend a minimum of twelve inches (12") beyond such pavement. All other Irrigation Lines Sleeve or Low Voltage Control Wire Sleeves shall be PVC Schedule 40 polyvinyl chloride.

G. Pipe manufactured more than two years before installation not permitted. All pipe shall have been protected for sun exposure during storage and installation.

H. Pipe which shows any sign that it has not been protected from exposure to sun at any time shall is not permitted.

2.03 FITTINGS:

A. Pressure Supply Line:

1. Fittings for Mainline pipe 1"-3" shall be Schedule 80 PVC Solvent Weld ASTM D 2464.
2. Fittings for Mainline Pipe size 4" and larger shall be ductile iron, slanted, deep bell, gasket style made in accordance with ASTM A-536, Grade 65-45-12 & AWWA C153. self-restrained fittings as manufactured shall be as manufactured by Leemco, Inc.

C. Reducer tees will be used in cases of pipe size reduction. Bushing will only be allowed in cases of reduction where such a reducer tee is not manufactured.

D. Rigid PVC Nipples: ASTM D1785, Schedule 80, Type 1, molded threads.

E. Schedule 40 PVC street ells.

- F. Brass: Red brass conforming to Federal Specification #WW-P-351. Schedule 40 threaded nipple stock, tees, ells, and unions.
- G. Copper - Wrought solder-joints.
- H. Cast Copper Flange Fittings conforming to ASTM B584/ANSI B16.18, max pressure rating: 300psi, Temp range-100 degree to 250 degree.
- I. Ductile Iron Flanged Fittings: ASTM A536-ANSI/AWWA C 110/A21.10, UL and FM requirements, pressure rating 250 psi rating for 1"-48" sizes and 150psi rating for 54" – 64"

2.04 FITTING CONNECTION:

- A. Solvent Cement: ASTM D2564 for PVC Pipe and fittings.
- B. Use heavy body cement for Sch 80 fittings. Follow ASTM procedures for all pipe welding and installation. Use Teflon Tape at all fittings.
- C. PVC Primer and Glue: Use in all cases as recommended by pipe and fittings manufacturer, including both pressure supply lines and non-pressure Lateral lines.
 - 1. IPS Weld -On P - 70 primer
 - 2. IPS Weld -On 2711 (gray) cement
- D. PVC to metal joints shall be made with PVC Schedule 80 threaded fittings into galvanize with female adapter to PVC pipe. The PVC fitting shall be hand tightened, plus one turn with strap wrench. Joint compound shall be IPS weld on Teflon pipe joint compound or equal.
- E. Metal-to-Metal joints: graphite and oil lubricant or Teflon paste on male threads only.

2.05 SLEEVES AND CONDUIT: For use under paving and hardscape as sleeves for irrigation pipe and conduit for control wire shall be PVC;

- 1 ½" and Smaller shall be Sch. 40
- 2" thru 4" shall be Class 315
- 6" and larger shall be Class 200

- A. Only standard lengths of pipe shall be used. Couple and weld only when length required is longer than a standard manufactured length.
- B. See details for specifications of installation and as outlined by pipe manufacturer.

2.06 GALVANIZED PIPE AND FITTINGS:

- A. All galvanized steel pipe shall be Schedule 40, threaded, coupled and hot-dip galvanized, and shall comply with ASTM A120 and A53.
- B. All fittings for galvanized steel pipe shall be 150 psi rated galvanized malleable iron, banded pattern.
- C. Pipe sizes indicated on the Drawings are nominal inside diameter unless otherwise noted.

2.07 COPPER PIPE AND FITTINGS:

- A. Pipe: Type K, hard tempered.
- B. Fittings: Wrought copper, solder joint type.
- C. Joints shall be soldered with silver solder, 45% silver, 15% copper, 16% zinc, 24% cadmium, solidus at 1125 Degrees F. and liquidus at 1145 Degrees F.

2.08 BRASS PIPE AND FITTINGS:

- A. Brass pipe shall be 85% red brass, American National Standard Institute (ANSI), Schedule 40 screwed pipe.
- B. Fitting shall be medium brass, screwed 125-pound class.

2.09 ISOLATION VALVES/ SHUT-OFF VALVES (GATE VALVES & BALL VALVES):

- A. Isolation Ball Valve for used prior to valve manifolds on mainline pipe 2" and smaller in size: Bronze, full port, threaded connection valve as manufactured by Nibco model T-585-70, or equal.
- B. Isolation Ball Valve for use on mainline pipe smaller than 2" in size, Bronze, full port, threaded connection valve as manufactured by Nibco model T-585-70, or equal.
- C. Isolation Gate Valve for use on mainline pipe 2" and 2-1/2" in size: Bronze, screw-in-bonnet, non-rising stem, cross handle, solid wedge, threaded connection valve as manufactured by Nibco model T-113-K, or equal.
- D. Isolation Gate Valve for use on mainline pipe 3" and larger: Iron bolted bonnet with 2" square operating nut, non-rising stem, resilient wedge type, soft seat, flanged end epoxy coated, bronze trimmed iron body as manufactured by Nibco model F-619-RW-SON flanged, or equal.

2.10 CONTROL WIRE:

- A. All control wire shall be of the Underwriter's Laboratory type UF (underground feeder), single conductor, solid copper, plastic insulated, 600 volt rated, for direct burial applications. Maximum conductor operating temperature, 60 degrees C. for both wet and dry locations. Wire composition is as follows:
 - 1) Conductor - the conductors shall be solid annealed uncoated copper meeting the applicable requirements of the latest revisions of ASTM B-3.
 - (2) Insulation - the insulation shall be colored plastic which meets the test requirements of I.P.C.E.A. (The Insulated Power Cable Engineer's Association) Pub. No. S-61-402, dated July 1961, Section 3.7 for 60 degrees C. polyvinyl chloride insulation. The insulation shall be flame retardant, resistant to fungus, resistant to corrosive fumes, suitable for wet locations and furnish some degree of inherent protections against mechanical abuse. Insulation thickness shall be 47 mils for AWG #14, #12 & #10, and 62 mils for AWG #8.
 - (3) Color Coding - The conductor insulation shall be color coded as follows:
 - a. All common ground wire shall be white.
 - b. All pilot (valve control) wire shall be black.
 - (4) Wire Connectors
 - a. 3m DBY/R Direct Burial Splice Kit, shall splice and effectively moisture seal two or more conductors. The electrical connector shall be a Scotchlok Y. The device shall be installed per manufacturer's instructions and all applicable codes. The device shall be UL Listed as a Wire Connector System for Use with Underground Conductors.
 - (5) Wire Connections for direct burial shall be "one stop" waterproof wire connectors.

2.11 WIRE SPLICES:

- A. Conductors shall be installed with no underground splices, unless absolutely necessary and unavoidable. Any and all underground splices that are required to be made, must be approved by the Architect, and shall be placed in a suitable type valve box for easy access.

- B. Wire splices on the two conductor cable communication wires shall be made with 3M DBY splice kit or approved equal.
- C. Wire splices on the multi-conductor cable communication wires shall be made with Preformed Super Serviseal with Polybee sealant (product #8006039).

2.12 AUTOMATIC CONTROL VALVES (ELECTRIC):

- A. All automatic control valves (electric) shall be globe or angle pattern, electrically controlled, hydraulically operated, single seat, normally closed.
- B. The valves shall be actuated by a normally closed solenoid valve operator using 24 volts, 60 cycle alternating current. The wires in the coil of the solenoid shall be embedded in an epoxy resin. The entire solenoid shall be enclosed in a water tight housing. Valves shall automatically close in event of electrical power failure.
- C. All automatic control valves shall have a flow control device for manually adjusting the amount of flow of water through the valve. The flow control device shall be adjusted so that the pressure at the nozzle of the sprinkler head farthest from the automatic control valve shall be that as specified in the irrigation legend per plan. The pressure at the sprinkler head shall be measured by means of a pilot pressure gauge while the sprinkler head is operating.
- D. Automatic control valves shall be as specified on the plans, Superior 950 Series or approved equal. Reference irrigation plan, detail and legend for size and appropriate model number.
- E. Tags: Christy's Standard Irrigation ID Tags.

2.13 VALVE BOXES

- A. Standard Remote-Control Valve Boxes. The valve box shall be durable plastic: The cover shall be branded with letters "RCV" and include valve number designation stenciled two inches (2") high on the outside of the cover with lid cover.
 - 1. Rainbird Series Model VB-STD: Black Body and Green Lid- Standard rectangular with bolt-down cover.
- B. Quick coupling valve boxes shall be round durable plastic: The cover shall be branded with the letters "QCV," two inches (2") high.
 - 1. Rainbird Series Model VB-10RND - 10" round with bolt-down cover.
- C. Drip Valves:
 - 1. Rainbird Series Model(s) VB-JMB-H –Black Body and Green Lid with locking hex bolt with Model VB-JMB-B: Black Body only. Use body in conjunction with Model VB-JMB-H. The cover shall be branded with the letters "DV," two inches (2") high and include valve number designation.
- D. Flush Valves valve boxes shall be round durable plastic:
 - 1. Rainbird Series Model VB-7RND. The cover shall be branded with the letters "FV," two inches (2") high.
- E. Gate valve and ball valve boxes shall be durable plastic: The cover shall be identified with the letters "GV" or "BV", two inches (2") high stenciled on the outside of the cover.
 - 1. Railbird Series - Model VB-10RND 10" round with bolt-down cover.
 - 2. Traffic Boxes shall be concrete with traffic box/cast iron lid: Carson/ Brooks 4-TT 10 1/4" diameter marked Irrigation. Brooks 3 1/2 (T) PB 10" x 17" pull box w/ full bolt down traffic cover marked "Irrigation". Locate in hardscape only.
- F. Valve boxes located in hardscape areas shall be concrete with traffic rated bolt-down cast iron cover. The cover shall be identifiable with 2" high stenciled letters on the outside cover marked "Irrigation".
- G. Use of valves boxes in hardscape shall require pre-approval from the District Representative and the Landscape Architect.

- H. Traffic Boxes shall be concrete with traffic box/cast iron lid: Carson/ Brooks 4-TT 10 1/4" diameter marked Irrigation. Brooks 3 1/2 (T) PB 10" x 17" pull box w/ full bolt down traffic cover marked "Irrigation". Locate in hardscape only.

2.14 SPRAY AND ROTOR HEADS:

- A. Pop-up Spray Type: Full or part circle pop-up spray type sprinkler body, stem, nozzle and screen constructed of heavy-duty plastic. The sprinkler shall have a soft wiper seal for cleaning debris from pop-up stem as it retracts into case to prevent sprinkler from sticking up. The sprinkler shall have a matched precipitation rate plastic nozzle with an adjusting screw capable of regulating the radius and flow. The sprinkler shall have a strong stainless steel retract spring for positive pop down. Pop-up height shall be as indicated on plans. The sprinkler head shall have a screen under the nozzle to protect it from clogging and for easy removal for cleaning and flushing system. The sprinkler head shall have a bottom inlet and may have a side inlet for ease of installation. Use only the bottom inlet for sprinkler heads equipped with anti-drain devices. As Manufactured by Hunter Pro Series or approved equal.
- B. Pop-up Rotary Type: Rotary sprinkler of the gear driven type. Nozzles shall be available for true matched precipitation rates:
1. The sprinkler shall be available in adjustable arc configuration. The adjustable arc sprinkler shall be adjustable from 40 degrees to 360 degrees in 1-degree increments. Adjustments shall be made from the top of the riser assembly in either the up or down position.
 2. The pop-up sprinkler shall be of height as indicated on plans. Nozzle shall be integrally molded multiple orifice type that can be changed with tools included. Radius shall be adjustable by means of an exchangeable nozzle or a movable diffuser pin. Nozzle turret shall be molded with a service indentation to accept a tool for raising nozzle piston for service.
 3. The sprinkler shall have a 3/4- or 1-inch NPT inlet and shall be accessible by a threaded cap for easy service.
 4. The body of the sprinkler shall be constructed of non-corrosive heavy-duty ABS. The sprinkler shall be equipped with a filter screen for debris stoppage. The sprinkler shall also be available in shrub model with the same nozzle package. The sprinkler shall carry a 2-year unconditional warranty.
 5. All sprinkler heads with similar functions shall be of common manufacture and, with the exception of shrubbery heads, shall be marked with the manufacturer's name and identification in a position where they may be identified without being removed from the system.
 - 6.
- C. Swing Joint Assemblies:
1. Swing joint assemblies for pop-up spray type heads consisting of 1/2" inlets shall use two heavy-duty Marlex street ells, as manufactured by Spears – Model M412-XXX or equal, with a single schedule 40 PVC threaded ell and one schedule 80 nipples, lengths as listed in detail.
 2. Swing joint assembly's pop-up rotary type sprinklers consisting of 3/4" and greater sprinkler inlets shall be pre-assembled, double O-ring, schedule 80 PVC. Swing joint as listed by KBI – Model TSA or equal.

2.15 BUBBLERS/ DRIP ASSEMBLIES:

- A. Low Volume Emitters -. Salco Pro-Spec Emitter or approved equal.
1. Internal Check Valve feature, model (PST-CV) include positive internal spring to hold back 9.25' of elevated water.
 2. 1/2" FIPT (PST) or 1/4" barbed base (PS)
 3. PC Flow: .05, 1, 2, or 4 gph.
 4. Pressure range: 5-65 psi
 5. Zone Filtration: 100 – 150 mesh

- B. IH Series Riser:
 - 1. Pre-assembled with two ½" MIPT UVR male adapters
 - 2. Maximum Flow: 7 gpm
 - 3. Maximum Pressure: 60 psi.
- C. Refer to Irrigation Legend for model numbers and irrigation detail sheet.

2.16 PULL BOX:

- A. All pull boxes shall be Brooks (concrete), or equal, for connection of conduit and route of communication and sensor cable. The pull box will have a cast iron lockable traffic lid.

PART 3 - EXECUTION

3.01 GENERAL:

All work shall conform to Section 308 of the "GREEN BOOK Standard Specifications FOR Public Works Construction" and except as modified herein. No work of this Section other than sleeving under pavement shall commence prior to the completion and acceptance of all grading work specified in Section 02910, Landscape Grading.

- A. Prior to all work of this Section, carefully inspect existing site conditions and equipment. Verify available pressure at point of connection and location of water meter provided by the Water Department.
- B. Verify that irrigation system may be installed in strict accordance with all pertinent codes and regulations, the original design, the reference standards and the manufacturer's recommendations.
- C. In the event of discrepancy, immediately notify the Landscape Architect. Do not proceed with installation in areas of discrepancy until all such discrepancies have been fully resolved.
- D. Trenches and other excavations for irrigation pipe and appurtenances shall be excavated true to alignment and grade and shall be of ample size for the proper performance of installation work, review, testing and backfill.
- E. Protect all existing utilities and repair any damage to existing utilities with matching new materials, at no increase in contract price.
- F. Generally, piping under concrete shall be installed by jacking, boring or hydraulic driving. Where any cutting or breaking of pavement, track sections and/or concrete work is necessary, it shall be removed and replaced by the Contractor. Permission to cut or break pavement, track sections and/or concrete shall be obtained from the District. No hydraulic driving will be permitted under asphalt concrete paving or track sections.

