

PROJECT MANUAL

FOR

PE BUILDING MODERNIZATION AT
EL ROBLE INTERMEDIATE SCHOOL
665 NORTH MOUNTAIN AVENUE
CLAREMONT, CA 91711

DSA Application: 03-125612

OWNER

CLAREMONT UNIFIED SCHOOL DISTRICT
665 NORTH MOUNTAIN AVENUE
CLAREMONT, CA 91711

ARCHITECT

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(909) 987-0909

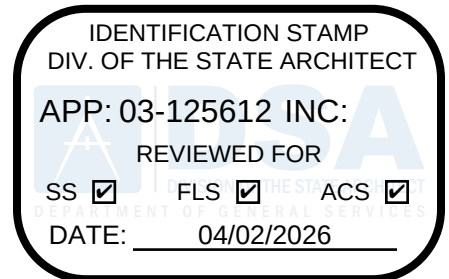
PROJECT 250176
OCTOBER 13, 2025

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FOR
PE BUILDING MODERNIZATION AT
EL ROBLE INTERMEDIATE SCHOOL

PROJECT 250176
DSA APPLICATION NO. 03-125612
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Claremont Unified School District
170 West San Jose Avenue
Claremont, CA 91711

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ARCHITECT

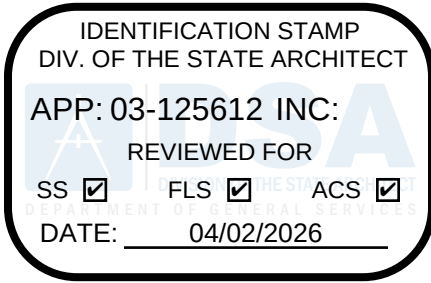
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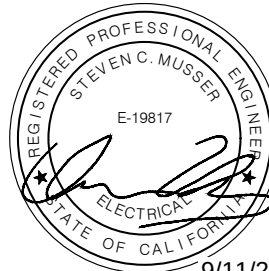
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9/11/25

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EL ROBLE INTERMEDIATE SCHOOL

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NOT USED

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NOT USED

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NOT USED

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NOT USED

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NOT USED

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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. Work under separate contracts.
- C. Work by Owner.
- D. Owner furnished products.
- E. Contractor use of site and premises.
- F. Owner occupancy.
- G. Work restrictions.

1.2 WORK INCLUDED

- A. Work of this Contract comprises general construction including remodeling, demolition of P.E. Building at El Roble Intermediate School located at 665 North Mountain Avenue, Claremont, CA 91711 for Claremont Unified 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.
- B. Preceding Work: Owner will award separate contract(s) for the following construction operations at Project site. Those operations are scheduled to be substantially complete before work under this Contract begins.

1.4 WORK BY OWNER

- A. Items noted "NIC" (Not In Contract) will be furnished and installed by Owner.

1.5 OWNER FURNISHED PRODUCTS

- A. Items noted "OFCI" (Owner-Furnished Contractor Installed) will be furnished by Owner and installed by Contractor.
- B. Items noted "OFOI" (Owner-Furnished Owner Installed) will be furnished by Owner and installed by Owner.
- C. Owner's Responsibilities:
 - 1. Arrange for and deliver Owner reviewed Shop Drawings, Product Data, and Samples to Contractor.
 - 2. Arrange and pay for Product delivery to site.
 - 3. On delivery, inspect Products jointly with Contractor.

4. Submit claims for transportation damage and replace damaged, defective, or deficient items.
 5. Arrange for manufacturer's warranties, inspections, and service.
- D. Contractor's Responsibilities:
1. Review Owner reviewed Shop Drawings, Product Data, and Samples.
 2. Receive and unload Products at site; inspect for completeness or damage, jointly with Owner.
 3. Handle, store, install and finish Products.
 4. Repair or replace items damaged after receipt.
- 1.6 CONTRACTOR USE OF SITE AND PREMISES
- A. Contractor shall have complete use of the site and premises throughout the construction period.
- 1.7 OWNER OCCUPANCY
- A. Full Owner Occupancy: Owner will occupy entire site during entire construction period for conduct of his normal operation.
- B. 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.
- C. Architect will prepare a Certificate of Substantial Completion for each specific portion of the Work to be occupied before Owner occupancy.
- D. 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.
- E. On occupancy, Owner will assume responsibility for maintenance and custodial service for occupied portions of building.
- F. Cooperate with Owner during construction operations to minimize conflicts and facilitate Owner usage.
- G. Perform the Work so as not to interfere with Owner's day-to-day operations.
- H. Maintain existing exits, unless otherwise indicated.
- I. Provide not less than 72 hours notice to Owner of activities that will affect Owner's operations.
- 1.8 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. Cash allowances.
- B. Contingency allowances.
- C. Schedule of Values.
- D. Application for Payment.
- E. Defect assessment.
- F. Non-payment for rejected work.
- G. Change procedures.
- H. Alternates.
- I. Unit prices.

1.2 CASH ALLOWANCES

- A. Include in the contract sum all cash allowances stated herein.
- B. Items covered by cash allowances shall be supplied for such amounts and by such persons as the Owner may direct, but the Contractor shall not be required to employ persons or entities against which the Contractor makes reasonable objection.
- C. Costs Included in Cash Allowances: Cost of Product to Contractor or Subcontractor, less applicable trade discounts; delivery to site and applicable taxes.
- D. Costs Not Included in the Cash Allowance: Product handling at the site, including unloading, uncrating, and storage; protection of products from elements and from damage; labor for installation and finishing; and overhead profit and other expenses contemplated. These expenses shall be included in the contract sum and not in the allowance.
- E. Funds will be drawn from cash allowance amount only by written authorization of the Owner.
- F. At closeout of contract, funds remaining in cash allowance amount will be credited to Owner by change order.
- G. Whenever costs are more than cash allowance amount, the contract amount will be adjusted accordingly by change order.
- H. 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 and product handling at site.

5. Promptly inspect products upon delivery for completeness, damage, and defects. Submit claims for damage.

1.3 CONTINGENCY ALLOWANCE:

- A. Include in the contract sum and base bid 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 to be determined by the Owner.

1.4 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.

1.5 APPLICATIONS FOR PAYMENT

- A. Submit digital copies 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.

1.6 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.

1.7 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.

1.8 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 and a statement describing the effect on Work by separate or other contractors.
- 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.

1.9 ALTERNATES

- A. An alternate is an amount proposed by the bidder and stated on the Bid Form for certain work defined herein that may be added to or deducted from the Base Bid amount if the Owner decides to accept a corresponding change in either the amount of construction to be completed, or in the products, materials, equipment, systems, or installation methods described in the Contract Documents.
- B. The cost for each Alternate is the net addition to or deduction from the Contract Sum to incorporate the Alternate into the Work.
- C. Include as part of each Alternate, miscellaneous devices, accessory objects, and similar items incidental to or required for a complete installation whether or not specifically mentioned as part of the Alternate.
- D. Alternates quoted on Bid Forms will be reviewed and accepted or rejected at the Owner's option. Accepted Alternates will be identified in Owner-Contractor Agreement.
- E. Coordinate related work and modify surrounding work as required to integrate the Work of each Alternate.
- F. Execute accepted alternates under the same conditions as other work of this Contract.

1.10 UNIT PRICES

- A. A unit price is an amount proposed by the bidder and stated on the Bid Form as a price per unit of measurement for materials or services that will be added to or deducted from the Contract Sum by change order in the event the estimated quantities of work required by the Contract Documents are increased or decreased.
- B. Unit prices shall include all necessary material, overhead, profit and applicable taxes.

- C. The Owner reserves the right to reject the Contractor's measurement of work-in-place that involves use of established prices, and to have this work measured by an independent surveyor acceptable to the Contractor at the Owner's expense.
- D. Refer to individual specification sections for construction activities requiring the establishment of unit prices.
- E. Specification sections referenced in the Schedule of Unit Prices contain requirements for materials and methods described under each unit price.
- F. Schedule of Unit Prices:
 - 1. Drilled Concrete Piers (Caissons)
 - (a) Section 03 20 00 - Concrete Reinforcing
 - (b) Section 03 30 00 - Cast-In-Place Concrete
 - (c) Section 31 63 26 - Drilled Caissons

2. PART 2 PRODUCTS

Not Used

3. PART 3 EXECUTION

Not Used

END OF SECTION

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SCHEDULE OF VALUES FORMAT*

Project: PE Building Modernization at El Roble Intermediate 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. 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.
- D. Limit each request to one proposed substitution.
- E. Request to include sufficient data so that direct comparison of proposed substitution can be made.
- F. 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.
- G. 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. Closeout conference.
- G. 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 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. Owner-Furnished equipment.
22. Preparation of Record Drawings.
23. Security.
24. Parking availability.
25. 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 02 43 00 - Structure Moving
4. Section 03 30 00 - Cast-in-Place Concrete
5. Section 04 20 00 - Reinforced Unit Masonry System
6. Section 04 20 13 - Veneer Masonry System
7. Section 04 20 19 - Adhered Masonry Veneer
8. Section 07 13 53 - Elastomeric Sheet Waterproofing
9. Section 07 19 00 - Water Repellants
10. Section 07 51 00 - Built-up Bituminous Roofing
11. Section 07 52 00 - Modified Bituminous Membrane Roofing
12. Section 07 54 23 - Thermoplastic-Polyolefin Roofing
13. Section 09 24 00 - Cement Plastering
14. Section 14 21 23 - Hydraulic Elevators - Passenger
15. 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. Procedures for completing and archiving web-based Project software site data files.
 - 5. Submittal of written warranties.
 - 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 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 - paper submittals.
- G. Shop drawings - paper submittals.
- H. Submittal procedures - electronic submittals.
- I. Shop drawings - electronic submittals.
- J. Product data.
- K. Samples.
- L. Manufacturers' instructions.
- M. Manufacturers' certificates.
- N. 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.
- 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. The General Conditions set forth additional requirements for submittals.