3.02 COMMISSIONING COORDINATION:

- A. Provide technical services of the equipment manufacturer and the contractor to operate and adjust equipment specified under this section during the commissioning phase activities, which include startup and functional performance testing, and documentation elements.

3.03 UTILITY SERVICES:

- A. Contractor shall provide for connections existing electrical services at locations indicated on the drawing.
- B. Contractor shall connect new mainline to water services at locations indicated on the civil engineer's drawings.

3.04 LAYOUT:

- A. All piping or equipment show diagrammatically on drawing outside of planting areas shall be installed inside planting areas whenever possible.

- B. Layout each sprinkler head and make any minor adjustments required due to differences between actual site conditions and the Drawings. Minor adjustments shall be maintained within the original design intent. Protect in place all existing trees and shrubs.
- C. Layout each system using staking method as approved by District's Representative. Maintain and protect approved staking layout.

3.05 TRENCHING AND BACKFILL:

- A. Trenching:
 - (1) Minimum trench width shall be six inches (6").
 - (2) Minimum trench depth below bottom of pipe shall be two inches (2").
 - (3) Minimum cover shall be based on finished grades, unless otherwise noted on Drawings.
 - a. Non-Pressure Lateral Line cover shall be no more than twelve inches (12") and not less than eight inches (8").
 - b. Pressure Supply line (Mainline) minimum cover shall be eighteen inches (18") for lines two and one-half inches (2-1/2") and less; twenty-four inches (24") for lines two and one-half inches (2-1/2") and larger.
 - c. Pipe and Wire Sleeves minimum cover shall be twenty-four inches (24").
- B. Backfill:
 - (1) All plastic pipe shall be bedded and encased with approved backfill material free of rocks and clods as indicated in the following table and/or shown on the plans.

Thickness Under Pipe Minimum	Thickness Above Pipe Minimum	Thickness at Side of Pipe Minimum
Two inches (2")	Four inches (4")	Two inches (2")
 - (2) Provide not less than four inches (4") clearance between each line and not less than six inches (6") clearance between line of other trades, unless otherwise noted.
 - (3) Do not install parallel lines directly over any other line.
 - (4) The balance of backfill material shall be approved soil. Unsuitable material, including clods and rocks over three fourths inch (3/4") in size, shall be removed from the premises and disposed of legally at no cost to the Owner.
 - (5) Backfill material shall be sufficiently compacted under and on each side of the pipe to provide support free of voids. Pipe joints shall remain exposed until the completion of pressure and leakage test, unless authorized by the Architect. The top six inches (6") of backfill shall be free of rocks over one inch (1"), subsoil, rubbish and debris.
 - (6) The remainder of the backfill material shall contain no lumps or rocks larger than two and three fourths inches (2-3/4"), nor contain rubbish and debris.
 - (7) Backfill shall be tamped or puddled to the dry density of adjacent soil. Backfill within areas of structurally compacted soils shall be returned to the original relative density as before trenching.

3.06 INSTALLATION OF PIPE:

- A. Unless otherwise specified, the construction of lateral lines and main lines shall include excavation and backfill, the furnishing, installing and testing of pipe, tube and fittings, the furnishing and installing of anchors, thrust blocks and location wire, the improvements, line flushing and testing, and all other work in accordance with the plans and specifications.

- B. Polyvinyl chloride pipe shall be installed in such a manner so as to provide for expansion and contraction as recommended by the manufacturer.
- C. All polyvinyl chloride pipe shall lay free in the trench with no induced strain. Where there is evidence of induced pipe strain, the Contractor shall be required to make pipe cuts and install angle fittings as necessary to eliminate the strain.
- D. When a connection is plastic to metal, a female adapter shall be used. The metal nipple shall be hand-tightened, plus one turn with a strap wrench. Joint compound shall be IPS weld-on Teflon pipe joint compound or equal. (Plastic to galvanize coupling to galvanize nipple. Do not connect galvanize into plastic).
- E. The Contractor will be required to remove and replace any fitting, which induces a torque strain to the pipe.
- F. Polyvinyl chloride pipe shall be cut with a PVC pipe cutter, hand saw or hack saw with the assistance of a square and sawing vise or in a manner so as to ensure square ends. Burrs at cut ends shall be removed prior to installation so that a smooth unobstructed flow will be obtained.
- G. All plastic-to-plastic joints shall be solvent-weld joints. Only the solvent recommended by the pipe manufacturer shall be used.
- H. The solvent-weld joints shall be made in the following manner:
 1. Thoroughly clean the mating pipe and fitting with a clean dry cloth.
 2. Try the parts for fit. The parts should "dry-mate" between one-third (1/3) and two-thirds (2/3) the depth of the socket. If adequate insertion is not obtained, or bottoming occurs, try another part until a satisfactory "dry-fit" is obtained.
 3. Apply a uniform coat of solvent to the outside of the pipe with a non-synthetic bristle brush.
 4. Apply a uniform coat of solvent-weld to the fitting socket.
 5. Reapply a light coat of solvent-weld to the pipe and quickly insert it into the fitting.
 6. Give the pipe or fitting a quarter turn to ensure even distribution of the solvents and make sure that the pipe is inserted to the full depth of the fitting socket.
 7. Hold in position for at least fifteen (15) seconds.
 8. Wipe off excess solvent that appears at the outer shoulder of the fitting.

NOTE: *For PVC Type I, 1120-1220, pipe mating surface shall first be cleaned with the application of Methyl Isobutyl Ketone (MIBK) solvent. This cleaning shall be accomplished by applying MIBK solvent to the full mating surface area and wiping off with a clean cloth, repeating the process, if necessary, until no trace of shine remains (neither streaks nor spots). The use of commercial PVC solvent-cement thinners as a substitute of MIBK is not allowed.*
- I. Pressure supply steel pipe and fittings: Assemble using red lead and boiled linseed oil paste or an approved equivalent. Brass and Galvanized threaded fittings shall be assembled with both Teflon tape and oil base compound to male threads only.
- J. Provide concrete thrust blocks at each change of direction and at all terminal points of all rubber gasket piping. Block in accord with pipe manufacturer's instructions.
- J. Provide thrust blocks at all changes of directions and reductions shall be mechanically restrained. Additional thrust blocks shall also be restrained as per manufacturer's recommendations. Gate valves shall be treated as a dead end and shall be mechanically restrained for serviceability.

3.07 INSTALLATION OF PIPE UNDER EXISTING PAVING:

- A. Piping under existing pavements may be installed by jacking, boring or by hydraulic driving, except as otherwise specified or directed.
- B. All pipes under pavement surface to be installed a minimum of 24 inches below A.C. paving with 6-inch bedding and a 6-inch cover of sand backfill.
- C. Secure Owner's permission prior to cutting or breaking existing pavements.
- D. Make completely clean cuts using power saws at approved locations only.
- E. Replace and restore all surfaces to original condition, including grade, landscaping and paving
 1. Restoration work shall match the original work in every respect, including type, strength, texture and finish.
 2. Consult with Owner for approved methods of patching and/or replacing any damaged paving sections as a result from boring saw cutting or removal.

3.08 INSTALLATION OF PIPE UNDER NEW PAVED AREAS:

- A. Coordinate installation of piping and wires under paved areas with other trades.
- B. All pipes under pavement surface to be installed a minimum of 24 inches below A.C. paving with a 6-inch bedding and a 6-inch cover of sand backfill.
- C. If the only piping installed is over 20 feet long, pressure testing is required for that section at the time of installation. Upon completion of piping installation, the entire system must be tested.
- D. If wire under paved areas cannot be continuous, all splices shall be enclosed in an approved pull box.

3.09 INSTALLATION OF CONTROL WIRE:

- A. Unless otherwise specified, the installation of control wire shall include excavation and backfill, the furnishing, installing and testing of the wires, the removal and/or restoration of existing improvements and all other work in accordance with the plans and specifications.
- B. Unless otherwise specified all neutral (common ground) wire shall be AWG #12 and all pilot (valve control) wire shall be AWG #14.
- C. At least one spare wire shall be installed from the controller clock to the most distant valve. When wire runs go in different directions from the controller clock, a separate spare wire shall be installed from the controller clock to the most distant valve in each different wire run direction.
- D. Tape and bundle all control wires at ten feet (10') o.c. maximum; place wiring with eighteen inch (18") minimum cover. When wiring is placed in common trenches with piping, set wiring two inches (2") from any piping. Place control wire along side of pipe. Do not place over the pipe.
- F. All wire splicing shall take place in the valve boxes and/or pull boxes. All splices shall be made with a mechanical connector encased in a self-curing epoxy resin that provides a permanent watertight connection. No underground splices will be allowed.
- G. All direct burial control wires shall be identified as to their respective valve number and controller clock letter in all pull boxes and at all wire termination. Spare wires and "future valve" wires, if any, shall also be identified. Labels and tags shall be used for identification which are not affected by moisture or temperatures between minus 30 degrees F. and plus 200 degrees F. The labels and tags shall be resistant to abrasion, dirt, grease, and chemicals used in lawn fertilizers and conditioners. The labels and tags shall be firmly attached to the wire in every case. The Contractor shall submit samples of the labels or tags to be used, to the Architect for recommended approval, prior to the installation of the control wire. Examples of nomenclature of tags or labels are as follows:

Neutral (common ground) wire	= "Neutral" Clock "A"
Pilot (valve control) wire	= "A.V. #1." Clock "A"
Spare Wire	= "Spare" Clock "A"

- H. The final operating sequence of the remote-control valves, within each individual controller clock, shall be as called out on drawings.
 - I. Testing:
 - (1) All direct burial control wire installed shall be tested in the following manner.
 - a. Before any backfill material is placed over the control wires in the trench, the wires shall be tested with a meter for insulation resistance. Minimum insulation resistance to ground shall be fifty (50) megohms. Any conductor not meeting this requirement shall be replaced.
 - b. After backfill encasement, the wires shall again be tested with a meter. The minimum acceptable insulation resistance to ground on this test shall be one (1) megohm. Any conductor not meeting this requirement shall be replaced.
- 3.10 INSTALLATION OF VALVES:
- A. General: Unless otherwise specified, the installation of the valves shall include excavation and backfill, the furnishing, installing and testing of fittings and valves, the furnishing and installing of valve boxes and appurtenances, accessories, the removal and/or restoration of existing improvements and all other work in accordance with the plans and specifications.
 - (1) Fill area under valve box with a minimum of three (3) cubic feet of pea gravel before box is installed.
 - B. Shut-off Valves: Shut-off valves installed underground shall be housed in a suitable valve box. The gate valve hand wheel shall be removed from the stem of all valves installed underground. The wheel shall be replaced with an operating nut.
 - C. Quick Coupling Valves: Unless otherwise indicated, locate valves within twelve inches (12") of hardscape. Install in designated valve box.
 - D. Automatic Control Valves: Automatic control valves shall be set upright and housed in designated valve box, with a hinged, lockable, top. The Contractor shall place Christy's Standard Valve Identification tags on each valve corresponding to its appropriate valve station number.
- 3.11 INSTALLATION OF SPRINKLER HEADS:
- A. Unless otherwise specified, the installation of sprinkler heads shall include excavation and backfill, the furnishing, installing and testing of risers, fittings and heads, the furnishing and installing of cone shaped screens at base of each head, the removal and/or restoration of existing improvements and all other work shall be in accordance with the plans and specifications.
 - B. Flushing: All water lines shall be thoroughly out before heads are installed.
 - C. Location and arc of heads shall be adjusted, if required to eliminate any dry spots, over water or spillage on adjacent areas.
- 3.12 THRUST BLOCKS:
- A. Thrust blocks shall be concrete 2000 psi at 28 days. They shall be placed so that sides subject to thrust or load are against undisturbed earth, and valves and fittings are serviceable after concrete has set.
- 3.13 INSTALLATION OF WARNING TAPE:
- A. Warning tapes shall be installed directly on top of the pipe longitudinally and shall be centered. The warning tape shall be installed continuous for the entire length of the pipe and shall be fastened to each pipe length by plastic tape banded around the pipe with fasteners no more than 5 feet apart. Taping attached to the sections of pipe before laying in the trench shall have flaps sufficient for continuous coverage. All risers between the mainline and control valves shall be installed with warning tape.

3.14 RECORD DRAWINGS:

- A. The Contractor shall provide and keep up to date on a daily basis, a complete record set of bond copies in black and white which shall be corrected daily and show every change from the original Drawings and specifications and the exact locations, sizes and kinds of equipment in red ink. Prints for this purpose may be obtained from the Owner. This set of Drawings shall be kept on the site and shall be used only as a record set. Architect shall review drawings prior to any planting.
- B. In order to complete the record Drawings in a neat, legible manner, the contractor shall indicate the necessary changes on Mylar tracings procured from the Owner/Landscape Architect.
- C. The contractor shall dimension from two (2) permanent points of reference, building corners, sidewalks, etc., the location of the following items:
 - 1. Water meters.
 - 2. Pump stations.
 - 3. Connection to existing water lines.
 - 4. Routing of pressure supply lines at every 100 feet along routing.
 - 5. Backflow prevention devices.
 - 6. Pressure regulators.
 - 7. Flow sensors.
 - 8. Master valves.
 - 9. Fertilizer injectors.
 - 10. Isolation gate valves.
 - 11. Isolation ball valves.
 - 12. Quick coupling devices.
 - 13. Air release valves.
 - 14. Electric control valves.
 - 15. Check valves.
 - 16. Field satellite units/controllers.
 - 17. Grounding rods.
 - 18. Control wire routing (if routed separately from pressure supply line).
 - 19. Communication cable routing (if routed separately from pressure supply line).
 - 20. Communication cable and control wire splices that are outside of control unit or field satellite unit.
 - 21. Other equipment as directed by District.
- D. Prior to scheduling a walk through for Substantial Completion, provide a record set of field drawings as described above to the District for review. After review, the District will return the set to the field foreman requesting further information or will notify that the record set of field drawings are complete. After approval from the District, a walk through for Substantial Completion may be scheduled.
- D. Prior to scheduling the final walk through, the final set of irrigation record drawings shall be professionally drafted.
- E. Contractor is responsible for delivering the final set of record drawings to the District prior to initiating the maintenance period.

3.15 CONTROLLER CHARTS:

- A. Do not prepare charts until record Drawings have been approved by the Owner's representative.
- B. Provide in controller chart for each automatic controller installed.
 - (1) Chart may be a reproduction of the record drawing if the scale permits fitting the controller door. If photo reduction prints are required, keep reduction to maximum size possible to retain full legibility.
 - (2) Chart shall be black-line print of the actual system, showing the area covered by that controller.
- C. Identify the area of coverage of each remote-control valve, using a distinctly different pastel color, drawn over the entire area of coverage.

- D. Following approval of charts by Owner's representative, they shall be hermetically sealed between two layers of 20-mil thick plastic sheet.
- E. Charts must be completed and approved prior to final review of irrigation system.