1.3 ARCHITECT'S DIGITAL DATA FILES

- A. Upon written request, and if asked nicely, the 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.

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.

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, 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 SHOP DRAWINGS - PAPER SUBMITTALS

- A. Submit six prints of each drawing. Four copies will be retained by Architect.
- B. Review comments will be shown on returned print. Contractor will make and distribute copies as required for his purpose.
- 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.

1.9 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.
- 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.

1.10 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.

1.11 PRODUCT DATA

- A. When specified in individual specification sections, submit copies of data for each product which Contractor requires.
- B. Submit six copies of product data made in paper format. Four copies will be retained by Architect.
- C. Electronic submittals for product data will comply with Article for electronic submittal procedures stated in this section.
- D. Mark each copy to identify applicable products, models, options, and other data. Supplement manufacturer's standard data to provide information unique to this Project.
- E. Manufacturer's standard product data or catalogs that do not indicate materials or products that are specific to project will be returned without review.
- F. 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.

1.12 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.

1.13 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.

1.14 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.

2. PART 2 PRODUCTS

Not Used

3. PART 3 EXECUTION

3.1 SUBMITTAL SCHEDULE

SUBMITTAL SCHEDULE				
SPEC. SECTION	TITLE	*SAMPLE	**CATALOG SHEET	**SHOP DRAWING
03 52 16	Lightweight Insulating Concrete		6	
03 54 16	Hydraulic Cement Underlayment		6	
04 05 13	Masonry Mortar	2		
04 20 00	Unit Masonry	4	6	
04 20 13	Veneer Masonry System	4	6	
04 20 19	Adhered Masonry Veneer	2	6	
04 23 00	Glass Masonry Units	2	6	
04 40 00	Stone Assemblies	4		
04 72 00	Cast Stone Masonry	2		6
04 73 00	Manufactured Stone Veneer	2	6	
05 12 00	Structural Steel Framing			6
05 21 00	Steel Joist Framing			6
05 31 13	Steel Floor Decking		6	6
05 31 23	Steel Roof Decking		6	6
05 40 00	Cold Formed Metal Framing		6	6
05 50 00	Metal Fabrications			6
05 51 00	Metal Stairs			6
05 51 33	Metal Ladders			6
05 52 00	Metal Railings	2		6

SUBMITTAL SCHEDULE				
SPEC. SECTION	TITLE	*SAMPLE	**CATALOG SHEET	**SHOP DRAWING
05 53 00	Metal Gratings	2		6
06 10 00	Rough Carpentry		6	
06 17 33	Wood I-Joists		6	6
06 17 36	Metal-Web Wood Joists			6
06 17 53	Shop-Fabricated Wood Trusses		6	6
06 18 00	Glue Laminated Construction		6	6
06 20 00	Finish Carpentry	2		6
06 41 13	Wood-Veneer-Faced Architectural Cabinets	2		6
06 41 16	Plastic-Laminate-Clad Architectural Cabinets	2		6
07 12 00	Built-Up Bituminous Waterproofing		6	
07 13 53	Elastomeric Sheet Waterproofing	2	6	6
07 17 00	Bentonite Waterproofing	2	6	6
07 18 00	Traffic Coating	2	6	6
07 19 00	Water Repellents		6	
07 21 13	Rigid Wall Insulation		6	
07 21 15	Continuous Wall Panel Insulation		6	
07 21 16	Blanket Insulation		6	
07 21 19	Foamed-In-Place Insulation		6	
07 21 26	Blown Insulation		6	
07 22 00	Roof and Deck Insulation		6	6
07 22 19	Nailable Insulated Sheathing		6	
07 25 00	Fiberglass Mat Gypsum Board and Air Barrier System	2	6	6
07 27 26	Fluid Applied Membrane Air-Barriers	2	6	6
07 31 13	Asphalt Shingles	2	6	6
07 32 00	Roof Tiles	2	6	
07 42 49	Fiber Cement Cladding System	2	6	6
07 46 23	Wood Siding	2		
07 51 00	Built-Up Bituminous Roofing		6	
07 52 00	Modified Bituminous Membrane Roofing		6	
07 54 19	Polyvinyl-Chloride Roofing	2	6	6

SUBMITTAL SCHEDULE				
SPEC. SECTION	TITLE	*SAMPLE	**CATALOG SHEET	**SHOP DRAWING
07 54 23	Thermoplastic-Polyolefin Roofing	2	6	6
07 61 00	Sheet Metal Roofing	2	6	6
07 62 00	Sheet Metal Flashing and Trim	2	6	6
07 71 23	Manufactured Gutters and Downspouts	2	6	6
07 72 33	Roof Hatches		6	
07 81 00	Applied Fireproofing		6	
07 81 23	Intumescent Fireproofing	2	6	
07 84 00	Firestopping		6	
07 92 00	Joint Sealants	2	6	
07 95 13	Expansion Joint Cover Assemblies		6	6
08 11 13	Hollow Metal Doors and Frames	2	6	6
08 12 13	Hollow Metal Frames		6	6
08 14 00	Wood Doors	2	6	6
08 14 23	Clad Wood Doors	2	6	6
08 31 00	Access Doors and Frames		6	
08 32 00	Sliding Glass Doors	2	6	6
08 33 23	Overhead Coiling Doors		6	6
08 36 13	Sectional Overhead Doors	2	6	6
08 41 13	Aluminum-Framed Entrances and Storefronts	2	6	6
08 43 13	Fire-Rated Aluminum Storefront	2	6	6
08 43 23	Fire-Rated Steel Framed Storefront	2	6	6
08 45 00	Translucent Wall and Roof Assemblies		6	6
08 51 13	Aluminum Windows	2	6	6
08 51 23	Steel Windows	2	6	6
08 52 00	Wood Windows	2	6	6
08 62 00	Unit Skylights		6	6
08 71 00	Door Hardware		6	6
08 80 00	Glazing	2	6	
09 21 16	Gypsum Board Assemblies	1		
09 22 16	Metal Stud Framing System		6	6
09 24 00	Cement Plastering	2	6	

SUBMITTAL SCHEDULE				
SPEC. SECTION	TITLE	*SAMPLE	**CATALOG SHEET	**SHOP DRAWING
09 30 11	Ceramic Tile Floor Finishing	2	6	6
09 30 12	Ceramic Tile Wall Finishing	2	6	6
09 30 13	Fiber Reinforced Porcelain Panels	2	6	6
09 30 14	Porcelain Tile Floor Finishing	2	6	6
09 30 15	Porcelain Tile Wall Finishing	2	6	6
09 30 16	Quarry Tile Floor Finishing	2	6	6
09 51 13	Acoustical Panel Ceilings	2	6	6
09 51 33	Direct Applied Acoustical Ceiling	2	6	6
09 62 23	Bamboo Flooring	2	6	6
09 64 56	Wood Stage Flooring	2	6	6
09 64 66	Wood Athletic Flooring	2	6	6
09 64 69	Wood Athletic Floor Restoration	2	6	
09 65 00	Resilient Flooring	2	6	6
09 65 16	Linoleum Flooring	2	6	6
09 65 17	Linoleum Tile Flooring	2	6	6
09 65 56	Resilient Dance Flooring	2	6	6
09 65 66	Resilient Athletic Flooring	2	6	6
09 65 70	Textile Tile Flooring	2		6
09 65 71	Textile Sheet Flooring	2		6
09 66 13	Portland Cement Terrazzo Flooring	2	6	6
09 66 23	Thin-Set Epoxy Terrazzo Flooring	2	6	6
09 67 26	Quartz Flooring	2	6	
09 68 13	Tile Carpeting	2	6	
09 68 16	Sheet Carpet	2	6	6
09 72 00	Wall Coverings	2	6	
09 72 06	Digital Wall Covering Graphic	2		6
09 77 33	Fiber Reinforced Plastic Panels	2	6	
09 84 13	Fabric Covered Sound-Absorbing Panels	2		3
09 84 33	Sound-Absorbing Wall Panels	2		6
09 90 00	Painting	2	6	
09 96 23	Graffiti Resistant Coating	2	6	