3.16 TESTS:

- A. Pressure Tests:
 - (1) All pressure lines shall be tested under hydrostatic pressure of 150 pounds per square inch, and all non-pressure lines shall be tested under the existing static pressure and both be proved watertight. Contractor shall provide all equipment for hydrostatic tests at no cost to the Owner.
 - (2) Pressure shall be sustained in the lines for not less than two (2) hours. If leaks develop, the joints shall be replaced, and the test repeated until the entire system is proved watertight.
 - (3) Tests shall be observed and recommended for approval by the Landscape Architect/and or owners field superintendent prior to backfill.
- B. Coverage Test:
 - (1) When the irrigation cooling system is completed, the Contractor, in the presence of the Landscape Architect, shall perform test coverage of water afforded the field areas, complete and adequate. The Contractor shall furnish all materials and perform all work required to correct any inadequacies of coverage disclosed arising from his work.
 - (2) Contractor shall inform the Owner's representative of any deviation from the plan required due to wind, planting, soil or site conditions that bear on proper coverage; and upon approval, perform changes to provide for proper coverage at no additional cost to Owner.

3.17 REVIEWS:

- A. Normal Progress Reviews: Normal progress reviews shall be requested from the Architect at least forty-eight (48) hours in advance of any anticipated review. A review will be made by the Landscape Architect on each of the steps listed below. The Contractor will not be permitted to initiate the succeeding steps of work until he has received written approval to proceed by the inspector.
 - (1) Immediately prior to the commencement of the work of the Section.
 - (2) Pressure supply line installation, trenching and testing.
 - (3) System layout.
 - (4) After placement of all heads, valves and controllers for coverage test.
 - (5) Final review and receipt of "Record Drawings" and "Controller Charts."
 - (6) Final acceptance of project by Owner.
- B. In no event shall the Contractor cover up or otherwise remove from view any work under this contract without prior approval. The Contractor, at his expense, shall open any work covered prior to review to view.
- C. Unprepared Review Requests: In the event the Contractor requests review of work and said work is incomplete, the Contractor shall be responsible for review cost.
- D. Completion: The work will be accepted, in writing, when the whole shall have been completed satisfactorily to the Owner. In judging the work, no allowance for deviation from the original plans and specifications will be made unless already approved by the Owner, in writing, at the proper times.
 - (1) Leave the entire installation in complete operating order, free from any and all defects in material, workmanship or finish, regardless of any discrepancies and/or omissions in plans or specifications.

- (2) Remove from the site all debris and rubbish resulting from the work and leave the installation in clean condition.

3.18 GUARANTEE:

- A. The installed irrigation system shall be guaranteed by the Contractor as to material and workmanship, including settling of backfilled areas below grade for a period of one (1) year following the date of final acceptance of the work.
- B. The Contractor, as part of the work under his contract, shall make all adjustments without extra cost to the Owner, including the complete restoration of all damaged planting, paving, or other improvements of any kind.
- C. Should any operational difficulties in connection with the sprinkler system develop within the specified guarantee period which in the opinion of the Owner may be due to inferior material and/or workmanship, said difficulties shall be immediately corrected by the Contractor to the satisfaction of the Owner at no additional cost to the Owner, including any and all other damage caused by such defects.
- D. The Owner reserves the right to make temporary repairs during the guarantee period as necessary to keep systems in operating condition without voiding the Contractor's guarantee, nor relieving the Contractor of his responsibilities.

3.20 TURN OVER ITEMS:

- A. Turn over items shall include quick coupler keys, and as built prints.
- B. Refer to equipment to be furnished under spec section 1.08 for list of additional items.

3.21 MAINTENANCE:

- A. Maintenance of irrigation system prior to job completion, and during the Landscape Maintenance period, shall be the responsibility of the Contractor including, but not limited to, the following:
 - (1) Cleaning of plugged irrigation heads.
 - (2) Irrigation heads adjustments.
 - (3) Volume of water being applied. (Coordinate with landscape maintenance).
 - (4) Programming of the controller. (Coordinate with landscape maintenance).
 - (5) Repairing leaking valves, etc.
 - (6) Any other problem areas, which occur after installation, attributed to the irrigation system.
 - (7) Repair or replace equipment due to acts of vandalism, theft or pest damage.
 - (8) Lower all turf heads to final grades prior to final acceptance by District.
- B. The contractor's responsibility for the irrigation of plant materials and the maintenance and repair of the irrigation system begins on the contract start date. The methods that are required to irrigate the grounds include automatic irrigation systems and hand or portable irrigation components. The contractor shall plan and adjust irrigation schedules for automatic, hand or portable irrigation system.
- C. Sprinkler Heads: Irrigation includes watering of lawns, shrubs, trees, palms, ground cover and plants. Care shall be exercised by regulating the time and equipment to prevent wasting of water. Watering shall be done in a manner that will avoid erosion, run-off, or ponding due to excessive quantities or rate of application. Sprinkler heads shall be adjusted to prevent water spray on buildings and sidewalks. It shall be the contractor's responsibility to apply enough water to assure and maintain the health and vigor of all lawn, shrubs, trees, and planted areas.

- D. Water Restrictions: The contractor shall be in compliance with Federal, State and local water agencies and authorities' directives. The District reserves the right to reduce or eliminate watering during water shortages. The contractor shall be held liable for fines imposed by Federal, State and/or local water agencies.
- E. The contractor is responsible for required irrigation by any means during the periods of system breakdown.
- F. Frequency of Services: Irrigation Maintenance shall be weekly. Automatic watering systems in the immediate area of pedestrian traffic shall be set to operate during the hours of 10:00 PM to 4:30 AM.

END OF SECTION

SECTION 32 93 00

LANDSCAPE PLANTING

PART 1 - GENERAL

1.01 RELATED DOCUMENTS:

The provisions of the "GREENBOOK Standard Specifications for Public Works Construction," latest edition, including General and Supplementary Conditions and Division 1 Specification Sections, shall apply except as modified herein.

1.02 SCOPE:

Work of this Section includes all material, equipment, and labor necessary for and incidental to completing all Landscape Planting work as indicated on the Drawings, or as reasonably implied, or as designated herein, including, but not limited to, the following.

- A. Carefully inspect the site and verify all existing conditions and dimensions prior to proceeding with any work under this contract.
- B. Apply for all permits and pay for same.
- C. Clear and remove from the site all construction debris, surface growth, or other undesirable material.
- D. Installation of deep root barriers as specified on the plan.
- E. Fine grading of all planting areas and weed abatement.
- F. Preparation of all planting holes.
- G. Furnishing and installation of all plant materials sod unless otherwise noted.
- H. Furnishing and installation of all required planting backfill materials, top dressing, edging, topsoil, and miscellaneous materials.
- I. Obtain an agronomic/ germination soil test after rough grading of the site is complete. Take a minimum of two (2) samples from the various planting area shown within the scope of work. Obtain an agronomic/germination soils test for any imported soil brought in to finish off or add to landscape areas on site. The contractor shall review the agronomic soils test results and recommendations and comply with its findings. **Sludge base amendments shall not be allowed. After the completion of the fine grading and the placement of the soil amendments per the initial agronomic soils report, the contractor shall obtain another agronomic soils report to verify all planting areas within the scope have been amended per the agronomic report.**
- J. Provide (90) ninety continuous calendar days Maintenance Period.
- K. Project clean up and de-weeding of all planting areas.
- L. Provide one-year guarantee for all plant material.

1.03 RELATED WORK SPECIFIED ELSEWHERE:

Section 328400 - Irrigation Systems
Section 311000 – Site Clearing.
Section 312000 – Earth Moving.
Section 334600 – Sub drainage.
Section 321824 – Athletic Field Surfacing

1.04 DEFINITIONS:

- A. Backfill: The earth used to replace or the act of replacing earth in an excavation.

- B. Bare-Root Stock (Applies to Palms only): Plants with a well-branched, fibrous-root system developed by transplanting or root pruning, with soil or growing medium removed, and with not less than minimum root spread according to ANSI Z60.1 for type and size of plant required.
- C. Container-Grown Stock: Healthy, vigorous, well-rooted plants grown in a container, with a well-established root system reaching sides of container and maintaining a firm ball when removed from container. Container shall be rigid enough to hold ball shape and protect root mass during shipping and be sized according to ANSI Z60.1 for type and size of plant required.
- D. Finish Grade: Elevation of finished surface of planting soil (not top of mulch or thatch layer).
- E. Manufactured Topsoil: Soil produced off-site by homogeneously blending mineral soils or sand with stabilized organic soil amendments to produce topsoil or planting soil.
- F. Pesticide: A substance or mixture intended for preventing, destroying, repelling, or mitigating a pest. This includes insecticides, miticides, herbicides, fungicides, rodenticides, and molluscicides. It also includes substances or mixtures intended for use as a plant regulator, defoliant, or desiccant.
- G. Pests: Living organisms that occur where they are not desired, or that cause damage to plants, animals, or people. These include insects, mites, grubs, mollusks (snails and slugs), rodents (gophers, moles, and mice), unwanted plants (weeds), fungi, bacteria, and viruses.
- H. Planting Area: Areas to be planted.
- I. Planting Soil: Standardized topsoil; existing, native surface topsoil; existing, in-place surface soil; imported topsoil; or manufactured topsoil that is modified with soil amendments and perhaps fertilizers to produce a soil mixture best for plant growth.
- J. Plant; Plants; Plant Material: These terms refer to vegetation in general, including trees, shrubs, vines, ground covers, ornamental grasses, bulbs, corms, tubers, or herbaceous vegetation.
- K. Root Flare: Also called "trunk flare." The area at the base of the plant's stem or trunk where the stem or trunk broadens to form roots, the area of transition between the root system and the stem or trunk.
- L. Stem Girdling Roots: Roots that encircle the stems (trunks) of trees below the soil surface.
- M. Subgrade: Surface or elevation of subsoil remaining after excavation is complete, or the top surface of a fill or backfill before planting soil is placed.
- N. Subsoil: All soil beneath the topsoil layer of the soil profile and typified by the lack of organic matter and soil organisms.
- O. Surface Soil: Soil that is present at the top layer of the existing soil profile at the Project site. In undisturbed areas, the surface soil is typically topsoil; but in

1.05 QUALITY ASSURANCE:

The Contractor shall provide at least one person who shall be present at all times during execution of this portion of the work, who shall be thoroughly familiar with the type of materials being installed and the proper materials and methods for their installation, and who shall direct all work performed under this Section.

- A. All plants and planting material shall meet or exceed the specifications of Federal, State and County laws requiring inspection for plant disease and insect control.
- B. Nursery Qualifications: Company specializing in growing and cultivating the plants with three years documented experience and which is regularly inspected by the State Department of Agriculture.

- C. Installer's Qualifications: Landscaping Work shall be performed by a single firm specializing in commercial landscaping.
- D. Source Quality Control:
 - 1. General: Ship landscape materials with certificates on inspection required by governing authorities. Comply with regulations applicable to landscape materials.
 - 2. Do not make substitutions. If specified landscape materials are not obtainable, submit proof of non-availability to Landscape Architect or Owner together with propose plant substitution. For equivalent use of material as specified.
 - 3. Analysis and Standards: A Package standard product with manufacturer's certified analysis. For other materials, provide analysis by recognized laboratory made in accordance with methods established by the Association of Agriculture Chemists wherever applicable.
 - 4. Topsoil: Before delivery of topsoil, submit independent laboratory analysis of topsoil fill. Analysis shall indicate percentage of nitrogen, phosphorus, potash; soluble salts content, organic matter content, and pH value. Submit data to independent testing and inspection agency for Project as specified in Sub-section 1.04E.
 - 5. Trees, Shrubs and Plants: Provide trees, shrubs and plants of quantity, size, genus, species, and variety shown and scheduled for landscaping and complying with recommendations and requirements of ANZI Z60.1 – American Standard for Nursery Stock. Provide healthy, vigorous stock, grown in recognized nursery in accordance with good horticultural practice and free of disease, insects, eggs, larvae and defects such as knots, sunscald, injuries, abrasions or disfigurement.
 - 6. Label at least one tree and one shrub of each variety with a securely attached waterproofed tag bearing legible designation of botanical and common name.
 - a. Dimensions: The height and spread of all plant material shall be measured with branches in their normal positions. The caliper of other dimensions of any plant materials shall be of standard quality and size for type listed. When the same species of tree is shown in a group planting on the plan, all trees in the group shall match in height, spread and appearance. The height of balled and burlapped Palm trees shall be measure from the base of the palm above the finish grade to the bottom of the first green frond projecting upward from the palm pineapple. Refer to the Palm tree planting detail on the detail sheet.
 - 7. Inspection: The Landscape Architect reserves the right to inspect box size trees at place of growth or upon delivery to the site prior to planting for compliance with requirements for genus, species, variety, size and quality. Owner retains the right to further inspect trees and shrubs for size and condition of root-balls, root systems, insects, injuries and latent defects, and to reject unsatisfactory or defective material at any time during progress of work. Remove rejected trees or shrubs immediately from project site.
- E. The Applicator of all weed control materials shall be licensed by the State of California as a Pest Control Operator and a Pest Control Advisor in addition to any subcontractor licenses that are required.
 - 1. Provide certificate of compliance from governing authority having jurisdiction indicating approval of herbicide mixture.
- F. All materials and methods used for Weed Abatement must conform to Federal, State, and Local Regulations.
- G. Industry Standards: The following standards shall be referenced from a part of this Section.
 - 1. Standardized Plant Names latest edition issued by the American Joint Committee on Horticulture Nomenclature.
 - 2. American Standard for Nursery Stock for Stock, latest edition issued by American Association of Nurserymen, Inc.

- H. The Contractor shall obtain soil samples from the following areas after rough grading but prior to soil preparation and fine grading and after the initial placement of the material prior to planting: Submit Samples to Wallace Laboratories: 365 Coral Circle, El Segundo, Ca. 90245. Tel: (310) 615-0116 or an approved Soils Lab. Samples shall be taken at a minimum depth of 12 inches below the rough finish grade.

1.06 SUBMITTALS:

- A. Materials lists: Within five (5) days after award of the Contract, submit a complete list of all materials proposed to be furnished and installed under this Section, demonstrating complete conformance with the requirements specified.
1. Materials list shall include the weed control materials and quantities per acre intended for use in controlling the weed types prevalent and expected on the site, as supplied by the Landscape Contractor. Landscape Contractor shall furnish the general contractor and landscape Architect data to demonstrate the compatibility of the weed control materials and methods with the intended plant and seed varieties.
 2. Samples: Topsoil. Submit three 10-lb samples of topsoil fill to testing laboratory, in air-tight containers and submit to an approved Soils Laboratory for agronomic soil testing. Min 2 samples prior to amending and 1 sample at location to be determined after amending, verify location with Landscape Architect.
 3. Planting Schedule: Proposed Schedule: proposed planting schedule, indicating dates for each type of landscaping work during normal seasons for such work in area of site. Correlate with specified maintenance periods to provide maintenance from date of Substantial Completion review. Once accepted, revise dates only as approved in writing, after documentation of reasons for delays.
 4. Selection, Tagging and Ordering Plant Material:
 - a. Submit quantities, sizes, quality, and sources for plant materials and include photos of material for reference of quality of material expected to be delivered to site. The Landscape Architect reserves the right to review material once fully delivered to site and staged and reject any material not deemed meeting the bases of ANSI Z60.1.
 - b. Submit request for inspection and documentation to the Landscape Architect and Owner at least one month prior to start of landscape planting work, certifying that all plant materials have been ordered.
 - c. Plants shall be subject to inspection and rejection by the Landscape Architect and Owner at place of growth and after delivery, for conformance to specifications.
 5. Certificates: Deliver all certificates to the Landscape Architect upon delivery to job site. Include:
 - a. Quantity of commercial fertilizers
 - b. Quantity of soil amendments.
 - c. Quantity and quality of plant material
 - d. Quality and purity of seed germination
 6. Samples: a minimum 1-quart size sample of the following items shall be provided where applicable:
 - a. Mulch
 - b. Decomposed Granite
 - c. Fill Sand
 - d. Organic Compost
 - e. Other material request by Owner/ landscape Architect at time of submittal process.

7. Plant Photographs: Include color photographs in digital format of each required species and size of plant material as it will be furnished to the Project. Take photographs from an angle depicting true size and condition of the typical plant to be furnished. Include a scale rod person, or other measuring device in each photograph. For species where more than twenty plants are required, include a minimum of three photographs showing the average plant, the best quality plant, and the worst quality plant to be furnished. Identify each photograph with the full scientific name of the plant, plant size, and name of the growing nursery. Photographs shall be submitted to Landscape Architect and / or District's landscape inspector after completion of rough grading
- B. Samples for Verification: For each of the following: Trees and Shrubs: Three samples of each variety and size delivered to the site for review. Maintain approved samples on-site as a standard for comparison.
 1. Organic Compost and Soil Amendments: One-quart volume bag of each organic mulch type required; in sealed plastic bags labeled with composition of materials by percentage overweight and source of mulch. Each Sample shall be typical of the lot of material to be furnished; provide an accurate representation of color, texture, and organic makeup.
 2. Mulch: Two-pound sample of each mulch required, in sealed plastic bags labeled with source of mulch. Sample shall be typical of the lot of material to be delivered and installed at the site; provide an accurate indication of color, texture, and makeup of the material.
 3. Weed Control Barrier: 12 by 12 inches.
 4. Edging Materials and Accessories: Manufacturer's standard size, to verify color selected.
 5. Tree Grates, frames, and Accessories: Shall be delivered to the site in order to verify design and color selected.
 6. Root Barrier: Width of panel by 12 inches.
 7. Decomposed Granite: One-quart volume bag of each decomposed granite type required; in sealed plastic bags and labeled. Each Sample shall be typical of the lot of material to be furnished; provide an accurate representation of color and texture.
 8. Fill sand: One-quart volume bag.
- C. Product Certificates: For each type of manufactured product, from manufacturer, and complying with the following:
 1. Manufacturer's certified analysis including fertilizer, soil amendments, minerals, mulch and other standard or required products.
 2. Analysis of other materials by a recognized laboratory made according to methods established by the Association of Official Analytical Chemists, where applicable.
 3. Submit documentation after completion of rough grading, all plant material has been secured for the project and is available in the quantities and species/varieties specified.
- D. Material Test Reports: For existing native surface topsoil, existing in-place surface soil and imported or manufactured topsoil.

1.07 PRODUCT HANDLING:

- A. Delivery and Storage:
 1. Deliver all items to the job site in their original containers with all labels intact and legible at time of Landscape Architect's review.

2. Plants damaged during transit or delivery, or exhibiting broken limbs, defoliation or damaged from heat, frost or wind shall be rejected at the project site and replaced with new stock at no charge in Contract Time or Sum to the Owner.
3. Handle plant in a manner to avoid any damage to the plant. Protect plants at all times from sun or drying winds. Plants that cannot be planted immediately upon delivery shall be kept in the shade, well protected and adequately watered. Do not store plants on asphalt paving for a period no longer than a full workday.
4. Trees and Shrubs: Deliver trees and shrubs after preparations for planting have been completed and plant immediately. Keep Plants moist
 - a. Do not prune prior to delivery unless otherwise approved by the Landscape Architect.
 - b. Do not bend or bind-tie trees or shrubs in such a manner as to damage bark break branches or destroy natural shape.
 - c. Provide protective covering during delivery.
 - d. If planting is delayed more than 6 hours after delivery, set trees and shrubs in shade, protect from weather and mechanical damage, and keep roots moist by covering with mulch, burlap or other acceptable means of retaining moisture.
5. Groundcovers: Deliver plant materials immediately prior to placement. Keep plants moist. Do not remove container-grown stock from containers until planting time.

1.08 RESPONSIBILITY AND COORDINATION DURING WEED ABATEMENT:

- A. During Weed Abatement procedures, the landscape contractor is responsible for the erection of all signs and barriers required to prevent intrusion into the treated areas and to notify the public.
- B. No material or methods used for Weed Abatement shall affect the landscape planting or turf establishment. No material or method shall render the job site unusable for more than ten (10) days from date of application.
- C. Weeds: Include Dandelion; Jimsonweed; Quack grass; Horsetail; Morning Glory; Rush Grass; Mustard, Lambsquarter; Chickweed Cress; Crabgrass, Canadian Thistle, Notgrass, Poison Oak, Blackberry, Tansy Ragwort, Bermuda Grass, Johnson Grass. Poison Ivy, Nut Sedge, Nimble Will, Bent weed, Wild Garlic, Perennial Sorrel and Brome Grass

1.09 PROJECT CONDITIONS:

- A. Utilities- Determine location of underground utilities and perform work in a manner which will avoid possible damage. Hand excavate, as required. Maintain grade stakes set by others until removal is mutually agreed upon by parties concerned.
- B. Excavation – When conditions detrimental to plant growth are encountered, such as rubble fills, adverse drainage conditions, or obstructions, notify Architect/Engineer before planting.
- C. Field Measurements: Verify actual grade elevations, service and utility locations, irrigation system components, and dimensions of plantings and construction contiguous with new plantings by field measurements before proceeding with planting work.
- D. Interruption of Existing Services or Utilities: Do not interrupt services or utilities to facilities occupied by District or others unless permitted under the following conditions and then only after arranging to provide temporary services or utilities according to requirements indicated:
 1. Notify no fewer than two days in advance of proposed interruption of each service or utility.
 2. Do not proceed with interruption of services or utilities without inspector or construction manager's permission.

3. Weather Limitations: Proceed with planting only when existing and forecasted weather conditions permit planting to be performed when beneficial and optimum results may be obtained.
4. Apply products during favorable weather conditions according to manufacturer's written instructions and warranty requirements. Plant trees, shrubs, and other plants after finish grades are established and before planting turf areas unless otherwise indicated:
 - a. When planting trees, shrubs, and other plants after planting turf areas, protect turf areas, and promptly repair damage caused by planting operations.

1.10 SEQUENCING AND SCHEDULING:

- A. Planting Time - Proceed with and complete landscaping work as rapidly as portions of site become available.
 1. Correlate planting with specified maintenance periods to provide maintenance from date of Substantial Completion review.
 2. All irrigation work shall be inspected and approved before start of any work of this section.
- B. Coordination with lawns/turf areas – Plant trees and shrubs after grades are established and prior to planting lawns –hydro seeded or sodden- unless otherwise acceptable to Architect/Engineer. If planting of trees and shrubs occurs after lawn work, protect lawn areas and promptly repair damage to lawns resulting from planting operations.
- C. Observations:
 1. All field observations herein specified shall be made by the Landscape Architect/District. The Contractor shall request at least 48 hours in advance of the time observations are required.
 2. Field Observations will be required for the following parts of the work:
 - a. After rough grading is complete and the landscape contractor has crossed rip and tilled the planting areas and removed rocks in excess of one (1) inch.
 - b. When fine grading is complete per Civil Engineers precise grading plans and all rocks in excess of one (1) inches are removed and completion of soil amendments.
 - c. Plant material selection prior to site delivery –as time permits for review by Landscape architect. The contractor shall submit plant photographs of each material specified from the nursery of procurement. The contractor shall also submit the name of the nursery, the location and the name of the contact person along with a phone number of the nursery contact person.
 - d. When plant material is spotted for installation but before planting holes are excavated and when specimen tree locations are staked.
 - e. Specimen trees at source before delivery. All tree shown in tree masses or in row formation shall be matched in height and form, general appearance and shall be approved at the nursery before delivery.
 - f. When finished grading is complete in groundcover and other planting areas prior to conducting an irrigation coverage test.
 - g. Lawn areas prior to seeding or sodding.
 - h. Thirty-day establishment period after initial Hydroseed and issuance of landscape maintenance period.
 - i. Final acceptance and project turn over.

PART 2 - MATERIALS

All materials shall conform to the requirements of Section 212 of the Standard Specifications, except as modified herein.

2.01 GENERAL:

All materials shall be standard, first grade quality and shall be in prime condition when installed and accepted. Any commercially processed or packaged material shall be delivered to the site in the original unopened container bearing the manufacturer's guaranteed analysis.

A. Trees with damaged, crooked, or multiple leaders; tight vertical branches where bark is squeezed between two branches or between branch and trunk ("included bark"); crossing trunks or branches; cut-off limbs more than 3/4 inch in diameter; or with stem girdling roots will be rejected.

1. Collected Stock: Do not use plants harvested from the wild, from native stands, from an established landscape planting, or not grown in a nursery unless otherwise indicated.
2. Provide plants of sizes, grades, and ball or container sizes complying with ANSI Z60.1 for types and form of plants required. Plants of a larger size may be used if acceptable to Architect, with a proportionate increase in size of roots or balls.
3. Root-Ball Depth: Furnish trees and shrubs with root balls measured from top of root ball, which shall begin at root flare according to ANSI Z60.1. Root flare shall be visible before planting.
4. Labeling: Label at least one plant of each variety, size, and caliper with a securely attached, waterproof tag bearing legible designation of common name and full scientific name, including genus and species. Include nomenclature for hybrid, variety, or cultivar, if applicable for the plant as shown on Drawings.
5. If formal arrangements or consecutive order of plants is shown on Drawings, select stock for uniform height and spread, and number the labels to assure symmetry in planting.

2.02 SOIL CONDITIONERS AND FERTILIZERS:

Soil conditioners may include any or all of the specified conditioners herein specified and shall be applied at rates indicated in the soils report or special conditions.

2.03 TOPSOIL: Import Class 'A' Soil. Tested for agronomic and germination recommendations. Free from infestation with nematodes or other undesirable insects, plant diseased organisms and petroleum biproducts. ASTM D 5268, pH of 5.5 to 7.4 percent organic material minimum, free of stones one (1) inch or larger in any dimension.

2.04 PRE-PLANTING HERBICIDES:

- A. All Chemicals used for weed control shall be registered by the State of California Department of Food and Agriculture and the Environmental Protection Agency with registration identification on the label. Label shall be at job site at all times.
- B. All chemicals shall be applied as per registered label instruction and manufacturer recommendations.
- C. Chemicals requiring a licensed applicator must be applied by persons registered with the County Department of Agriculture's Commissioner's Office as possessing a current, valid, qualified pest control applicator's license.
- D. The use of any restricted materials is forbidden unless a special use permit is obtained from the County Department of Agriculture.
- E. The non-selective, translocative herbicide shall be "Round-Up" or equal.

2.05 SELECTIVE HERBICIDES: Selective pre-emergent herbicides – “Ronstar-G or equal.

2.06 ORGANIC SOIL AMENDMENTS:

- A. Humus material shall have an acid-soluble ash content of no less than 6% and no more than 20%. Organic matter shall be at least 50% on a dry weight basis.
- B. The pH of the material shall be between 6 and 7.5.
- C. The salt content shall be less than 10 milliohm/cm @ 25° C. on a saturated paste extract.
- D. Boron content of the saturated extract shall be less than 1.0 part per million.
- E. Silicon content (acid-insoluble ash) shall be less than 50%.
- F. Calcium carbonate shall not be present if to be applied on alkaline soils.
- G. Types of acceptable products are composts, manures, mushroom composts, straw, alfalfa, peat mosses etc. low in salts, low in heavy metals, free from weed seeds, free of pathogens and other deleterious materials.
- H. Composted wood products are conditionally acceptable [stable humus must be present]. Wood based products are not acceptable which are based on red wood or cedar.
- I. Sludge-based materials are not acceptable.
- J. Carbon: nitrogen ratio is less than 25:1.
- K. The compost shall be aerobic without malodorous presence of decomposition products.
- L. The maximum particle size shall be 0.5 inch, 80% or more shall pass a No. 4 screen for soil amending. Maximum total permissible pollutant concentrations in amendment in parts per million on a dry weight basis:

Arsenic	20	copper	150	selenium	50
Cadmium	15	lead	200	silver	10
Chromium	300	mercury	10	vanadium	500
Cobalt	50	molybdenum	20	zinc	300
		Nickel	100		
- M. Gypsum: To be agricultural grade gypsum and shall conform to section 212-1.2 of the standard specifications for Public Works Construction, latest edition.
- N. Non-Staining Iron Sulfate: Pelletized or granular form containing not less than 18.5% expressed metallic iron and shall be registered as an agricultural mineral, with the State Department of Agriculture in compliance with Article 2 - “Fertilizer Materials”, Section 1030 of the Agricultural Code as “Green Iron” manufactured by Gro-Power.
- O. Ammonium Sulfate: Granular form containing not less than 21% nitrogen and 24% sulfur and shall be registered as an agricultural mineral, with the State Department of Agriculture in compliance with Article 2 - “Fertilizer Materials”, Section 1030 of the Agricultural Code.

2.07 FERTILIZERS:

- A. Commercial fertilizers with an analysis of 5-3-1 Gro-Power Plus, Gro-Power Controlled Release Nitrogen, 16-20-0, 12-8-8 Urea formaldehyde as designated herein, or **approved substitute as required by the Agronomic soils report**.
- B. Fertilizer shall be delivered to the site in the original unopened container, bearing the manufacturer's guaranteed analysis. Any fertilizer that becomes caked or damaged, making it unsuitable for use, will not be accepted and shall be removed from site.

2.08 PLANTING TABLETS:

- A. Fertilizer planting tablets shall be tightly compressed commercial grade planting tablets having a 12-8-8 formula, weighing 7 grams each. The planting tablets shall be delivered to the site in the original, unopened containers, bearing the manufacturer's guaranteed analysis.

2.09 PLANT MATERIAL: The scientific and common names of plants herein specified conform to nursery standard for plant identification; in the event of a discrepancy, the landscape architect shall decide all questions as to interpretation. (Refer to plant legend on drawings). Each group of plant materials delivered to the site shall be clearly labeled as to species and variety and nursery source. All plants shall have normally well-developed branch structure, with vigorous and fibrous root systems which are not pot bound and surface exposed. The size of the plants shall correspond with that normally expected for species and variety of available nursery stock, or as specified on the drawings. Plants larger in size than specified may be used with the approval of the landscape architect, but the use of larger plants will make no change in contract price.

- A. Rejection: All plants not conforming to the requirements herein specified shall be considered defective, and such plants, whether in place or not, shall be marked as rejected and immediately removed from the site and replaced with new plant(s) at the contractor's expense. The plants shall be of the species, variety, and size as specified on the drawings or pre-selected at the nursery. Under no condition will there be any substitution of plants or sizes for those listed on the drawing.
- B. Pruning: At no time shall a tree or shrub be pruned, trimmed or topped prior to delivery, and any alteration of their shape shall be conducted only with the approval and when in the presence of the landscape architect.
- C. Protection: All plants shall be handled and stored so that they are adequately protected from drying out, from windburn, or from any other injury.
- D. Right of Inspection: The landscape architect reserves the right to approve or reject at any time upon delivery or during installation any or all plant material not conforming to plan specification, size, variety or condition.