SUBMITTAL SCHEDULE				
SPEC. SECTION	TITLE	*SAMPLE	**CATALOG SHEET	**SHOP DRAWING
10 11 17	Glass Marker Boards	2	6	6
10 11 19	Markerboards and Tackboards	2	6	6
10 11 43	Tackable Wallboard Systems	2	6	
10 14 00	Signage	2	6	6
10 21 11	Metal Toilet Compartments	2	6	6
10 21 12	Stainless Steel Toilet Compartments	2	6	6
10 21 14	Plastic Laminate Toilet Compartments	2	6	6
10 21 15	Plastic Toilet Compartments	2	6	6
10 21 19	Phenolic Toilet Compartments	2	6	6
10 21 20	Solid Color Reinforced Composite Toilet Compartment	2	6	6
10 22 39	Folding Panel Partitions	2	6	6
10 22 41	Folding Glass Partitions		6	6
10 28 13	Toilet Accessories		6	
10 44 00	Fire Protection Specialties		6	
10 51 13	Metal Lockers	2	6	6
10 56 26	Mobile Storage Shelving	2	6	6
10 75 00	Flag Poles	2	6	6
10 82 00	Grilles and Screens	2	6	6
11 13 13	Dock Bumpers		6	6
11 13 19	Dock Levelers		6	6
11 13 21	Hydraulic Dock Lifts		6	6
11 40 00	Food Service Equipment		6	6
11 61 43	Stage Curtains	2	6	
11 66 23	Gymnasium Equipment	2	6	6
11 66 43	Interior Scoreboards	2	6	6
11 68 33	Athletic Field Equipment		6	6
11 90 00	Miscellaneous Equipment		6	
12 21 13	Horizontal Louver Blinds	2	6	6
12 21 16	Vertical Louver Blinds	2	6	6
12 24 13	Roller Shades	2	6	6

SUBMITTAL SCHEDULE				
SPEC. SECTION	TITLE	*SAMPLE	**CATALOG SHEET	**SHOP DRAWING
12 48 43	Floor Mats	2	6	
12 61 00	Fixed Audience Seating	2	6	6
12 66 13	Telescoping Bleachers	2	6	6
13 34 23	Pre-Engineered Metal Shade Canopies	2	6	6
14 21 23	Electric Traction Elevators - Passenger	2	6	6
14 24 23	Hydraulic Passenger Elevators	2	6	6
14 42 00	Wheelchair Lifts	2	6	6
32 12 16	Asphalt Paving		6	
32 12 23	Stamped Asphalt Pavement		6	6
32 12 33	Solar Reflective Pavement Coating		6	6
32 13 13	Concrete Paving		6	
32 13 14	Pervious Concrete Paving		6	
32 18 13	Synthetic Grass Surfacing	2	6	6
32 18 16	Resilient Play Area Surfacing	2	6	
32 18 17	Fiber Playground Surfacing	2	6	6
32 18 23	Synthetic Running Track Surface	2	6	6
32 18 24	Synthetic Running Track Resurfacing	2	6	
32 31 13	Chain Link Fences and Gates	2	6	6
32 31 19	Decorative Metal Fences and Gates	2	6	6
32 31 30	Automatic Gates		6	6
32 80 00	Irrigation		6	

SUBMITTAL SCHEDULE				
SPEC. SECTION	TITLE	*SAMPLE	**CATALOG SHEET	**SHOP DRAWING
32 90 00	Planting		6	
33 10 00	Water Utilities		6	
33 30 00	Sanitary Utilities		6	
33 40 00	Storm Drainage Utilities		6	
33 51 00	Natural Gas Distribution		6	

* Samples are required for Architect's "color and material board". To expedite approval, Contractor shall expedite the submittal of these items. Color selections will not be made until all such items are received.

* * Number of Catalog Sheets and Shop Drawings are for submittals made in paper form.

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. 2025 California Building Standards Administrative Code (CBSAC), California Code of Regulations (CCR), Title 24, Part 1
 - 2. 2022 California Building Code (CBC) California Code of Regulations (CCR) Title 24, Part 2 (2021 International Building Code (IBC) with California amendments)
 - 3. 2022 California Electrical Code (CEC) California Code of Regulations (CCR) Title 24, Part 3 (2020 National Electric Code (NEC) with California amendments)
 - 4. 2022 California Mechanical Code (CMC) California Code of Regulations (CCR) Title 24, Part 4 (2021 Uniform Mechanical Code (UMC) with California amendments)
 - 5. 2022 California Plumbing Code (CPC) California Code of Regulations (CCR) Title 24, Part 5 (2021 Uniform Plumbing Code (UPC) with California amendments)
 - 6. 2022 California Energy Code, California Code of Regulations (CCR) Title 24, Part 6

7. 2022 California Existing Building Code (CEBC) California Code of Regulations (CCR) Title 24, Part 10	(2021) International Existing Building Code (IEBC) with California Amendments)

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) Prestressed Concrete - 1705A.3.4, Table 1705A.3 and 1910A.3
- (6) Precast Concrete - 1705A.3 and Table 1705A.3
- (7) Post Installed Anchors In Concrete - Table 1705A.3, 1910A.5 and 1909.2.7
- (8) Masonry - 1705A.4, TMS 402 and TMS 602 Table 3 and 4
- (9) Post Installed Anchors in Masonry - Table 1705A.3, 1910A.5 and 1909.2.7
- (10) Glass Unit Masonry - 1705.4.1
- (11) Masonry Veneer - 1705A.4.1
- (12) Structural Glued-Laminated Timber - 1705A.5.4
- (13) Wood - 1705A.5
- (14) Soils - 1705A.6 and Table 1705A.6
- (15) Pile Foundation - 1705A.7 and Table 1705A.7
- (16) Pier Foundation - 1705A.8 and Table 1705A.8
- (17) Sprayed Fire-Resistant Materials - 1705A.14
- (18) Mastic and Intumescent Fire-Resistant Coatings - 1705A.17.1, 1705A.17.2
- (19) Exterior Insulation and Finish Systems - 1705A.16
- (20) Water-Resistive Barrier - 1705A.16.1
- (21) Penetration Fire Stops and Joints - 1705A.17
- (22) Smoke Control Systems - 1705A.18
- (23) Shotcrete - 1705A.19, 1908A.5, 1908A.10
- (24) Reinforced Gypsum Concrete - 2514
- (25) Composition Construction Cores - 1910A.4
- (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) Structural Wood - Continuous and Periodic Inspection - 1705A.11.1 and 1705A.12.2
 - (3) Cold-Formed Steel Framing - Periodic Inspection- 1705A.11.2 and 1705A.12.3
 - (4) Storage Racks and Access Floors - Periodic Inspection - 1705A.12.7
 - (5) Architectural Components - Periodic Inspection - 1705A.12.5
 - (6) Mechanical and Electrical Components - Periodic Inspection - 1705A.12.6

- (7) Designated Seismic Systems - Verification - 1705A.13.3
 - (8) Seismic Isolation Systems - Continuous Inspection - 1705A.12.8 and 1705A.13.4
- 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) Guniting/Shotcrete - 1908A.5, 1908A.10
 - (3) Reinforcing Bars Table - 1705A.2.1, 1910A.2
 - (4) Waiver of Reinforcing Bar Tests - 1910A.2
 - (5) Prestressing Steel & Anchorage - 1910A.3
 - (6) Batch Plant Inspection - 1705A.3.3
 - (7) Waiver of Batch Plant Inspection - 1705A.3.3.1, 1705A.3.3.2
 - (8) 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) Pre-Fabricated Wood I-Joists - 2303.1.2
 - (3) Glued-Laminated Members - 2303.1.3
 - (4) Wood Structural Panels - 2303.1.5
 - (5) Fiberboard - 2303.1.6
 - (6) Hardboard - 2303.1.7
 - (7) Particleboard - 2303.1.8
 - (8) Floor Underlayment - 2303.1.8.1
 - (9) Preservative Treatment - 2303.1.9
 - (10) Structural Composite Lumber - 2303.1.10
 - (11) Fire-Retardant Treated Wood - 2303.2

- (b) Wood Inspection
 - (1) Timber Connectors - 1705A.5.6
 - (2) Plate Connected Wood Trusses - 1705A.5.2
 - (3) Glu-Laminated Fabrication - 1705A.5.4
- 7. Veneer (Chapter 14)
 - (a) Materials
 - (1) Masonry Units - 1403.4, 2103A
 - (2) Precast Concrete Units - 1403.6
 - (3) Mortar and Grout 2103A.2, 2103A.3
 - (4) Bond and Shear Tests - 1410.2.1
 - (b) Inspection of Veneer
 - (1) Veneer Inspection - 1705A.4.1
- 8. Roof Covering (Chapter 15)
 - (a) Installation
 - (1) Roof Tile - 1507.3.10, 1513
- 9. Aluminum (Chapter 20)
 - (a) Materials
 - (1) General - 2002.1
 - (b) Inspection
 - (1) Testing and Inspection - 2003.1
- 10. 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) Structural Steel - 2202.1

(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 - 1704.4 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.
- E. Permanent convenience receptacles may be utilized during construction.

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 and for public access to existing building.
- 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.

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.

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 INTERIOR ENCLOSURES

- A. Provide temporary partitions and ceilings as required to separate work areas from Owner occupied areas, to prevent penetration of dust and moisture into Owner occupied areas, and to prevent damage to existing materials and equipment.

1.21 SECURITY

- A. Provide security and facilities to protect Work and existing facilities and Owner's operations from unauthorized entry, vandalism, or theft.
- B. Coordinate with Owner's security program.

1.22 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.
- E. Designated existing on-site roads may be used for construction traffic.

1.23 PARKING

- A. Arrange for temporary surface parking areas to accommodate construction personnel.
- B. Existing on-site parking areas may be used for construction personnel.

1.24 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.

1.25 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.

1.26 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.

1.27 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.
- E. Permanent facilities shall not be used for field offices.
- 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.

1.28 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 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.
- M. Do not use materials and equipment removed from existing premises, except as specifically permitted by the Contract Documents.
- N. Where product is designated to match an existing product, provide product that matches in size, profile, finish, dimension and other characteristics the existing product identified.