2.10 ORGANIC MULCH MATERIAL: provided by AGRONIM ES -2 Cover mulch or equal.

2.11 DECOMPOSED GRANITE:

A. Decomposed Granite: Igneous rock which has weathered in place or any sedimentary material principally derived from igneous rock. Provide washed material free of organic material and other deleterious substances. All decomposed granite to be pre-stabilized with 'stabilizer' by Stabilizer, Inc.

B. Material shall be C-35 conforming to the following gradation as determined by ASTM C 136:

<u>1. Sieve Size</u>	<u>Percent Passing (by weight)</u>
A. 3/8 inch	B. 100
No. 4	100
No. 8	93
No. 16	65
No. 30	44
No. 50	28
No. 100	16
No. 200	8.7

- 2. Resistance "R" value 82%.
- 3. Sand equivalent value 61%.

2.12 WEED-CONTROL BARRIERS:

- A. Nonwoven Geotextile Filter Fabric: Polypropylene or polyester fabric, 3 oz. /sq. yd. minimum, composed of fibers formed into a stable network so that fibers retain their relative position. Fabric shall be inert to biological degradation and resist naturally encountered chemicals, alkalis, and acids. Mirafi 140N.
- B. Composite Fabric: Woven, needle-punched polypropylene substrate bonded to a nonwoven polypropylene fabric, 4.8 oz. /sq. yd. Mirafi 700X.

2.13 TREE STABILIZATION MATERIALS:

A. Stakes and Ties:

1. Upright and Guy Stakes: Rough-sawn, sound, new lodge pole pine, free of knots, holes, cross grain, and other defects, 2-inch diameter for 24" box and smaller 2 1/2" for 25" box nominal by length indicated, pointed at one end.
2. Flexible Ties: Shall be manufactured of virgin flexible vinyl meeting ASTM-D-412 standards for tensile and elongation strength. Material shall be black for ultraviolet resistance.
3. Tree ties shall be manufactured with a double back locking configuration and secured with one galvanized nail to prevent slippage. Tree ties shall elongate with the tree growth preventing damage to the tree. Install and secure per manufacturer's written recommendations:
 - a. Products: Subject to compliance with requirements, available products that may be incorporated into the work include, but are not limited to the following:
 - 1) VIT Products, Inc. 32" for 24" box and smaller cinch belts/buckles for 36" box.
5. Rigid Braces: 1/2" round threaded metal rod shall be encased in U.V. black vinyl tubing placed at the center of the rod. The rod is to be bent in a 360-degree circle
6. The meeting points of the rod shall be spread apart permitting the brace to be placed on the tree by holding it parallel to the tree trunk with one open part of the circle on either side of the trunk. The threaded ends shall be inserted through drilled holes in the stakes or poles secured with nuts, lock washers and flat washers. Rigid braces to be used with Landscape Architect/ District approval only:
 - a. Products: Subject to compliance with requirements, available products may be incorporated into the work include, but are not limited to the following:
 - 1) VIT Products, Inc. TB 24, TB 36 and TB 42.

B. Palm Bracing: Battens or blocks, struts, straps, and protective padding as indicated:

1. Battens or Blocks and Struts: Rough-sawn, sound, new hardwood or softwood, free of knots, holes, cross grain, and other defects, 2-inch diameter for 24" box and smaller 2 1/2" for 36" box for nominal by lengths indicated.
2. Straps: Adjustable steel or plastic package banding straps.
3. Padding: Burlap.
4. Proprietary Palm-Bracing Devices: Proprietary systems to secure each new planting by trunk; sized per manufacturer's written recommendations unless otherwise indicated:
 - a. Products: Subject to compliance with requirements, available products that may be incorporated into the work include, but are not limited to the following:
 - 1) Arborbrace; Arborbrace, Palm Bracing.

2.14 LANDSCAPE EDGINGS:

- A. Concrete mow strip / header: Concrete mow strip shall be 6" x 6" in dimension and contain (1) on #3 rebar continuous. Rebar shall overlap 12" at all splices. Expansion joints shall be located at 48" O.C. Refer to section 321313 CONCRETE, for concrete material specifications.

2.15 ROOT BARRIERS:

- A. Black, molded, modular panels manufactured with 50% recycled polyethylene plastic with ultraviolet inhibitors, 85 mils thick, with vertical root deflecting ribs protruding $\frac{3}{4}$ in out from panel, and each panel 24" wide:

Products: Subject to compliance with requirements, available products that may be incorporated into the work include, but are not limited to the following:

- a. Deep Root Corporation –Linear Guide #UB-24.

Products shall be installed as follows, unless otherwise indicated on drawings:

- a. 15-gallon trees: #UB-24.
b. 24-inch box trees: #UB-24.
c. 36-inch box trees: #UB-24.
d. 48 in box trees and larger: Per manufacturer's recommendations.

Provide deep root corporation, 'water barrier' for all bamboo installations.

2.16 HYDROSEED:

- A. Type of Hydro seed shall be as noted on the drawings. Refer to Planting Legend.

2.17 SOD:

- A. Type of Sod shall be a noted on the drawings. Refer to Planting Legend.

2.18 COBBLESTONE /BOULDERS:

- A. Cobblestone shall be 4 – 8 "cobble, Sierra available at Southwest Boulders. Set cobblestone in 3 sack slurry mix.
B. Boulders shall be Sierra Select available at Southwest Boulders. Bury boulders one third depth, place in slurry mix.

2.19 TREE GRATE

- A. Refer to planting plans for type, size, color, and thickness of application.
B. Install with Manufactured Frame, refer to detail.
C. ADA Cast Iron Tree Grate. Iron-Smith Company or approved equal.

PART 3 - EXECUTION

Installation shall conform to the requirements of Section 308 of the "Standard Specifications," except as modified herein.

- 3.01 GENERAL: Prior to the start of work of this Section, all trash and deleterious materials on the surface of the ground shall be removed and legally disposed of. Verify the following information prior to commencement wit work:
A. Verify that topsoil material to be reused is acceptable and has been testes pursuant to all state and local requirements for lead, mercury, or any other contaminants.
B. Verify that building and trench backfilling has been completed and inspected.
C. Verify that the subsoil base has been scarified, contoured, and compacted.

- D. Verify that all existing utilities have been protected and are in good working condition prior to commencement of seeding. Make necessary repairs as required.
- E. Verify that drainage and grading has been completed per Civil Engineers precise grading plans.

3.02 EXAMINATION:

- A. Examine areas to receive plants for compliance with requirements and conditions affecting installation and performance:
- B. Verify that no foreign or deleterious material or liquid such as paint, paint washout, concrete slurry, concrete layers or chunks, cement, plaster, oils, gasoline, diesel fuel, paint thinner, turpentine, tar, roofing compound, or acid has been deposited in soil within a planting area.
- C. Do not mix or place soils and soil amendments in frozen, wet, or muddy conditions.
- D. Suspend soil spreading, grading, and tilling operations during periods of excessive soil moisture until the moisture content reaches acceptable levels to attain the required results.
- E. Uniformly moisten excessively dry soil that is not workable, and which is too dusty.
- F. Proceed with installation only after unsatisfactory conditions have been corrected.
- G. If contamination by foreign or deleterious material or liquid is present in soil within a planting area, remove the soil and contamination as directed by Architect and replace with new planting soil.
- H. Notify architect minimum 5 working days prior to the following reviews to be attended at their option:
 - 1. Pre-installation conference.
 - 2. Completion of fine grading.
 - 3. Delivery of plant materials, tree layout and sample plan.
 - 4. After installation of 1 tree for conformance to specified details.

3.03 WEED ABATEMENT:

- A. Prior to the installation of the irrigation system, all weed growth shall be removed within the areas designated to be cleared and grubbed. Refer to plans for limit of work.
 - 1. Perennial grasses and weeds existing in the planting areas require control prior to removal, spray these areas per Pest Control Adviser's or landscape contractor's recommendations (Round-up or other approved herbicide.) Physically remove all weeds and undesirable material from the site.
 - 2. Remove all dead weeds by rake or hoe to a depth of one to two inches (1" to 2") below the surface of the soil. Remove all weed and/or undesirable grass residue and top growth and dispose of in a legal manner.
 - 3. Upon completion of all fine grading work and prior to soil preparation, perform weed control measures.
 - 4. Apply a pre-emergent (Roundstar G or approved equivalent) at a minimum rate of 150 lbs per acre.
 - 5. Irrigate all areas designated to be planted on which pre-emergent is applied for a minimum of 10 minutes per setting, two settings per applications.

3.04 SOIL PREPARATION AND FINE GRADING:

- A. Soil Preparation: Prior to amending the surface, soil should be cross-ripped or otherwise tilled to a depth of twelve inches (12"). All planting areas to receive soil preparation. All rock one inch (1") and larger shall be removed to a depth of four inches (4"). Dispose of all debris off-site in a legal manner.

- B. Planting Areas: To all planting areas, uniformly broadcast soil amendments and thoroughly incorporate to a minimum six-inch (6") depth by means of a rototiller or equal.

Soil Amendments are to be thoroughly incorporated at the following rates per one thousand square feet (1,000 sf.) by rototilling or other approved method:

3 cu. yds.	Organic amendment
200 lbs.	5-3-1 Commercial fertilizers
10 lbs.	Iron Sulfate
50 lbs.	Agricultural Gypsum

- C. Deep water leaching:

1. After initial soil sample(s) have been taken, soil has been amended and installation / testing of the irrigation system is complete, all areas shall be deep water leached and compacted and settled by continuous application of irrigation water until the soil has received a minimum of 8" of water.
2. After leaching operation, soil samples shall be taken again by Contractor per Architect's direction and given to the District's soil laboratory for a final testing. Soil test shall meet the following requirements:
 - a. ECe - Maximum 3.0.
 - b. pH - Maximum 7.50.
 - c. Minimum 6.00 PH.
3. Re-application of soil amendment and leaching operation shall be waived by the District if the District determines the EC and pH are at acceptable levels.
4. Deep water leaching shall be done prior to the application of commercial fertilizer; however, gypsum and compost must be adequately roto-tilled in to the upper 12" prior to the leaching process.
5. Do not undertake leaching operations in expansive soils.
6. Care shall be taken that the rate of application of water does not cause erosion or sluffing of soils.

- D Finish Grade:

1. Rough grade shall be within one tenth (1/10) of one foot (1') of finish grade.
2. Work such as fine grading and light cultivation are required of all planting areas indicated on plan to prepare grades prior to seed or stolon planting.
3. After approximate finished grades have been established, all soil areas shall be compacted and settled by application of heavy irrigation to a minimum depth of twelve inches (12").

3.04 PLACEMENT OF TOPSOIL: Refer to Earth Moving Section

- A. Place topsoil in raised planter areas as shown on the plans.
- B. Fine grade area(s) to desired elevations and contours as referenced on the plans.
- C. Compact area to desired compaction.

3.05 FINAL GRADES:

- A. After the foregoing specified deep watering, minor modifications to grade may be required to establish the final grade. These areas shall not be worked until the moisture content has been reduced to a point where working it will not destroy soil structure.
- B. Refer to the Civil Engineer's Precise Grading Plans for drainage and grading of all planting area.

- C. Finished earth berm surfaces shall be smooth and even between contours; shapes shall be to the satisfaction of the Landscape Architect.
- D. All areas shall be graded so the final grades will be two inch (2") below adjacent curbing in shrub/groundcover areas, one inch (1") below adjacent sidewalks in turf areas. Set final grades flush in playfields adjacent to valve boxes.
- E. Eliminate all erosion scars.

3.06 TREE AND SHRUB INSTALLATION:

- A. Actual planting shall be performed during those periods when weather and soil conditions are suitable and in accordance with locally acceptable horticultural practices.
- B. All irrigation work shall have been reviewed by the Landscape Architect prior to beginning any planting.
- C. Installation of all plant material shall be in accordance with the planting details.
- D. Locations for plants and outlines of areas to be planted shall be marked on the ground by the Landscape Contractor before any plant pits are dug. The landscape architect shall review all locations. If any underground utilities are encountered in the excavation of the planting areas, notify the Landscape Architect immediately so that other locations for planting may be selected.
- E. Excavation for Planting:
 - 1. Excavation for planting shall include the stripping and stacking of all acceptable topsoil encountered within the areas to be excavated for trenches, tree holes, plant pits and planting beds.
 - 2. Protect all areas from excessive compaction when trucking plants or other material to the site.
 - 3. All excavated holes shall have vertical sides with rough surfaces and shall be of a size is at least twice the width and depth of the original plant container. The holes shall be, in all cases, large enough to permit planting without damage to the rootball. Compact soil so depth of rootball is three (3") higher than existing grade.
- F. Planting:
 - 1. No planting shall be done in any area that is under construction, where the grades have not been established or fine graded until the area concerned has been satisfactorily prepared in accordance with these specifications.
 - 2. No more plants shall be distributed in the planting area on any day than can be planted and watered on that day.
 - 3. Containers shall be cut, and plants shall be removed in such a manner that the ball of earth surrounding the roots is not broken, and they shall be planted and watered as herein specified immediately after the removal from the containers. Containers shall not be cut or broken prior to placing the plant in the planting areas.
 - 4. The amended surface shall be used for backfill around trees and shrubs; use the following formula (thoroughly blended):

Native on-site soil (Refer to soils report. Import soil may be used)	6 parts
Organic Amendments	4 parts
Commercial Fertilizer 5-3-1	15 lbs/cy
Iron Sulfate	2 lbs/cy.

Note: Mix proportions are for bid purposes only. If mix proportions differ from agronomic soils test results notify the architect and or general contractor immediately.

5. Three inches of amend backfill shall be thoroughly mixed with three inches of native or import soil at the bottom of each hole to provide a transitional soil mix of at least six inches between the native soil and backfill.
6. Backfill shall be placed at the bottom of each hole, and thoroughly compacted to a height that when a plant is placed in the hole, its root crown is three inches (3") above the established final grade. Any plants, which settle deeper than specified above, shall be raised back to the correct level. After the plant has been placed, additional backfill shall be added to the hole to cover approximately one-half the root ball. At this stage, water shall be added to the top of the partly filled hole to thoroughly saturate the root ball and adjacent soil.
7. After the water has completely drained, fertilizer tablets shall be place as indicated:
 - 3 tablets per one-gallon container
 - 6 tablets per five-gallon container
 - 12 tablets per fifteen-gallon container
 - 14 tablets per 24" box
 - 18 tablets per 36" box
 The remainder of the hole shall then be backfilled.

3.07 TURF AREA PREPARATION:

- A. Prior to planting turf, prepare surface soil as follows:
 1. Remove existing grass, vegetation, and turf. Do not mix into surface soil.
 2. Remove 8 inches of existing surface soil.
 3. Add 8 inches of new Class A topsoil with a minimum amount of organic matter 50% of dry weight. Apply soil amendments and fertilizers according to planting soil mix proportions and mix thoroughly into top 8 inches of soil. Till soil to a homogeneous mixture of fine texture.
 4. Remove stones larger than 1/2 inch in any dimension and sticks, roots, trash, and other extraneous matter to a depth of 6".
 5. Legally dispose of waste material, including grass, vegetation, and turf, off District's property.
 6. Compost material per CHPS credit ME2.1 if directed.
- B. Finish Grading: Grade planting areas to a smooth, uniform surface plane with loose, uniformly fine texture. Grade to within plus or minus 1/2 inch of finish elevation. Roll and rake, remove ridges, and fill depressions to meet finish grades. Limit finish grading to areas that can be planted in the immediate future.
- C. Moisten prepared area before planting if soil is dry. Water thoroughly and allow surface to dry before planting. Do not create muddy soil.
- D. Before planting, obtain Architect's acceptance of finish grading; restore planting areas if eroded or otherwise disturbed after finish grading.

1.08 SEEDING:

- A. Sow seed with spreader or seeding machine. Do not broadcast or drop seed when wind velocity exceeds 5 mph. Evenly distribute seed by sowing equal quantities in two directions at right angles to each other:
 1. Do not use wet seed or seed that is moldy or otherwise damaged.

2. Do not seed against existing trees. Limit seed a minimum of 24" from trunks.
- B. Sow seed at a total rate recommended by supplier.
 - C. Rake seed lightly into top 1/8 inch of soil, roll lightly, and water with fine spray.
 - D. Protect seeded areas from hot, dry weather or drying winds by applying compost mulch] or planting soil within 24 hours after completing seeding operations. Soak areas, scatter mulch uniformly to a thickness of 3/16 inch, and roll surface smooth.

3.09 HYDROSEEDING:

- A. Hydro seeding: Mix specified seed, fertilizer, and fiber mulch in water, using equipment specifically designed for hydro seed application. Continue mixing until uniformly blended into homogeneous slurry suitable for hydraulic application:
 1. Mix slurry with fiber-mulch and manufacturer's recommended tackifier.
 2. Apply slurry uniformly to all areas to be seeded in a one-step process. Apply slurry at a rate so that mulch component is deposited per supplier's recommendations, and seed component is deposited at not less than the specified seed-sowing rate.
 3. Minimum Purity: 97% (Exclusive of coating material), Minimum Germination: 90%
 4. Minimum Germination: 90%
 5. Application Specification:
 - a. Mulch: 2,000 lbs. per acre. Wood fiber or clean paper free of impurities
 - b. Binder: M-Binder at 40 to 160 lbs. per acre depending on degree of slope. Add slowly to tank to avoid clumping.
 - c. Pre-Plant Fertilizer: Starter fertilizer (15-15-15) at 400 lbs. per acre. Incorporate additional elements as needed by soil test.
 - d. Seeding Rate: 10-12 lbs. per 1,000 square feet.

3.10 SODDING:

- A. Lay sod within 24 hours of harvesting. Do not lay sod if dormant or if ground is frozen or muddy.
- B. Lay sod to form a solid mass with tightly fitted joints. Butt ends and sides of sod; do not stretch or overlap. Stagger sod strips or pads to offset joints in adjacent courses. Avoid damage to subgrade or sod during installation. Tamp and roll lightly to ensure contact with subgrade, eliminate air pockets, and form a smooth surface. Work sifted soil or fine sand into minor cracks between pieces of sod; remove excess to avoid smothering sod and adjacent grass:
 1. Lay sod across angle of slopes exceeding 1:3.
 2. Anchor sod on slopes exceeding 1:6 with wood pegs spaced as recommended by sod manufacturer but not less than 2 anchors per sod strip to prevent slippage.
- C. Saturate sod with fine water spray within two hours of planting. During first week after planting, water daily or more frequently as necessary to maintain moist soil to a minimum depth of 1-1/2 inches below sod.

3.12 TREE, SHRUB, AND VINE PRUNING:

- A. Remove only dead, dying, or broken branches as directed by Architect. Do not prune for shape.
- B. Prune, thin, and shape trees, shrubs, and vines as directed by Architect. Prune, thin, and shape trees, shrubs, and vines according to standard professional horticultural and arboricultural practices.
- C. Unless otherwise indicated by Architect, do not cut tree leaders; remove only injured, dying, or dead branches from trees and shrubs; and prune to retain natural character.
- D. Do not apply pruning paint to wounds.

3.13 PLANTING AREA MULCHING:

- A. Install weed-control barriers (if specified) before mulching according to manufacturer's written instructions. Completely cover area to be mulched, overlapping edges a minimum of 12 inches and secure seams with galvanized pins.
- B. Mulch backfilled surfaces of all planting areas and other areas indicated on the plans, unless no mulch is indicated:
 - 1. Organic Mulch in Planting Areas: Apply 2-inch average thickness of organic mulch extending 12 inches beyond edge of individual planting pit or trench and over whole surface of planting area, and finish level with adjacent finish grades. Do not place mulch within 2-inches of trunks or stems.
 - 2. Organic mulch shall not be applied to landscape areas that exceed 3:1 in slope gradient.

3.14 DECOMPOSED GRANITE /INFIELD ATHLETIC SURFACING:

- A. Material Certificates: Certificates signed by suppliers certifying that each material complies with requirements. Sample Mock-up:
 - 1. Provide 8 ft. x 8 ft. x 4-inch-thick sample mock-up with redwood header for each color of decomposed granite.
- B. Verify that subgrade is dry and in suitable condition to support surfacing and imposed loads.
- C. Proof-roll subgrade using heavy, pneumatic-tired rollers to locate areas that are unstable or that require further compaction.
- D. Do not begin paving installation until unsatisfactory conditions have been satisfactorily corrected.
- E. Place and compact surfacing material at optimum moisture content to required grades, lines, cross sections, and thickness to not less than 95 percent of maximum dry unit weight according to ASTM D 1557:
 - Shape material to required crown elevations and cross-slope grades.
 - 1. Place materials in a single layer.
 - 2. Compacted thickness shall be 4 inches minimum.
- E. Edging: Install edgings at perimeter of surfacing except where decomposed granite surfacing abuts asphalt or concrete paving.
- F. Ensure that prepared subgrade is ready to receive surfacing.
- G. Compact surfacing with 5 ton or larger rollers or using other equipment acceptable to Architect. Compact with vibratory-plate compactors in areas inaccessible to rollers.

- H. Examine surface immediately after rolling for indicated crown, grade, and smoothness. Adjust surfaces as required and reroll to obtain smoothness and required elevations.
- I. Protection: After final rolling, do not permit vehicular traffic on surfacing.
- J. Thickness: Compact to produce the thickness indicated within the following tolerances:
 - 1. Surface Course: Plus 1/4 inch, no minus.
- K. Surface Smoothness: Compact to produce a surface smoothness within the following tolerances as determined by using a 10-foot straightedge applied transversely or longitudinally to surfaced areas:
 - 1. Surface Course: 1/4 inch.

3.15 PLANTING IN RAISED PLANTERS OR POTS:

- A. Place a layer of drainage gravel at least 4 inches thick in bottom of planter. Cover bottom with filter fabric and wrap filter fabric 6 inches up on all sides. Duct tape along the entire top edge of the filter fabric, to secure the filter fabric against the sides during the soil-filling process.
- B. Fill planter with planting soil. Place soil in lightly compacted layers to an elevation of 1-1/2 inches below top of planter, refill natural settlement.

3.16 PALM TREE STABILIZATION:

- A. Palm Bracing: Install bracing system at three or more places equally spaced around perimeter of trunk to secure each palm until established unless otherwise indicated:
 - 1. Site-Fabricated Palm-Bracing Method:
 - a. Place battens over padding and secure battens in place around trunk perimeter with at least two straps, tightened to prevent displacement. Ensure that straps do not contact trunk.
 - b. Place diagonal braces and cut to length. Secure upper ends of diagonal braces with galvanized nails into battens or into nail-attached blocks on battens. Do not drive nails, screws, or other securing devices into palm trunk; do not penetrate palm trunk in any fashion. Secure lower ends of diagonal braces with stakes driven into ground to prevent outward slippage of braces.
 - 2. Proprietary Palm-Bracing Device: Install palm-bracing system sized and positioned as recommended by manufacturer unless otherwise indicated and according to manufacturer's written instructions.

3.17 EDGING INSTALLATION:

- A. Concrete mow strip / header: Install concrete mow curbs per standard detail and per Section 321313 – Concrete Paving.
- B. Shovel-Cut Edging: Separate mulched areas from turf areas with a 45-degree, 4- to 6-inch- deep, shovel-cut edge.
- C. Aluminum edging: as specified on plans.

3.18 ROOT-BARRIER INSTALLATION:

- A. Install root barrier where trees are planted within 60 inches of paving or other hardscape elements, such as walls, curbs, and walkways unless otherwise shown on Drawings.

- B. Align root barrier vertically with bottom edge angled at 20 degrees away from the paving or other hardscape element and run it linearly along and adjacent to the paving or other hardscape elements to be protected from invasive roots.
- C. Install root barrier continuously in each direction from the tree trunk. If trees are spaced closer, use a single continuous piece of root barrier:
 - 1. Position top of root barrier per manufacturer's recommendations.
 - 2. Do not distort or bend root barrier during construction activities.
 - 3. Do not install root barrier surrounding the root ball of tree.

3.19 WATERING:

- A. Apply water to all planted areas during operations and thereafter, until acceptance of the work. Apply water in sufficient quantities and as often as seasonal conditions require keeping the planted areas sufficiently moist at all times, well below the root system of grass and plants.
- B. All turf areas shall be kept damp at all times and irrigation should be adjusted accordingly. This normally would involve four (4) to six (6) watering periods daily, each watering period (ON) regulated to just dampen the mulch without creating run off.
 - 1. Intervals between irrigation (OFF) sequences should be judged by the length of the time mulch remain damp. Once the mulch begins to dry out, the water (ON) sequence should be repeated.

3.20 ESTABLISHMENT AND MAINTENANCE PERIOD: The Contractor shall continuously maintain all areas involved in this contract during the progress of the work and during the 30-day establishment period for all turf and Ground cover areas and (90) day maintenance period for the Athletic Playfields excluding the artificial turf stadium until final acceptance of the work by the Owner. Plant establishment period: The contractual establishment period shall be for no less than thirty - (30) continuous calendar days. The contractual establishment period begins on the first day after all planting in this project is completed and accepted and the planted areas are brought to a neat, clean and weed free condition. (All turf areas and Ground cover areas installed by flats shall be reviewed under the establishment period).

- A. Landscape maintenance period: ***Upon the acceptance of the substantial completion of the landscape and irrigation installation the landscape maintenance period may begin.*** The Contractor shall request an on-site review of the landscape at the end of the establishment period. The turf areas shall show an even, healthy stand of grass free of patches or spare spots. The contractor will be notified in writing the acceptance of the establishment period and commencement of the maintenance period. If such criteria are met to the satisfaction of the District, a field notification shall be issued to the Contractor from the District, to establish the effective beginning date of the Maintenance Phase. The District has the ultimate authority in setting the beginning date for the maintenance period.
 - 1. Any day when the Contractor fails to adequately maintain plants replace unsuitable plants or do weed control or other work, as determined necessary by the Landscape Architect and/or owner's field representative will not be credited as one of the landscape maintenances working days.
 - 2. In order to carry out the landscape maintenance work, the Contractor shall furnish protective barriers/fences around landscape areas, sufficient men and adequate equipment to perform the work during the maintenance period. The Contractor shall be responsible for maintaining adequate protection of the entire project area. Damaged areas caused by erosion, tire damage, graffiti, pests or other damage as deemed by the District shall be repaired at the Contractor's expense.
- B. All sidewalks, paved areas and other areas adjacent to the planting areas shall be cleaned of all debris, soil, or other materials at intervals of not more than seven (7) days.
 - 1. Improper maintenance or possible poor condition of any planting during the scheduled landscape maintenance period may cause postponement of the final acceptance of the landscape maintenance period. Contractor shall bear all costs for extension of the Landscape maintenance period.

2. In the event there is evidence of poor-100% germination of the turf grass seed or poor performance of the sod or shrub/groundcover areas, the contractor shall obtain an agronomic soils test for each area and provide copies of the test results to the District to verify the appropriate use and incorporation of amendments per agronomic soils reports and appropriateness of all maintenance work performed. If additional fertilizers are needed, up to a maximum of 25% beyond the amount specified, such amendments shall be provided by the Contractor at no additional cost to the District.
3. Depressions caused by vehicles, bicycles, or foot traffic shall be filled and leveled. Replant damaged areas with same material unless area was prior seed with turf grass or a Hydroseed mix –plant area with sod or select shrub species identified in seed mix at one (1) gallon minimum or as readily available. Replant at no expense to District unless damaged was caused by other trade contractors.

C. Plant Maintenance:

1. All areas shall be kept free of debris, and all planted areas shall be weeded at intervals of not more than ten (10) days. Watering, mowing, fertilization, spraying and pest control, as may be required, shall be included in the maintenance period. Maintenance shall include gopher control.
 - a. All personnel on the project shall be well trained, clean, and neat at all times and be conversant with these specifications.
 - b. All work shall be performed in accordance with the best landscape maintenance practices and in keeping with the high aesthetic level of facilities being maintained.
 - c. Contractor shall be responsible for removing all weeds in joints of sidewalks, curbs, and hardscape throughout the project.
 - d. All landscape areas shall be patrolled weekly to check for vandalism damage, broken tree branches, rodents, insects, pest and diseases.
 - e. Water Management:
 - f. Water only as required to allow penetration into the soil and avoid excess run-off. Once plant material is established, water only as needed to maintain healthy plant material.
 - g. Avoid water waste by setting controllers appropriately for current season and weather.
 - h. Avoid blocking the clear view of signs, illumination of light poles fixtures, the airflow out of vents and conflict with pedestrian and vehicles and their views.
 - i. Safety of users shall be a prime goal of maintenance especially in regard to pruning of trees and trimming of ground covers away from walkways and/or structures.
 - j. The Contractor, at his own expense, shall replace all dead or damaged plant material during the maintenance period and prior to final acceptance of the maintenance period.
2. Pruning Trees – prune trees to select and develop permanent scaffold branches that are smaller in diameter than the trunk branch to which they are attached that have vertical spacing from 18” to 48” and radial orientation. Other pruning shall be performed to correct the following:
 - a. So permanent scaffold branches do not overlay one another.
 - b. To eliminate diseased or damaged growth.
 - c. To eliminate narrow V-shaped branch forks that lack strength.
 - d. To reduce toppling and wind damage by thinning out crowns.
 - e. To maintain growth within space limitation
 - f. To maintain natural appearance.
 - g. To balance crown with roots.
 - h. All tree pruning shall be done with hand equipment operated from the ground. If trees are larger than able to be pruned in such a manner, the condition will be brought to the attention of the District.
 - i. Remove no more than 50% of a plant's foliage during pruning operations.
 - j. Topping of trees will not be tolerated unless approved by the District.