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 73 29

CUTTING AND PATCHING

1. PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Requirements and limitations for cutting and patching of Work.

1.2 DEFINITIONS

- A. Cutting: Removal of in-place construction necessary to permit installation or performance of other work.
- B. Patching: Fitting and repair work required to restore surfaces to original or specified conditions after installation of other work.

1.3 REGULATORY REQUIREMENTS

- A. Unless specifically shown on the drawings, no structural member shall be cut, drilled, or notched without prior written authorization from the Architect and the Division of the State Architect.

1.4 SUBMITTALS

- A. Submit written request in advance of cutting or patching which affects:

- 1. Structural integrity of any element of Project.
- 2. Integrity of weather-exposed or moisture-resistant element.
- 3. Efficiency, maintenance, or safety of any operational element.
- 4. Visual qualities of sight exposed elements.
- 5. Work of Owner or separate contractor.

- B. Include in request:

- 1. Identification of Project.
- 2. Location and description of affected work.
- 3. Necessity for cutting or patching.
- 4. Description of proposed work, and Products to be used.
- 5. Alternatives to cutting and patching.
- 6. Effect on work of Owner or separate contractor.
- 7. Written permission of affected separate contractor.
- 8. Date and time work will be executed.

1.5 QUALITY ASSURANCE

- A. Do not cut and patch structural elements in a manner that could change their load-carrying capacity or load-deflection ratio.
- B. Do not cut or patch operating elements that would reduce their capacity to perform or that would result in increased maintenance or decreased operational life or safety.

- C. Do not cut or patch construction that would result in visual evidence of cutting or patching.
- D. Remove and replace construction that has been cut or patched in a visually unsatisfactory manner.

2. PART 2 PRODUCTS

2.1 MATERIALS

- A. Primary Products: Those required for original installation.
- B. Substitutions: Under provisions of Section 01 25 13.

3. PART 3 EXECUTION

3.1 EXAMINATION

- A. Inspect existing conditions prior to commencing Work, including elements subject to damage or movement during cutting and patching.
- B. After uncovering existing Work, inspect conditions affecting performance of work.
- C. Beginning of cutting or patching means acceptance of existing conditions.

3.2 PREPARATION

- A. Provide temporary supports to ensure structural integrity of the Work. Provide devices and methods to protect other portions of Project from damage.
- B. Provide protection from elements for areas which may be exposed by uncovering work.

3.3 CUTTING AND PATCHING

- A. Execute cutting, fitting, and patching to complete Work.
- B. Fit Products together, to integrate with other work.
- C. Uncover work to install ill timed work.
- D. Remove and replace defective or non-conforming work.
- E. Remove samples of installed work for testing when requested.
- F. Provide openings in the Work for penetration of mechanical and electrical work.
- G. Cut rigid materials using saw or drill. Pneumatic tools not allowed without prior approval.

3.4 PERFORMANCE

- A. Execute work by methods to avoid damage to other Work, and which will provide appropriate surfaces to receive patching and finishing.
- B. Employ skilled and experienced installer to perform cutting and patching.
- C. Cut rigid materials using masonry saw or core drill. Pneumatic tools not allowed without prior approval.
- D. Restore work with new Products in accordance with requirements of Contract Documents.
- E. Fit work air tight to pipes, sleeves, ducts, conduit, and other penetrations through surfaces.
- F. At penetrations of fire rated walls, partitions, ceiling, or floor construction, completely seal voids with fire rated material, to full thickness of the penetrated element.

- G. Refinish surfaces to match adjacent finish. For continuous surfaces, refinish to nearest intersection or natural break. For an assembly, refinish entire unit.

3.5 CLEANING

- A. Clean areas and spaces where cutting and patching was performed.
- B. Completely remove paint, mortar, oils, sealant, and similar materials.

END OF SECTION

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. 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.

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.
- 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: Same digital data software program, version, and operating system as the original Contract Drawings.
 2. Format: Annotated PDF electronic file with comment function enabled.
 3. Incorporate changes and additional information previously marked on record prints. Delete, redraw, and add details and notations where applicable.
 4. Refer instances of uncertainty to Architect through Construction Manager for resolution.
 5. 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. 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.

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. Each prime contractor is responsible for warranties related to its own contract.
- E. Execute and assemble documents from subcontractors, suppliers, and manufacturers.
- F. Provide Table of Contents and assemble in binder with durable plastic cover.
- G. Submit prior to final Application for Payment.
- H. Manufacturer's disclaimers and limitations on product warranties do not relieve Contractor of warranty on the work that incorporates the products.
- I. Manufacturer's disclaimer and limitations on product warranties do not relieve suppliers, manufacturers, and subcontractors required to countersign special warranties with Contractor.
- J. 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.
- K. 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.
- L. 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.

2. PART 2 PRODUCTS

Not Used

3. PART 3 EXECUTION

Not Used

END OF SECTION

SECTION 02 41 19

SELECTIVE DEMOLITION

1. PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Removal of designated building equipment and fixtures.
- B. Removal of designated construction.
- C. Disposal of materials.
- D. Cap and identify utilities.
- E. Temporary partitions to allow building occupancy.
- F. Temporary fire protection.
- G. Schedule of materials and equipment.

1.2 DEFINITIONS

- A. Remove: Detach items from existing construction and legally dispose of them 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.

1.3 MATERIALS OWNERSHIP

- A. Historic items, relics, cornerstones, commemorative plaques, tablets and similar objects encountered during demolition are to remain the Owner's property.
- B. Carefully remove each item in a manner to prevent damage and deliver to Owner.

1.4 SUBMITTALS

- A. Predemolition Photographs: Show conditions of existing adjacent construction and site improvements that might be misconstrued as damaged by demolition operations. Submit before work begins.
- B. Record Documents: Submit under provisions of Section 01 77 00. Accurately record locations of utilities and subsurface obstructions.

1.5 REGULATORY REQUIREMENTS

- A. Conform to applicable codes for demolition work, safety of structure, electrical disconnection and reconnection dust control and disposal of materials.
- B. Comply with California Fire Code (CFC), California Code of Regulations, (CCR) Title 24, Part 9, Chapter 5 - Fire Service Features and Chapter 33 - Fire Safety During Construction and Demolition.
- C. Obtain required permits from authorities.
- D. Notify affected utility companies before starting work and comply with their requirements.
- E. Do not close or obstruct egress width to exits.
- F. Do not disable or disrupt building fire or life safety systems without 3 day prior written notice to the Owner.

1.6 EXISTING CONDITIONS

- A. Areas of buildings to be demolished will be evacuated and their use discontinued before start of work.
- B. Owner will occupy building(s) adjacent to demolition area. Conduct demolition so owner's operation will not be disrupted.
- C. Provide at least 72 hour notice to Owner of activities that will affect Owner's operation.
- D. Maintain access to existing walkways, exits and other adjacent occupied facilities.
- E. Owner assumes no responsibility for areas of buildings to be demolished.
- F. Hazardous Materials: It is not anticipated that hazardous materials will be encountered in the work.
 - 1. Hazardous materials will be removed by Owner before start of work.
 - 2. Hazardous materials will be removed by Owner under separate contract.
 - 3. If materials suspected of containing hazardous materials are encountered, do not disturb. Notify Architect.
 - 4. Conform to applicable regulatory procedures when discovering hazardous or contaminated materials.

1.7 SCHEDULING

- A. Schedule work under provisions of Section 01 32 17.
- B. Schedule Work to coincide with owner occupancy.
- C. Perform work during normal hours of operation.
- D. Notify Owner in writing 5 days in advance of any required work to be performed on a weekend or holiday.
- E. Perform noisy, malodorous, dusty, work during hours agreed upon by the Owner.
- F. Coordinate utility and building service interruptions with Owner.
- G. Schedule tie-ins to existing systems to minimize disruption.
- H. Coordinate Work to ensure fire sprinklers, fire alarms, smoke detectors, emergency lighting, exit signs and other life safety systems remain in full operation in occupied areas.

1.8 PROJECT CONDITIONS

- A. Conduct demolition to minimize interference with adjacent and occupied building areas.
- B. Cease operations immediately if structure appears to be in danger and notify Architect. Do not resume operations until directed.

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.
- D. Verify that hazardous waste remediation is complete.

3.2 PREPARATION

- A. Existing Utilities: Locate, identify, disconnect and seal or cap off indicated utilities serving areas to be demolished.
- B. Protect existing items which are not indicated to be salvaged, removed, or altered.
- C. Erect and maintain weatherproof closures for exterior openings.
- D. Erect and maintain temporary partitions to prevent spread of dust, fumes, noise, and smoke to provide for Owner occupancy as specified in Section 01 11 00.

3.3 DEMOLITION

- A. Conduct demolition to minimize interference with adjacent and occupied building areas.
- B. Cease operations immediately if structure appears to be in danger. Notify Architect. Do not resume operations until directed.
- C. Maintain protected egress and access to the Work.
- D. Maintain fire safety during demolition in accordance with CFC, Chapter 33.
- E. Demolish in an orderly and careful manner. Protect existing supporting structural members.

3.4 DISPOSAL OF DEMOLISHED MATERIALS

- A. Except for items to be reinstalled, or otherwise 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.

3.5 CLEANING

- A. Clean adjacent structures and improvements of dust, dirt and debris caused by demolition.
- B. Remove temporary construction.
- C. Return adjacent areas to condition existing before demolition operations began.
- D. Leave site in a clean condition.

END OF SECTION

SECTION 03 10 00
CONCRETE FORMING AND ACCESSORIES

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. This Section is related to concrete forming and accessories and includes:
 - 1. Formwork for cast-in-place concrete, with shoring, bracing, and anchorage.
 - 2. Installation of items to be embedded in concrete, such as anchor bolts, inserts, embeds, and sleeves.
 - 3. Openings for other work.
 - 4. Form accessories.
 - 5. Form stripping.
- B. Related Sections:
 - 1. Section 03 20 00: Concrete Reinforcing.
 - 2. Section 03 30 00: Cast-in-Place Concrete.
 - 3. Section 05 12 00: Structural Steel Framing.
- C. Reference Standards:
 - 1. ACI 117 Standard Specifications for Tolerances for Concrete Construction and Materials.
 - 2. ACI 301 Specifications for Structural Concrete.
 - 3. ACI 318-14 Building Code Requirements for Structural Concrete and Commentary.
 - 4. ACI 347 Guide to Formwork for Concrete.
 - 5. National Institute of Standards and Technology - PS 1 Structural Plywood
 - 6. 2022 California Building Code.
 - 7. 2022 California Building Code, Title 24 CCR, Chapter 19A.
 - 8. APA American Plywood Association Design and Construction Guide. PS 1-109 Structural Plywood.
 - 9. Local AQMD – San Joaquin Valley Air Pollution District.

1.3 SUBMITTALS

- A. See Section 01 33 00: Submittal Procedures.
- B. Product Data: Provide data on void form materials and installation requirements.
- C. Shop Drawings: Indicate pertinent dimensions, materials, bracing, and arrangement of joints and ties. Review and approval will not include form strength and adequacy.
- D. Keep an accurate record of the dates of removal of forms, form shores and reshores, and furnish copies to the SEOR.

1.4 QUALITY ASSURANCE

- A. Comply with the pertinent provisions of Section 01 40 00: Quality Requirements.

- B. Construct forms according to ACI 347, "Guide to Formwork for Concrete," and conforming to tolerances of ACI 117, "Standard Specifications for Tolerances for Concrete Construction and Materials."
- C. Designer Qualifications: Design formwork under direct supervision of a Professional Structural Engineer experienced in design of concrete formwork and licensed in California.
- D. Maintain one copy of each installation standard on site throughout the duration of concrete work.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Comply with pertinent provisions of Section 01 60 00: Product Requirements, delivering materials in a timely manner to ensure uninterrupted progress.
- B. Store prefabricated forms off ground in ventilated and protected manner to prevent deterioration from moisture.
 - A. Deliver void forms and installation instructions in manufacturer's packaging.
 - B. Store void forms off ground in ventilated and protected manner to prevent deterioration from moisture.

PART 2 PRODUCTS

2.1 FORMWORK - GENERAL

- A. Provide concrete forms, accessories, shoring, and bracing as required to accomplish cast-in-place concrete work.
- B. Design and construct to provide resultant concrete that conforms to design with respect to shape, lines, and dimensions.
- C. Comply with applicable state and local codes with respect to design, fabrication, erection, and removal of formwork.
- D. Comply with relevant portions of ACI 347, ACI 301, and ACI 318.

2.2 WOOD FORM MATERIALS

- A. Softwood Plywood: PS 1, B-B Medium or High Density Concrete Form Overlay, Class I, grade marked, not mill oiled.
- B. Lumber: DF species; WCLIB Construction grade or better, WWPA No. 1 grade or better; with grade stamp clearly visible.

2.3 REMOVABLE PREFABRICATED FORMS

- A. Void Forms: Moisture resistant treated paper faces, biodegradable, structurally sufficient to support weight of wet concrete mix until initial set; two inches (2") thick.

2.4 FORMWORK ACCESSORIES

- A. Form Ties: Prefabricated rod, flat band, wire, internally threaded disconnecting type, or equal, not leaving metal within 1-1/2 inches of concrete surface.

- B. Form Release Agent:
 - 1. Capable of releasing forms from hardened concrete without staining or discoloring concrete or forming bug holes and other surface defects, compatible with concrete and form materials, and not requiring removal for satisfactory bonding of coatings to be applied:
 - a. Composition: Colorless reactive, mineral oil-based, soy-based, or vegetable oil-based compound.
 - b. Do not use materials containing diesel oil or petroleum-based compounds.
 - c. VOC content: In compliance with applicable local, state, and federal regulations.
- C. Embedded Anchor Shapes, Plates, Angles and Bars: As specified in Section 05 12 00: Structural Steel Framing.

2.5 PREFABRICATED FORMS

- A. Tubular Column Type: Round, spirally wound laminated fiber material, surface treated with release agent, non-reusable, of sizes indicated.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Verify lines, levels, and centers before proceeding with formwork. Ensure that dimensions agree with Drawings.

3.2 EARTH FORMS

- A. Hand trim sides and bottom of earth forms. Remove loose soil prior to placing concrete. Sides of all footings and grade beams shall be formed, unless the member detail provides at least three inches (3") clear cover to reinforcement and indicates the member is cast against earth. Remove formwork prior to backfilling operations.

3.3 ERECTION - FORMWORK

- A. Erect formwork, shoring, and bracing to achieve design requirements, in accordance with requirements of ACI 301.
- B. Rigidly construct forms to prevent mortar leakage, sagging, displacement, or bulging between studs. Use clean, sound, approved form material, coated with specified materials only, not oil. Provide backing on all plywood joints.
- C. Coat forms with the specified resin coating, not form oil. Construct forms to exact shapes, sizes, lines, and dimensions required to obtain level, plumb, and straight surfaces. Provide openings, offsets, keys, reglets, anchorages, recesses, moldings, chamfers, blocking, screeds, drips, bulkheads, and all other required features. Make forms easily removable without hammering or prying against concrete. Space forms apart with metal spreaders. Construct forms to accurate alignment, locations, and grades, and provide against sagging, leakage of concrete mortar, or displacement occurring during and after placing of concrete. Coordinate installation of inserts and anchors in forms according to shop drawings and requirements for Work of other Sections.
- D. Provide bracing to ensure stability of formwork. Shore or strengthen formwork subject to overstressing by construction loads.

- E. Corners and angles: Provide 3/4-inch by 3/4-inch beveled chamfer strips for all exposed concrete corners and angles square unless indicated otherwise.
- F. Reglets and Rebates: Form required reglets and rebates to receive frames, flashing, and other equipment. Obtain required dimensions, details, and precise positions for Work to be installed under other Sections and form concrete accordingly.
- G. Form Joints: Align joints and make watertight. Keep form joints to a minimum. Fill joints to produce smooth surfaces, intersections, and arises. Use polymer foam or equivalent fillers at joints and where forms abut or overlap existing concrete to prevent leakage of mortar.
- H. Recesses, Drips, and Profiles: Provide smooth milled wood or pre-formed rubber or plastic shapes of types shown and required.
- I. Cleanouts and Cleaning: Provide temporary openings in all wall forms and other vertical forms for cleaning and inspection. Clean forms and surfaces to receive concrete prior to placing.
- J. Re-Use: Clean and recondition form material before re-use.

3.4 APPLICATION - FORM RELEASE AGENT

- A. Apply form release agent on formwork in accordance with manufacturer's recommendations.
- B. Apply prior to placement of reinforcing steel, anchoring devices, and embedded items.
- C. Do not apply form release agent where concrete surfaces will receive special finishes or applied coverings that are affected by agent. Soak inside surfaces of untreated forms with clean water. Keep surfaces coated prior to placement of concrete.

3.5 INSERTS, EMBEDDED PARTS, AND OPENINGS

- A. All necessary pipe sleeves, anchors, or other required inserts shall be accurately installed as part of the work of other Sections, according to Section 03 30 00: Cast-In-Place Concrete, for submittal requirements related to this scope.
- B. Obtain approval before framing openings in structural members that are not indicated on Drawings.
- C. Provide formed openings where required for items to be embedded in passing through concrete work.
- D. Locate and set in place items that will be cast directly into concrete.
- E. Conduits or Pipes:
 - 1. Locate so as not to reduce strength of the concrete.
 - 2. Do not place pipes, other than conduits, in a slab 4-1/2 inches thick or less in any case. Conduit buried in a concrete slab shall not have an outside dimension greater than 1/3 the slab thickness nor be placed below the bottom reinforcing or over the top reinforcing.
 - 3. Sleeves: Pipe sleeves may pass through the slab or walls if not exposed to rusting or other deterioration and are of uncounted or galvanized iron or steel. Provide sleeves of diameter large enough to pass any hub or coupling on pipe, including any insulation.

4. Conduits may be embedded in walls only if the outside diameter does not exceed 1/3 the wall thickness, are spaced no closer than three (3) diameters on centers, and not impair the strength of the structure.
- F. Coordinate with work of other Sections in forming and placing openings, slots, reglets, recesses, sleeves, bolts, anchors, other inserts, and components of other Work.
 - G. Install accessories in accordance with manufacturer's instructions so they are straight, level, and plumb. Ensure items are not disturbed during concrete placement.
 - H. Install waterstops in accordance with manufacturer's instructions, so they are continuous without displacing reinforcement. Heat seal joints so they are watertight.
 - I. Provide temporary ports or openings in formwork where required to facilitate cleaning and inspection. Locate openings at bottom of forms to allow flushing water to drain.
 - J. Close temporary openings with tight fitting panels, flush with inside face of forms, and neatly fit so joints will not be apparent in exposed concrete surfaces.