3. Under no circumstances shall stripping of lower branches, (raising up or skirting) of young trees be permitted. Lower branches shall be retained in a pinched back condition with as much foliage as possible to promote caliper trunk growth (tapered trunk). Lower branches can be cut flush with the trunk only after the tree is able to stand erect without staking or other support. No stubbing of major branches will be accepted.
4. Evergreen trees shall be thinned out and shaped when necessary in prevent wind and storm damage. The primary pruning of deciduous trees shall be done during the dormant season. Damaged trees or those that constitute health or safety problems shall be pruned at any time of the year as required.
5. Post fertilize all turf areas at the end of every 45-60 days (of maintenance) at the rate of three pounds (3 lbs.) per one thousand square feet (1,000 sf.) using ammonium sulfate, 21-7-14, evenly applied and thoroughly watered in. The first application should occur 14 days after planting. Thirty (30) days after planting fertilize with 20-6-10 fertilizer at rate of three to four (3 to 4) lbs per 1,000 square feet. Water thoroughly. In early fall and spring, substitute a complete fertilizer such as 16-6-8 or equal for the ammonium sulfate at a rate of 6 lbs. per 1000 sf.
6. Mowing of turf will commence when turf grass has reached a height of one inch (1"). The height of cut will be 1/2" to 3/4" as directed by the Grounds Supervisor. Mowing will be at least weekly after the first cut. Turf must be well established and free of bare spots and weeds to the satisfaction of the Landscape Architect prior to final acceptance by the Owner.
 - a. Excess grass clippings shall be picked up and removed from site. Don not leave grass clipping on newly cut turf grass, remove immediately.
7. The Contractor shall maintain the irrigation systems in a like new operating condition; adjusting head heights and spray arcs as necessary. The Contractor is responsible for proper watering of all planting areas, for providing any necessary supplemental water as may be required and shall replace any material damaged due to improper moisture.
8. During the maintenance period, the Contractor shall be responsible for maintaining adequate protection for all planting areas. Removing all litter and foreign debris from planters and planting areas. Any damaged areas shall be repaired, and any plant materials replaced at the Contractor's expense. Replace all shrubs, trees and groundcover deemed to be in poor health or dead during the maintenance period.
9. Weed Control: Keep basins and areas between plants free of weeds. Use recommended legally approved pre-emergent herbicides and removal by hand methods. Avoid frequent soil cultivation that destroys shallow roots. Use mulches to help prevent weed seed germination. Avoid post-emergent herbicides in groundcover areas where overspray may kill young rooted cuttings.
 - a. Use of chemical spraying maybe necessary to rid turf areas of noxious weeds.
10. Insect Control: Maintain a reasonable control with approved materials and methods that are legally accepted in the area.
11. The Contractor's maintenance period will be extended past the (90) days if these provisions are not filled.

3.21 GUARANTEE AND REPLACEMENT:

- A. Any turf/groundcover area found to be dead or in poor condition due to such improper weed abatement practices and/or methods, as determined by the Landscape Architect and/or Owner, shall be replaced by the Contractor at his expense.
- B. Material and Labor involved in the replacing of material shall be supplied by the Landscape Contractor at no additional cost to the Owner.

- C. All plant material installed under the contract shall be guaranteed against any and all poor health, inadequate or inferior materials and or improper installation for a period of one (1) year. This guarantee shall commence on the date of final acceptance of the project after the completion of the contract's maintenance period. Any plant found to be dead or in poor condition resulting from improper planting; fertilization as determined by the District/Landscape Architect shall be replaced by the contractor at no expense to the District.
- D. Any plant material –trees, shrubs, groundcover and/or turf –found to be dead, missing or in poor condition as determined by the Landscape Architect during the contract maintenance period shall be replaced immediately and not at the end of the contract maintenance period. The Landscape Architect shall be the sole judge as to the condition of plant material. Material replaced within the guarantee period shall be replaced by the contractor within seven (7) days.
- E. All plant material shall have new growth trimmed neatly, turf shall be mowed, and all hardscape shall be cleaned prior to final acceptance.

END OF SECTION

SECTION 33 10 00

WATER UTILITIES

1. PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Water mains, valves, fittings, and accessories.
- B. Fire hydrants and assemblies.
- C. Backflow preventer.
- D. Thrust blocks.

1.2 REFERENCES

- A. ASSE 1013 - Performance Requirements for Reduced Pressure Principle Backflow Preventers.
- B. ASSE 1015 - Performance Requirements for Double Check Backflow Prevention Assembly.
- C. AWWA C104 - Standard for Cement-Mortar Lining for Ductile-Iron and Gray Iron Pipe and Fittings for Water.
- D. AWWA C105 - Standard for Polyethylene Encasement for Ductile-Iron Piping for Water and other Liquids.
- E. AWWA C110 - Standard for Gray-Iron and Ductile-Iron Fittings, 3 inch through 48 inch for Water and Other Liquids.
- F. AWWA C111 - Standard for Rubber-Gasket Joints for Ductile-Iron and Gray-Iron Pressure Pipe and Fittings.
- G. AWWA C151 - Standard for Ductile-Iron Pipe Centrifugally Cast in Metal Molds or Sand-Lined Molds for Water or Other Liquids.
- H. AWWA C300 - Standard for Reinforced Concrete Pressure Pipe, Steel Cylinder Type, for Water and Other Liquids.
- I. AWWA C502 - Standard for Dry-Barrel Fire Hydrants.
- J. AWWA C600 - Standard for Installation of Gray and Ductile Cast-Iron Water Mains and Appurtenances.
- K. AWWA C651 - Standard for Disinfecting Water Mains.
- L. AWWA C900 - Standard for Polyvinyl Chloride (PVC) Pressure Pipe, 4 inch through 12 inch for Water.
- M. AWWA C901 - Standard for Polyethylene Pressure. Pipe and Tubing 1/2 inch through 3 inch, for Water Service.
- N. AWWA M17 - Manual for Installation, Field Testing, and Maintenance of Fire Hydrants.
- O. AWWA M23 - Manual for PVC Pipe-Design and Installation.
- P. ASTM B88 - Seamless Copper Water Tube.
- Q. ACPA - American Concrete Pipe Association, Concrete Pipe Handbook.
- R. CDA - Copper Development Association, Copper Tube Handbook.
- S. NFPA 1963 - Standard for Screw Threads and Gaskets for Fire Hose Connections.

- T. UL 246 - Standard for Hydrants for Fire Protection Service.

1.3 REGULATORY REQUIREMENTS

- A. Conform to applicable code for materials and installation of the Work of this Section.

1.4 SUBMITTALS

- A. Submit under provisions of Section 01 33 00.
- B. Submit product data for pipe and pipe accessories.
- C. Submit reports on piping disinfecting.

1.5 PROJECT RECORD DOCUMENTS

- A. Submit documents under provisions of Section 01 77 00.
- B. Accurately record location of pipe runs, connections, and depths.
- C. Identify and describe unexpected variations to subsoil conditions or discovery of uncharted utilities.

2. PART 2 PRODUCTS

2.1 PIPE AND PIPE FITTINGS

- A. General: Provide piping materials and factory-fabricated piping products of sizes, types, pressure ratings, and capacities as indicated.
- B. Piping: Provide pipes of the following materials, of weight/ class indicated. Provide pipe fittings and accessories of same material and weight/class as pipes , with joining method as indicated.
- C. Copper Tube: ASTM B88; Type K hard drawn.
- D. Ductile-Iron Pipe: AWWA C151, with cement mortar lining complying with AWWA C104; Class 51 unless otherwise indicated.
 - 1. Fittings: Ductile-iron, AWWA C110; cement lined, AWWA C104; and rubber-gasket joints, AWWA C111.
 - 2. Encasement: AWWA C105, polyethylene film tube.
- E. Concrete Pipe: Reinforced steel cylinder type, AWWA C300.
 - 1. Fittings: Reinforced concrete pipe fittings.
- F. Polyvinyl Chloride (PVC) Pipe: AWWA C900, Class 150.
 - 1. Fittings: Integral wall (thickened bell end), integral sleeve reinforced bell end or elastomeric gasket couplings meeting the requirements of AWWA C900.
- G. Polyethylene (PE) Pipe: AWWA C901, Class 160.
 - 1. Fittings: Copper alloy or nylon barbed insert type with 2 strap-type stainless steel clamps over pipe at each insert.

2.2 HYDRANT

- A. Type as required by utility company.

2.3 BACKFLOW PREVENTORS

- A. ASSE standard backflow preventer of size indicated for maximum flow rate and maximum pressure loss indicated.
- B. ASSE 1015 double-check backflow prevention assembly with valves on inlet and outlet and strainer on inlet. Include test rocks with 2 positive-seating check valves for continuous-pressure application.

2.4 PIPE IDENTIFICATION

- A. Metallic-Lined Plastic Underground Warning Tapes: Polyethylene plastic tape with metallic core, 6 inches wide by 4 mils thick, solid blue in color with continuously printed caption in black letters "CAUTION - WATER LINE BURIED BELOW."
- B. Nonmetallic Piping Label: Engraved plastic-laminate label, for installation on main electrical meter panel; not less than 1 inch by 3 inches, with captions "CAUTION - THIS STRUCTURE HAS A NONMETALLIC WATER SERVICE."

2.5 PIPE ACCESSORIES

- A. Valves and Fittings: Conform to AWWA Specifications. All valves and fittings shall be designed for an operating pressure larger than the design pressure of lines on which they are installed.
- B. Gate Valves: Double disk parallel seat type, iron body, bronze mounted inside screw, non-rising stem, flanged or screw filling standard hub nut.
- C. Thrust Blocking: Provide on water lines at bends, tees and fire hydrants. Use 2,500 psi concrete as specified in Section 03 30 00. Locate and place in accordance with standard practice.
- D. Access Boxes: Unless otherwise specified in accordance with Section 22 30 00.

2.6 FILL MATERIAL

- A. Sand: Type specified in Section 31 20 00.

3. PART 3 EXECUTION

3.1 EXAMINATION

- A. Verify that trench cut is ready to receive work, and excavations, dimensions, and elevations are as indicated.
- B. Beginning of installation means acceptance of existing conditions.

3.2 PREPARATION

- A. Hand trim excavations to required elevations. Correct over excavation with fill material of sand.
- B. Remove large stones or other hard matter which could damage drainage tile or impede consistent backfilling or compaction.

3.3 INSTALLATION - PIPE AND FITTINGS

- A. Maintain separation of water main from sewer piping in accordance with code.
- B. Install pipe to indicated elevation to within 5/8 inches.
- C. Route pipe in straight line.
- D. Install pipe to allow for expansion and contraction without stressing pipe or joints.
- E. Slope water pipe and position drains at low points.

- F. Form and place concrete for thrust restraints at each elbow or change of direction of pipe.
- G. Copper Tube: Install in accordance with CDA "Copper Tube Handbook"
- H. Ductile-Iron Pipe: Install in accordance with AWWA C600 "Appurtenances."
- I. Concrete Pipe: Install in accordance with ACPA "Concrete Pipe Handbook."
- J. Polyvinyl Chloride (PVC) Pipe: Install in accordance with AWWA M23.
- K. Polyethylene (PE) Pipe: Install in accordance with manufacturer's installation instructions.
- L. Form and place concrete for thrust blocks.
- M. Install warning tape during back-filling of trench for underground water service piping. Locate 8 inches below finished grade directly over piping.
- N. Water Main Connection: Arrange and pay for tap in water main, of size and in location as indicated, from water Purveyor.
- O. Water Service Termination: Terminate water service piping 5'-0" from building foundation in location and invert as indicated. Provide temporary pipe plug for piping extension into building.

3.4 INSTALLATION - HYDRANT

- A. Comply with AWWA M17. Install with gate valve and provision for drainage as indicated.
- B. Set hydrants plumb and locate nozzles perpendicular to roadway.
- C. Set hydrants to grade with nozzles at least 20 inches above ground.
- D. Locate control valve 4 inches away from hydrant.
- E. Provide drainage pit 36 inches square by 24 inches deep filled with 2 inch washed gravel. Encase elbow of hydrant in gravel to 6 inches above drain opening. Do not connect drain opening to sewer.
- F. Paint hydrants in accordance with Section 09 90 00.

3.5 INSTALLATION - BACKFLOW PREVENTOR

- A. Install backflow preventer of type, size and capacity indicated. Include valves and test cocks.
- B. Install according to authority having jurisdiction.
- C. Support backflow preventers, valves, and piping on 2,500-psi; concrete piers as indicated.

3.6 INSTALLATION OF VALVES

- A. General: Install valves as indicated with stems pointing up. Provide valve box over underground valves.

3.7 FIELD QUALITY CONTROL

- A. Piping Tests: Conduct piping tests before joints are covered, and after thrust blocks have sufficiently hardened. Fill pipeline 24 hours prior to testing, and apply test pressure to stabilize system. Use only potable water.
- B. Hydrostatic Test: Test at not less than 1-1/2 times working pressure for two hours.

3.8 ADJUSTING AND CLEANING

- A. Use disinfecting procedure prescribed by authority having jurisdiction.
- B. In case a method is not prescribed by that authority, use procedure described in AWWA C651, or as described below:
 - 1. Fill system or part thereof with water/chlorine solution containing at least 50 ppm of chlorine. Valve off system or part thereof and allow to stand for 24 hours.
 - 2. Drain system or part thereof of previous solution and refill with water/chlorine solution containing at least 200 ppm of chlorine. Valve off system or part thereof and allow to stand for three hours.
 - 3. Flush system with clean potable water until chlorine does not remain in water coming from system.
- C. Prepare reports for all disinfecting activities and submit to Architect.

END OF SECTION

SECTION 33 30 00

SANITARY UTILITIES

1. PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Sanitary drainage piping, fittings, and accessories.
- B. Connection of building sanitary drainage system to municipal sewers.
- C. Manhole access, cleanout access.

1.2 REFERENCES

- A. ACPA - American Concrete Pipe Association.
- B. ASTM C76 - Reinforced Concrete Culvert, Storm Drain, and Sewer Pipe.
- C. ASTM C443 - Joints for Circular Concrete Sewer and Culvert Pipe, Using Rubber Gaskets.
- D. ASTM D2855 - Practice for Making Solvent-Cemented Joints with Poly (Vinyl Chloride) (PVC) Pipe and Fittings.
- E. ASTM D3212 - Specifications for Joints for Drain and Sewer Plastic Pipes Using Flexible Elastomeric Seals.
- F. ASTM D3034 - Type PSM Poly(Vinyl Chloride) (PVC) Sewer Pipe and Fittings.
- G. AWWA C105 - Standard for Polyethylene Encasement for Ductile-Iron Piping for Water and other Liquids.
- H. CISPI - Cast Iron Soil Pipe Institute.

1.3 REGULATORY REQUIREMENTS

- A. Conform to applicable code for materials and installation of the Work of this Section.

1.4 SUBMITTALS

- A. Submit under provisions of Section 01 33 00.
- B. Submit product data for pipe and pipe accessories.

1.5 PROJECT RECORD DOCUMENTS

- A. Submit documents under provisions of Section 01 77 00.
- B. Accurately record location of pipe runs, connections, manholes, cleanouts and invert elevations.
- C. Identify and describe unexpected variations to subsoil conditions or discovery of uncharted utilities.

2. PART 2 PRODUCTS

2.1 SEWER PIPE MATERIALS

- A. Plastic Pipe: ASTM D3034, Type PSM, SDR35 wall thickness, polyvinyl chloride (PVC) material; bell and spigot style solvent sealed end joints.

2.2 PIPE ACCESSORIES

- A. Fittings: Same material as pipe, molded or formed to suit pipe size and end design, in required 'T', bends, elbows, cleanouts, reducers, traps, and other configurations required.

2.3 PIPE IDENTIFICATION

- A. Metallic-Lined Underground Warning Tapes: Polyethylene plastic tape with metallic core, 6 inches wide by 4 mils thick, solid blue in color with continuously printed caption in black letters "CAUTION - SANITARY SEWER LINE BURIED BELOW."

2.4 MANHOLES AND CLEANOUTS

- A. Lid and Frame: Cast iron construction, removable lid, closed lid design; nominal lid and frame diameter as indicated.
- B. Shaft Construction and Eccentric Cone Top Section: Reinforced precast concrete pipe sections, lipped male/female dry joints; cast steel ladder rungs into shaft sections at 12 inches nominal shaft diameter as indicated.
- C. Base Pad: Cast-in-place concrete of type specified in Section 03 30 00; levelled top surface to receive concrete shaft sections, sleeved to receive sewer pipe sections.
- D. Cleanouts: Cast-iron ferrule and countersunk brass cleanout plug, with round cast-iron access frame and heavy-duty secured, scoriated cast-iron cover.

2.5 FILL MATERIAL

- A. Sand: Type specified in Section 31 20 00.

3. PART 3 EXECUTION

3.1 EXAMINATION

- A. Verify that trench cut is ready to receive work, and excavations, dimensions, and elevations are as indicated.
- B. Beginning of installation means acceptance of existing conditions.

3.2 PREPARATION

- A. Hand trim excavations to required elevations. Correct over excavation with fill material of sand.
- B. Remove large stones or other hard matter which could damage drainage tile or impede consistent backfilling or compaction.

3.3 INSTALLATION - PIPE

- A. Extend sanitary sewerage system to connect to building sanitary drain, of sizes and in locations indicated.
- B. Join and install cast-iron soil pipe and fittings with compression gaskets in accordance with CISPI Handbook, Volume I. Use service class gaskets.
- C. Encase cast iron soil pipe and fittings in polyethylene tubing in accordance with AWWA C105.
- D. Join vitrified clay pipe and fittings with rubber sealing elements and install piping in accordance with ASTM C12.
- E. Join concrete pipe and fittings with rubber gaskets and install piping in accordance with ACPA Installation Manual.

- F. Solvent cement ABS pipe and fittings in accordance with ASTM D3212 and install piping in accordance with ASTM D2321.
- G. Solvent cement PVC pipe and fittings in accordance with ASTM D2855 and install piping in accordance with ASTM D2321.
- H. Place pipe on minimum four inch deep bed of sand.
- I. Lay pipe to slope gradient noted on Drawings with maximum variation from true slope of 1/8 inch in 10 feet.
- J. Install warning tape during back-filling of trench for underground sanitary sewer piping. Locate 8 inches below finished grade directly over piping.
- K. Install sand at sides and over top of pipe. Provide top cover to minimum compacted thickness of 12 inches.
- L. Place sand in maximum 6 inch lifts, consolidating each lift.
- M. Increase compaction of each successive lift. Refer to Section 31 20 00 for compaction requirements. Do not displace or damage pipe when compacting.
- N. Connect to municipal sewer system.

3.4 INSTALLATION - MANHOLES

- A. Form bottom of excavation clean and smooth to correct elevation.
- B. Form and place cast-in-place concrete base pad, with provision for sanitary sewer pipe end sections.
- C. Establish elevations and pipe inverted for inlets and outlets as indicated.
- D. Mount lid and frame level in grout, secured to top cone section to elevation indicated.

3.5 INSTALLATION - CLEANOUTS

- A. Install cleanouts and extension from sewer pipe to cleanout at grade as indicated.
- B. Set cleanout frame and cover in concrete block 18 x 18 x 12 inches deep.
- C. Set top of cleanouts flush with paved surfaces. Elsewhere, set top 1 inch above surrounding earth grade.
- D. Install accessories as indicated.
- E. Set top of frame and covers flush with paved surfaces. Elsewhere, set top 3 inches above grade.

3.6 FIELD QUALITY CONTROL

- A. Field inspection will be performed under provisions of Section 01 45 29.

3.7 PROTECTION

- A. Protect finished installation under provisions of Section 01 61 00.
- B. Protect pipe from damage or displacement until backfilling operation is in progress.

END OF SECTION

SECTION 33 40 00

STORM DRAINAGE UTILITIES

1. PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Storm drainage piping, fittings, and accessories.
- B. Connection of building and site storm drainage system to point of disposal.
- C. Catch basins, drywells, cleanouts, outfalls, manhole access.
- D. Paved area drainage, site surface drainage.

1.2 REFERENCES

- A. ACPA - American Concrete Pipe Association.
- B. ASTM A74 - Cast Iron Soil Pipe and Fittings.
- C. ASTM C12 - Practice for Installing Vitrified Clay Pipe Lines.
- D. ASTM C33 - Specification for Cement Aggregates.
- E. ASTM C76 - Reinforced Concrete Culvert, Storm Drain, and Sewer Pipe.
- F. ASTM C700 - Vitrified Clay Pipe, Extra Strength, Standard Strength and Perforated.
- G. ASTM C858 - Specifications for Underground Precast Concrete Utility Structures.
- H. ASTM D2564 - Solvent Cements for Poly (Vinyl Chloride) (PVC) Plastic Pipe and Fittings.
- I. ASTM D2855 - Practice for making Solvent - Cemented Joints with Poly (Vinyl Chloride) (PVC) Pipe and Fittings.
- J. ASTM D2321 - Underground Installation of Thermoplastic Pipe for Sewers and other Gravity-Flow Applications.
- K. ASTM D3034 - Type PSM Poly (Vinyl Chloride) (PVC) Sewer Pipe and Fittings.
- L. ASTM D3350 - Standard Specification for Polyethylene Plastic Pipe and Fittings Materials.
- M. AWWA C105 - Standard for Polyethylene Encasement for Ductile-Iron Piping for Water and other Liquids.
- N. CISPI - Cast Iron Soil Pipe Institute.

1.3 REGULATORY REQUIREMENTS

- A. Conform to applicable code for materials and installation of the Work of this Section.

1.4 SUBMITTALS

- A. Submit under provisions of Section 01 33 00.
- B. Submit product data indicating pipe, pipe accessories and drainage structure.
- C. Submit manufacturer's installation instructions.

1.5 PROJECT RECORD DOCUMENTS

- A. Submit documents under provisions of Section 01 77 00.
- B. Accurately record location of pipe runs, connections, catch basins, manholes, cleanouts, and invert elevations.
- C. Identify and describe unexpected variations to subsoil conditions or discovery of uncharted utilities.

2. PART 2 PRODUCTS

2.1 STORM DRAINAGE PIPE MATERIALS

- A. Reinforced Concrete Pipe: ASTM C76, Class II with Wall Type B; mesh reinforcement; bell and spigot end joints.
- B. Polyvinyl Chloride Pipe (PVC): ASTM D3034; SDR 35 minimum wall thickness; bell and spigot style; solvent cement joints conforming to ASTM D2564.
- C. High Density Polyethylene HDPE: ASTM F2648, ADS N-12 ST IB pipe with a smooth interior; soiltight bell and spigot joint and gaskets conforming to ASTM F477.
- D. High Density Polyethylene HDPE: ASTM F2648, ADS N-12 WT IB pipe with a smooth interior; watertight bell and spigot joints conforming to ASTM D3212 and gaskets per ASTM F477.
- E. Buried Thermoplastic Stormwater Chambers: ASTM F2922 and ASTM F2787.
- F. Perforated Polyvinyl Chloride Pipe (PVC): ASTM D3034; SDR 35 minimum wall thickness; bell and spigot style; solvent cement joints conforming to ASTM D2564; perforations to be symmetrically located in an arc of 160 degrees. Perforations shall have a total open area of at least 0.3 square inches per lineal foot of pipe. Perforations shall be either holes or slots. Diameter of holes may vary from 1/4 inch minimum to 3/8 inch maximum; the width of the slots may vary from 3/16 inch minimum to 5/16 inch maximum; the length of the slot shall not exceed 4 inches.
- G. Athletic Field Turf Underdrain Pipe: ASTM D3350, 1-1/2 inch high x 12 inch wide fabric wrapped high density polyethylene drainage pipe equivalent to AvanEDGE pipe manufactured by Advanced Drainage Systems, www.ads-pipe.com.
- H. Slot Drain: ACO Sports System 3000, www.acousa.com or Sports Edge XT-6 Slot Drain System, www.sportsedge.com.
- I. Substitutions: Under provisions of Section 01 25 13.

2.2 PIPE ACCESSORIES

- A. Fittings: Same material as pipe, molded or formed to suit pipe size and end design, in required 'T', bends, elbows, cleanouts, reducers, traps, and other configurations required.
- B. Geotextile Fabric: As specified in Section 31 20 00.

2.3 PIPE IDENTIFICATION

- A. Metallic-Lined Plastic Underground Warning Tapes: Polyethylene plastic tape with metallic core, 6 inches wide by 4 mils thick, solid blue in color with continuously printed caption in black letters "CAUTION - STORM SEWER SERVICE BURIED BELOW."

2.4 CATCH BASINS

- A. Basin Lid and Frame: Galvanized cast iron construction, hinged lid, linear grill lid design; nominal lid and frame size as indicated. Grate bars to be less than 1/2 inch apart.

- B. Base Pad: Cast-in-place concrete of type specified in Section 32 13 13; levelled top surface sleeved to receive storm sewer pipe sections.

2.5 MANHOLES AND CLEANOUTS

- A. Lid and Frame: Cast iron construction, removable lid, diamond mat lid design; nominal lid and frame diameter as indicated.
- B. Shaft Construction and Eccentric Cone Top Section: Reinforced precast concrete pipe sections, lipped male/female joints; cast steel ladder rungs into shaft sections at 12 inches; nominal shaft diameter as indicated.
- C. Base Pad: Cast-in-place concrete of type specified in Section 03 30 00; levelled top surface to receive concrete shaft sections, sleeved to receive sewer pipe sections.
- D. Cleanouts: Cast-iron ferrule and countersunk brass cleanout plug, with round cast-iron access frame and heavy-duty, secured, scoriated cast-iron cover.

2.6 DRY WELLS

- A. ASTM C858, precast reinforced perforated concrete rings with cast-in-place concrete floor and lift-off-type concrete cover with lift rings.
- B. Wall thickness of 4 inches with 1 inch diameter or 1 x 3 inch slotted perforations totally free area of 15 percent of ring surface.
- C. Aggregate fill for drywell; ASTM C33 gravel, crushed gravel or crushed stone.

2.7 CURB INLETS

- A. Cast-in-place reinforced concrete of type specified in Section 03 30 00. Conform to standards of authority having jurisdiction and as indicated.
- B. All exposed face plates and metal parts to be galvanized.

2.8 OUTFALLS

- A. Cast-in-place reinforced concrete of type specified in Section 03 30 00.
- B. Provide head wall, apron, tapered sides and rip-rap as indicated.
- C. Rip rap to be irregular broken stone weighing between 10 to 40 pounds each.

2.9 FILL MATERIAL

- A. Sand: Type specified in Section 31 20 00.

3. PART 3 EXECUTION

3.1 EXAMINATION

- A. Verify that trench cut is ready to receive work, and excavations, dimensions, and elevations are as indicated.
- B. Beginning of installation means acceptance of existing conditions.

3.2 PREPARATION

- A. Hand trim excavations to required elevations. Correct over excavation with fill material of sand.
- B. Remove large stones or other hard matter which could damage drainage tile or impede consistent backfilling or compaction.

3.3 INSTALLATION - PIPE

- A. Extend storm sewerage piping to connect to building storm drain, of sizes and in locations indicated.
- B. Include storm sewerage system piping and appurtenances from a point 5'-0" outside building foundation to point of disposal.
- C. Join and install cast iron soil pipe and fittings with compression gaskets in accordance with CISPI Handbook, Volume I. Use service class gaskets.
- D. Encase cast iron soil pipe and fittings in polyethylene tubing in accordance with AWWA C105.
- E. Join vitrified clay pipe and fittings with rubber sealing elements and install piping in accordance with ASTM C12.
- F. Join concrete pipe and fittings with rubber gaskets and install piping in accordance with ACPA Installation Manual.
- G. Solvent cement PVC pipe and fittings in accordance with ASTM D2855 and install piping in accordance with ASTM D2321.
- H. Place pipe on minimum 4 inch deep bed of sand.
- I. Install perforated PVC pipe at a minimum slope of 0.05 percent. Coordinate with installation of drainage fill and filter fabric specified in Section 31 20 00 and drainage panel specified in Section 07 13 53.
- J. Install warning tape during back-filling of trench for underground storm drain piping. Locate 8 inches below finished grade directly over piping.
- K. Lay pipe to slope gradients noted with maximum variation from true slope of 1/8 inch in 10 feet.
- L. Install coarse sand at sides and over top of pipe. Provide top cover to minimum compacted thickness of 12 inches.
- M. Place sand in maximum 6 inch lifts, consolidating each lift.
- N. Increase compaction of each successive lift. Refer to Section 31 20 00 for compaction requirements. Do not displace or damage pipe when compacting.
- O. Connect to municipal drainage system.

3.4 INSTALLATION – ATHLETIC FIELD TURF UNDERDRAIN PIPE

- A. Place geotextile fabric over entire prepared subgrade of athletic field. Stake fabric in place with galvanized hair pin ties spaced at 10'-0" on center intervals.
- B. Place field turf underdrain pipe directly on geotextile membrane in herringbone pattern. Space piping as noted in the project drawings.
- C. Place pipe from center of field to perimeter drain system at slope noted in project drawings.
- D. Attach underdrain pipe fabric covering to subgrade with 60 d nails at 3'-0" intervals.
- E. Terminate field turf under drain pipe at perimeter of field. Connect pipe to perimeter drainage system.

3.5 INSTALLATION - CATCH BASINS, AND MANHOLES

- A. Form bottom of excavation clean and smooth to correct elevation.
- B. Form and place cast-in-place concrete base pad, with provision for storm drainage pipe end sections.

- C. Establish elevations and pipe inverts for inlets and outlets as indicated.
- D. Mount lid and frame level in grout, secured to top cone section to elevation indicated.
- E. Install accessories as indicated.
- F. Set top of frame and covers flush with paved surfaces. Elsewhere, set tops 3 inches above grade.

3.6 INSTALLATION - CLEANOUTS

- A. Install cleanouts and extension from sewer pipe to cleanout at grade as indicated.
- B. Set cleanout frame and cover in concrete block 18 x 18 x 12 inches deep.
- C. Set top of cleanout flush with paved surfaces. Elsewhere, set top 1 inch above surrounding earth grade.

3.7 INSTALLATION - DRYWELL

- A. Install as indicated on undisturbed native soil.
- B. Fill around drywell with 1 to 2 inch crushed rock on gravel to a minimum of 12 inches beyond drywell perimeter. Fill drywell full depth with crushed rock or gravel.
- C. Set top of drywell a minimum of 12 inches below finish grade.

3.8 INSTALLATION - INLETS AND OUTFALLS

- A. Construct as indicated of reinforced concrete to elevations required.
- B. Surfaces shall be formed by forms and shall not be shaped by plastering.
- C. Install steps, grating and face plate assemblies as indicated.
- D. Extend rip-rap beyond outfall as indicated.

3.9 FIELD QUALITY CONTROL

- A. Field inspection will be performed under provisions of Section 01 45 29.
- B. Clear interior of piping and structures of dirt and other debris as work progresses.

3.10 PIPELINE FLUSHING

- A. Flush newly constructed storm drain piping with water.
- B. Collect and remove any rock, debris and silt using a metal screen during flushing procedure.

3.11 PROTECTION

- A. Protect finished installation under provisions of Section 01 61 00.
- B. Protect pipe from damage or displacement until backfilling operation is in progress.

END OF SECTION