3.6 FORM CLEANING

- A. Clean forms as erection proceeds to remove foreign matter within forms.
- B. Clean formed cavities of debris prior to placing concrete.

3.7 FORMWORK TOLERANCES

- A. Construct formwork to maintain tolerances required by ACI 117, unless otherwise indicated.
- B. Deflection: Limit deflection of forming surfaces from concrete pressure to L/240.
- C. Finish Lines:
 1. Position formwork to maintain hardened concrete finish lines within following permissible deviations:
 - a. Variation from plumb:

In 10'-0"	1/4 inch
In any story or 20'-0"	3/8 inch
In 40'-0" or more	3/4 inch
 - b. Variation from level or grades indicated:

In 10'-0"	1/4 inch
In any story or 20'-0"	3/8 inch
In 40'-0" or more	3/4 inch
 - c. Cross-sectional dimensions:

Minus	1/4 inch
Plus	1/2 inch

3.8 FIELD QUALITY CONTROL

- A. An independent testing agency will perform field quality control tests, as specified in Section 01 40 00: Quality Requirements.
- B. Inspect erected formwork, shoring, and bracing to ensure that work is in accordance with formwork design, and to verify that supports, fastenings, wedges, ties, and items are secure.

3.9 FORM REMOVAL

- A. Do not remove forms or bracing until concrete has gained sufficient strength to carry its own weight and all superimposed loads as determined by testing field cured cylinders, but not sooner than specified in ACI 347. Load supporting forms may be removed when concrete has attained 75 percent of required 28-day compressive strength, but no sooner than three (3) days, provided construction is reshored. Vertical formwork for cast-in-place concrete walls may be removed no sooner than one (1) day following concrete placement, provided that Contractor can demonstrate that no sloughing or sagging of concrete will occur:
 - 1. Reshore structural members as specified per ACI 347.
 - 2. Remove formwork progressively so unbalanced loads are not imposed on the structure.
 - 3. Avoid damage to concrete surfaces during removal.
 - 4. Remove formwork in same sequence as concrete placement to achieve similar concrete surface coloration.
- B. Do not remove forms or bracing until concrete has gained sufficient strength to carry its own weight and imposed loads.
- C. Loosen forms carefully. Do not wedge pry bars, hammers, or tools against finish concrete surfaces scheduled for exposure to view.
- D. Store removed forms to prevent damage to form materials or to fresh concrete. Discard damaged form.

END OF SECTION 03 10 00

SECTION 03 20 00
CONCRETE REINFORCING

PART 1 GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. This Section is related to concrete reinforcement and includes:
1. Reinforcing steel for cast-in-place concrete foundations.
 2. Reinforcing steel for cast-in-place concrete slabs-on-grade.
 3. Supports and accessories for steel reinforcement.
- B. Related Sections:
1. Section 03 10 00: Concrete Forming and Accessories.
 2. Section 03 30 00: Cast-in-Place Concrete.
 3. Section 05 12 00: Structural Steel Framing.
- C. Reference Standards:
1. ACI 301 Specifications for Structural Concrete.
 2. ACI 318 Building Code Requirements for Structural Concrete and Commentary.
 3. ACI SP-066 ACI Detailing Manual.
 4. ASTM A615/A615M Standard Specification for Deformed and Plain Carbon-Steel Bars for Concrete Reinforcement.
 5. ASTM A706/A706M Standard Specification for Deformed and Plain Low-Alloy Steel Bars for Concrete Reinforcement.
 6. ASTM A775/A775M Standard Specification for Epoxy-Coated Steel Reinforcing Bars.
 7. ASTM D3963/D3963M Standard Specification for Fabrication and Jobsite Handling of Epoxy-Coated Steel Reinforcing Bars.
 8. AWS D1.4 Structural Welding Code - Reinforcing Steel.
 9. CRSI Concrete Reinforcing Steel Institute Manual of Standard Practice.
 10. CRSI Concrete Reinforcing Steel Institute Placing Reinforcing Bars.

1.3 SUBMITTALS

- A. See Section 01 33 00: Submittal Procedures.
- B. Shop Drawings:
1. Comply with requirements of ACI SP-066. Include the following:
 - a. Complete bar layout.
 - b. Representative sections.
 - c. Details for congested conditions.
 - d. Proposed layout where vertical and horizontal bars intersect.
 - e. Bar schedules.
 - f. Typical bending diagrams and offsets.
 - g. Shapes of bent bars.
 - h. Spacing of bars.
 - i. Splice lengths and locations.

- C. Where welding is proposed:
 - 1. Detail welding to conform to AWS D1.4.
 - 2. Submit copies of welding operator's certificate.
 - 3. Where reinforcement complying with ASTM A615 is to be welded, chemical tests shall be performed to determine the weldability in accordance with ACI 318.
 - 4. Weld procedure specifications (WPS):
 - a. All WPS's shall be submitted to the Structural Engineer of Record (SEOR) for review and approval prior to use.
 - b. For WPS's that have been qualified by test, the supporting Procedure Qualification Record (PQR) shall be submitted to the SEOR for review and approval.
 - c. Included shall be WPS for repair welds.
- D. Reports: Submit certified copies of mill test report of reinforcement materials analysis.

1.4 QUALITY ASSURANCE

- A. Comply with the pertinent provisions of Section 01 40 00: Quality Requirements.
- B. Perform work of this Section in accordance with ACI 301.
- C. Welders' Certificates: Submit certifications for welders employed on the Project, verifying AWS qualification within the previous 12 months.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Comply with pertinent provisions of Section 01 60 00: Product Requirements, delivering materials in a timely manner to ensure uninterrupted progress.
- B. Bundle bars, tag with identification, and transport and store so as not to damage any material. Use metal tags indicating size, length, and other marking shown on placement drawings. Maintain tags after bundles are broken.
- C. Avoid exposure to dirt, moisture, or conditions harmful to reinforcement.
- D. Extra Material:
 - 1. Provide an allowance of an additional ten percent (10%) of the total reinforced steel tonnage in addition to the quantities shown on the Drawings. This additional steel shall be installed in sizes and locations as directed by the structural Engineer.

PART 2 PRODUCTS

2.1 REINFORCEMENT

- A. Reinforcing Steel:
 - 1. ASTM A615/A615M, Grade 60 (60,000 psi):
 - a. Deformed billet-steel bars.
 - b. Unfinished.
 - c. Only to be used for conditions where bars will not be welded.
- B. Reinforcing Steel:
 - 1. ASTM A706/A706M, Grade 60 (60,000 psi) deformed low-alloy steel bars:
 - a. Unfinished.
 - b. Used in all cases where welding of bars is required.

- C. Reinforcement Accessories:
 - 1. Tie wire: ASTM A1064, annealed copper bearing steel, minimum 16 gage, 0.0508 inch.
 - 2. Chairs, bolsters, bar supports, spacers:
 - a. Sized and shaped for adequate support of reinforcement during concrete placement. Standard manufactured products shall conform to the Concrete Reinforcing Institute Manual of Standard Practice, latest edition.
 - 3. Use dense precast concrete supports with embedded wire ties for reinforcement placed on grade. Elsewhere, use wire bar supports.
- D. Welding electrodes: AWS D1.4, Table 5.1 and 5.3, low hydrogen electrodes, E8018 for Grade 60 steel.

2.2 REBAR SPLICING

- A. Coupler Systems: Mechanical devices for splicing reinforcing bars conforming to the requirements of ACI 318; capable of developing 1.25fy of the steel reinforcing yield strength in tension and compression.
- B. For reinforcement, all mechanical splices in Special Structural Walls, Special Moment Frames, and Concrete Diaphragms shall be Type 2, conforming to the requirements of ACI 318, capable of developing 1.25fy of the steel reinforcing yield strength in tension and compression, and develop the specified tensile strength of the spliced bar:
 - 1. Products:
 - a. Dayton Superior Corporation; Bar Lock Coupler System: www.daytonsuperior.com (ICC-ESR 2481).
 - b. Lenton Lock Couplers (IAPMO-ES 129).
- C. Dowel Bar Splicer with Dowel-Ins:
 - 1. Mechanical devices for connecting dowels; capable of developing full steel reinforcing design strength in tension and compression.
 - a. Products:
 - 1) Dayton Superior Corporation; Dowel Bar Splicer D101A with Straight Dowel-In: www.daytonsuperior.com.
 - 2) Lenton Form Savers (IAPMO-ES 129).

2.3 FABRICATION

- A. Fabricate concrete reinforcing in accordance with CRSI - Manual of Standard Practice.
- B. Bending and Forming:
 - 1. Fabricate bars of the indicated sizes and bend and form to required shapes and lengths by methods not injurious to materials.
 - 2. Do not heat reinforcement for bending.
 - 3. Bend bars No. 6 size and larger in the shop only.
 - 4. Bars with unscheduled kinks or bends are subject to rejection.
 - 5. Use only tested and approved bar materials.
- C. Welding:
 - 1. Use only ASTM A706 steel where welding is proposed:
 - a. Perform welding where shown or approved, by the direct electric arc process in accordance with AWS D1.4 using specified low hydrogen electrodes.
 - b. Preheat six inches (6") each side of joint.
 - c. Protect joints from drafts during the cooling process; accelerated cooling is prohibited.
 - d. Do not tack weld bars.

- e. Welding shall not be done on or within two (2) bar diameters of any bent portion of a bar that has been bent cold.
 - f. Welding of crossing bars shall not be permitted for assembly reinforcement unless authorized by the SEOR.
 - g. Clean metal surfaces to be welded of all loose scale and foreign material.
 - h. Clean welds each time electrode is changed and chip burned edges before placing welds.
 - i. When wire brushed, the completed welds must exhibit uniform section, smooth welded metal, feather edges without undercuts or overlays, freedom from porosity and clinkers, and good fusion and penetration to the base metal.
 - j. Cut out welds or parts of welds found defective with chisel and replace with proper welding.
 - k. Fillet welds may be considered prequalified per AWS D1.4.
 - l. Other welds are to be qualified per AWS D1.4.
- D. Where ASTM A615 steel is to be used or occurs in existing elements and is to be welded:
- 1. Complete chemical analyses shall be performed to determine chemical composition and, for a new bar, provided in the mill certifications to determine weldability in accordance with ACI 318 with modifications per AWS D1.4.
 - 2. The carbon equivalency (CE) shall be clearly defined and bars with a CE above 0.75 shall not be welded.
 - 3. Welding Procedure Specifications and supporting PQRs with required testing per AWS D1.4 shall be provided for review and approval prior to welding.
 - 4. These WPS and PQRs shall be specific to the CE as determined above, and shall, in addition to the other AWS requirement, include minimum and maximum preheat and interpass temperatures that are specified to the CE. This preheat and interpass temperature shall be strictly enforced in the field.
 - 5. If separate shipments of bars vary the weldability, the process listed in the above requirements shall be repeated for these new bars.
- E. Locate reinforcing splices not indicated on Drawings at point of minimum stress. Review locations of splices with SEOR.
- F. Bar support shall be concrete or metal chairs, spacers or hangers. Reinforcing bars shall not be supported by forms.
- G. Bar supports shall be provided for reinforcing at slabs on grade also. No lifting of bars into place as the concrete is being poured.

PART 3 EXECUTION

3.1 PLACEMENT

- A. Before placing bars, and again before concrete is placed, clean bars of loose rust and/or mill scale, dirt, oil, or any other coating that may be deleterious or could reduce bond with the concrete.
- B. Securing in place:
- 1. Accurately place bars and wire tie in precise position where bars cross.
 - 2. Bend ends of wire ties away from the forms.
 - 3. Wire tie bars to the corners of ties and stirrups.
 - 4. Support bars according to the Concrete Reinforcing Steel Institute (CRSI) "Placing Reinforcing Bars," using approved accessories and chairs.
 - 5. Place precast concrete cubes with embedded wire ties to supporting reinforcing steel bars in concrete placed on grade and in footings.

- 6. Take adequate precautions to ensure that reinforcing bar position and spacing is maintained during concrete placement.
- C. Do not displace or damage vapor barrier.
- D. Maintain concrete cover around reinforcing per requirements on Drawings.
- E. Splices:
 - 1. Do not splice reinforcing bars at the points of maximum stress except where indicated.
 - 2. Lap splices as shown or required to develop the full strength or stress of the bars.
 - 3. Stagger splices in horizontal wall bars at least 48 inches longitudinally in alternate bars and opposite faces.
 - 4. Splice bars only at locations shown on the drawings. Where splices are not detailed, lap bars using a Class B lap as defined in ACI 318 and stagger adjacent splices 48 bar diameters minimum unless otherwise noted.
- F. Joints:
 - 1. Construction Joints: Install so strength and appearance of concrete are not impaired, at locations indicated or as approved by Architect.
 - a. Place joints perpendicular to main reinforcement.
 - b. Continue reinforcement across construction joints unless otherwise indicated
- G. Field Welding: As specified for fabrication.

3.2 FIELD QUALITY CONTROL

- A. Comply with all pertinent provisions of Section 01 40 00: Quality Requirements.
- B. Supervision: Perform Work to this Section under supervision of a capable superintendent.
- C. An independent testing agency, as specified in Section 01 40 00: Quality Requirements, shall inspect installed reinforcement for conformance to Contract Documents before concrete placement.
- D. Where welding is done in the shop or at the site, perform welding of reinforcing bars under inspection of the testing laboratory welding inspector in accordance with Chapter 17 of the CBC. The welding inspector shall make a systematic record of all welds:
 - 1. Identification marks of welders.
 - 2. List of defective welds.
 - 3. Manner of correction of defects:
 - a. The welding inspector shall check the material, equipment details of construction and procedures, as well as the welds. The inspector shall check the ability of the welder. The welding inspector shall furnish the structural Engineer and the enforcement agency with a verified report that the welding required to be inspected is proper and has been done in conformity with the approved Plans and Specifications. The welding inspector shall use all means necessary to determine the quality of the weld. The inspector may use gamma ray, magnaflux, trepanning, sonics, or any other aid to visual inspection, which the inspector may deem necessary to assure the adequacy of the welding.

END OF SECTION 03 20 00

SECTION 03 30 00
CAST-IN-PLACE CONCRETE

1.2 SUMMARY

- A. Section includes cast-in-place concrete, including formwork, reinforcement, concrete materials, mixture design, placement procedures, and finishes, for the following:
 - 1. Footings and foundation walls.
 - 2. Interior slabs-on-grade.
 - 3. Exterior slabs-on-grade.
 - 4. Concrete filled floor deck.
 - 5. Concrete stairways and elevated Landings.
- B. Related Sections:
 - 1. 03 10 00 Concrete Forming and Accessories
 - 2. 03 20 00 Concrete Reinforcing
 - 3. 03 33 10 Concrete Moisture Vapor Emission Control
 - 4. 03 35 43 Polished Concrete Finishing

1.3 DEFINITIONS

- A. Cementitious Materials:
 - 1. Portland cement alone or in combination with one or more of the following, subject to compliance with requirements:
 - a. Blended hydraulic cement.
 - b. Fly ash and other pozzolans.
 - c. Ground granulated blast-furnace slag.
 - d. Silica fume.
- B. Water/Cement Ratio (w/cm): The ratio by weight of water to cementitious materials.

1.4 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Design Mixtures: For each concrete mixture. Submit alternate design mixtures when characteristics of materials, Project conditions, weather, test results, or other circumstances warrant adjustments.
- C. Steel Reinforcement Shop Drawings: Placing drawings that detail fabrication, bending, and placement. Include bar sizes, lengths, material, grade, bar schedules, stirrup spacing, bent bar diagrams, bar arrangement, splices and laps, mechanical connections, tie spacing, hoop spacing, and supports for concrete reinforcement.
- D. Shop Drawings:
 - 1. Construction Joint Layout: Indicate proposed construction joints required to construct the structure.
 - a. Location of construction joints is subject to approval of the Architect.
- E. Certificates: Weighmaster's certificates.
- F. Material Certificates:
 - 1. For each of the following, signed by manufacturers:
 - a. Cementitious materials
 - b. Admixtures.
 - c. Waterstops.

- d. Curing materials.
 - e. Floor and slab treatments.
 - f. Bonding agents.
 - g. Adhesives.
 - h. Vapor Barriers.
 - i. Semi-rigid joint filler.
 - j. Joint-filler strips.
 - k. Repair materials.
- G. Material Test Reports:
- 1. For the following, from a qualified testing agency, indicating compliance with requirements:
 - a. Aggregates: Include service record data indicating absence of deleterious expansion of concrete due to alkali aggregate reactivity.
 - b. Vapor Barrier: Provide third party documentation that all testing was performed on a single production roll and a summary of test results per ASTM E1745 Section 8.1.
- H. Concrete Contractor's Certification
- 1. Provide ACI floor finisher certification documents for at least three finishers who will be installing slab placements.
- I. Concrete Batch Plant Certifications. Name and address of the concrete supplier's batch plant and plant certifications by National Ready-Mix Concrete Association and/or State Department of Transportation.
- J. Concrete Mix Design: Fill out and submit attached Concrete Mix Design Submittal Form for interior slabs. Submit only one form indicating same mix design proportions for all interior slabs concrete.
- 1. Submit complete information.
 - 2. Submit only one mixture design indicating same mix design for all interior slabs.
- K. Slab Joint and Placement Plan:
- 1. Provide a pour plan identifying the following:
 - a. Exterior walls and column grid locations.
 - b. Extent of pours including width, length, slab placement area and volume.
 - c. Locations of construction joints.
 - d. Location of sawn contraction joints if different from those shown or if not shown on the drawings.
 - 2. Slab joint and placement plan shall be developed and submitted on a full-sized copy of the Architectural Floor Plan.
- L. Pre-Slab Installation Meeting
- 1. Provide record of notification of pre-slab meeting including company name, persons contacted, and date and method of contact.
 - 2. Provide meeting minutes to all participants and CUSD Construction Manager including sign-in sheet.
- M. Delivery Tickets:
- 1. Copies of delivery tickets for each load of concrete delivered to site.
 - 2. Indicate on each ticket information required by ASTM C94 including additional information required for slabs.

3. Information on ticket shall include quantities of all material batched including the amount of free water in the aggregate and the quantity of water that can be added at the site without exceeding the maximum water cement ratio of the approved mix design. Aggregate moisture corrections shall be based on ASTM definitions of aggregate moisture content and absorption.
 4. Mix identification number on ticket shall match number on submitted and approved mix design.
- N. Floor surface flatness and levelness measurements indicating compliance with specified tolerances.
- O. Warranty:
1. Vapor barrier manufacturer written warranty citing (a) compliance with the designated ASTM E1745 classification, and (b) no manufacturing defects in the product for, at least, **5** years

1.5 QUALITY ASSURANCE

- A. Codes and Standards:
1. Comply with provisions of following codes, specifications, and standards, except where more stringent requirements are shown or specified:
 - a. CBC 2022 California Building Code (CCR Title 24, Part 2, as adopted and amended by DSA).
 - b. American Concrete Institute (ACI) Publications:
 - 1) Comply with the following unless modified by requirements in the Contract Documents:
 - a) ACI 301, "Specifications for Structural Concrete."
 - b) ACI 117, "Specification for Tolerances for Concrete Construction and Materials and Commentary."
 - c) ACI 302.1R, "Guide to Concrete Floor and Slab Construction."
 - d) ACI 302.2R, "Guide for Concrete Slabs that receive Moisture-Sensitive Flooring Materials."
 - e) ACI 305R, "Guide to Hot Weather Concreting."
 - f) ACI 306R, "Guide to Cold Weather Concreting."
 - g) ACI 318, "Building Code Requirements for Structural Concrete and Commentary."
- B. Floor Finisher Qualifications (For placements larger than 10,000 square feet.):
1. The concrete floor finishing subcontractor Lead Finisher and at least two additional members of the finishing crew shall be certified under the Concrete Flatwork Finisher Training and Certification Program as granted by the American Concrete Institute and shall be present during finishing.
 2. The concrete floor finisher subcontractor shall have experience in finishing interior floors of similar size and scope in at least 5 previous projects.
- C. Post-Installed Concrete Anchors Installers: ACI-certified Adhesive Anchor Installer.
- D. Concrete Supplier Approval
1. The concrete supplier shall be fully approved and acceptable by the concrete subcontractor as the producer of concrete for which the subcontractor is to place and finish. Prepare Statement of Approval of Concrete Supplier stating project name, name of concrete supplier, along with the statement of approval and the signatures of the Contractor and concrete floor subcontractor. Submit statement as specified in Submittals paragraph above

- E. Manufacturer Qualifications:
 - 1. A firm experienced in manufacturing ready-mixed concrete products and that complies with ASTM C94/C94M requirements for production facilities and equipment:
 - a. Manufacturer certified according to NRMCA's "Certification of Ready Mixed Concrete Production Facilities."
- F. District will employ Concrete Oversight Management (COM) services for this project.
- G. Source Quality Control: Furnish Weighmaster's certificates for all concrete.
- H. Welding Qualifications: Qualify procedures and personnel according to AWS D1.4/D1.4M, "Structural Welding Code - Reinforcing Steel."
- I. Concrete Testing Service: Engage a qualified independent testing agency approved by DSA to perform material evaluation tests and to design concrete mixtures.
- J. 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.
- K. Workmanship:
 - 1. Remove and replace or repair concrete related work which does not conform to specified requirements including strength, tolerances and finishes as directed by Owner.
 - 2. Contractor shall be responsible for cost of corrections or delays to other work affected by, or resulting from, corrections to concrete Work.
 - 3. If results of compressive strength tests reveal deficiencies in concrete, meet requirements of ACI 301.
- L. Concrete Plant Certification: Certify primary and secondary plants proposed for furnishing concrete as being approved at highest level by NRCMA and by Department of Transportation in State where project is located.

1.6 MEETINGS

- A. Pre-construction concrete slab Installation:
 - 1. Plan, host, and attend a pre-slab installation meeting to be conducted at site by Architect and CUSD Concrete Oversight Management team (CUSD COM).
 - 2. Schedule meeting approximately 14 days prior to first concrete slab installation and after all concrete submittals have been submitted and approved.
 - 3. Require responsible representatives of each party involved with the concrete slab work to attend the meeting. Representatives to be present shall include personnel who are directly involved in overseeing the work and who have authority to control the concreting work.
 - 4. Notify all required attendees in writing of scheduled time and place at least two weeks in advance of meeting. Include copy of agenda with invitation.
 - 5. The meeting shall convene only when all parties are present.
 - 6. Minutes of the meeting shall be recorded, typed, printed, and distributed to all parties concerned by the General Contractor within 5 days of the meeting. One copy of the minutes shall also be transmitted to the Owner's representative for information purposes.
 - 7. Attendees shall include, but not be limited to the following:
 - a. CUSD Construction Manager
 - b. CUSD Consultant
 - c. CUSD COM
 - d. Architect

- e. General Contractor
 - 1. Project manager
 - 2. Superintendent (present during all slab placements)
- f. Concrete Subcontractor
 - 1. Project manager
 - 2. Finish Foreman (present during all slab placements)
- g. Concrete floor polishing subcontractor
- h. Concrete Supplier
 - 1. Quality Assurance Representative (present during all slab placements)
- i. CUSD testing agency representative (present during all slab placements)
- 8. Changes to the contract documents from recommendations or discussions at the Pre-Construction meeting shall be approved in writing by the CUSD Construction Manager/Architect prior to implementation. CUSD COM is not authorized to change any specified requirement or to approve execution of any portion of the work.
- 9. Initial orientation meeting to discuss overall expectations, responsibilities, best practices, tolerances, coordination of trades, testing procedures and responsibilities, and specifics on how the Concrete Oversight Management (COM) team will coordinate and operate along with the GC, concrete contractor, project manager, Architect, etc..
 - a. Coordinate the work with other related work being performed.
 - b. Identify any potential problems that may impede planned progress and proper installation of work regarding quality of installation and warranty requirements.
 - c. Prior to submitting design mixes, review detailed requirements for preparing concrete design mixes and determine procedures for satisfactory concrete operations.
 - d. Identify any potential problems that may impede planned progress and proper installation of work regarding quality of installation and warranty requirements.
 - e. Prior to submitting design mixes, review detailed requirements for preparing concrete design mixes and determine procedures for satisfactory concrete operations.
 - f. Review requirements for submittals, status of coordinating work, and availability of materials.
 - g. Establish preliminary work progress schedule and procedures for materials inspection, testing, and certifications.
 - h. Coordination with Curing Agent and Polished Concrete installers.
- 10. Review the following:
 - a. Procedures for CUSD Concrete Oversight Management team
 - b. Special inspection and testing and inspecting agency procedures for field quality control.
 - c. Construction joints, control joints, isolation joints, and joint-filler strips.
 - d. Semirigid joint fillers.
 - e. Vapor-retarder installation.
 - f. Anchor rod and anchorage device installation tolerances.
 - g. Cold and hot weather concreting procedures.
 - h. Concrete finishes and finishing.
 - i. Curing procedures.
 - j. Forms and form-removal limitations.
 - k. Shoring and reshoring procedures.
 - l. Methods for achieving specified floor and slab flatness and levelness.
 - m. Floor and slab flatness and levelness measurements.
 - n. Concrete repair procedures.
 - o. Concrete protection.

- B. Pre-pour meetings: (Conduct pre-pour meetings prior to each and every pour)
1. Discuss plan for the upcoming pour.
 - a. Discuss and approve pour sequencing.
 - b. CUSD COM must approve.
 - c. Address joint placement if any changes or concerns arise.
 - d. Trade coordination.
 - e. Discuss any other concerns for upcoming pour such as weather, etc.
 2. Review previous pour results.
 - a. Ff/FI reports.
 - b. Any other test results needing review.
 - c. Address any issues that caused problems and require adjustments for upcoming pours.
 - d. Quickly review upcoming pour schedules.
 3. At the discretion of Architect/GC/CUSD COM attendees shall include, but not be limited to the following:
 - a. CUSD Construction Manager
 - b. CUSD Consultant
 - c. CUSD COM
 - d. Architect
 - e. General Contractor
 - f. Project manager
 - g. Superintendent (present during all slab placements)
 - h. Concrete Subcontractor
 - i. Project manager
 - j. Finish Foreman (present during all slab placements)
 - k. Concrete Supplier
 - l. Quality Assurance Representative (present during all slab placements)
 - m. CUSD testing agency representative (present during all slab placements)
 4. Notify all required attendees in writing of scheduled time and place at least two weeks in advance of meeting. Include copy of agenda with invitation.
 - a. Notify which representatives will be required to attend in writing.
 5. Minutes of the meeting shall be recorded, typed, printed, and distributed to all parties concerned by the Contractor within 5 days of the meeting. One copy of the minutes shall also be transmitted to the Owner's representative for information purposes.
- C. Progress: Scheduled by the Contractor during the performance of the work.
1. Review for proper installation of work progress.
 - a. Schedule installation review at the start of installation with the Vapor Retarder Manufacturer to ensure all of the manufacturers written instructions are complied with.
 2. Identify any installation problems and acceptable corrective measures.
 3. Identify any measures to maintain or regain project schedule if necessary.
- D. Completion: Scheduled by the Contractor upon proper completion of the work.
1. Inspect and identify any problems that may impede issuance of warranties or guaranties.
 - a. Prior to covering up the Vapor Retarder installation with concrete, have the Vapor Retarder manufacturer inspect and provide a certified report to the Architect the condition of the Vapor Retarder prior to being covered with concrete, and that the installation was in full compliance with the manufacturer's written instructions.
 2. Maintain installed work until the Notice of Substantial Completion has been executed.

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Steel Reinforcement: Deliver, store, and handle steel reinforcement to prevent bending and damage.
- B. Comply with ASTM C94/C94M and ACI 301 (ACI 301M).

1.8 FIELD CONDITIONS

- A. Cold-Weather Placement: Comply with ACI 301 (ACI 301M) and ACI 306.1 and as follows.
 - 1. Protect concrete work from physical damage or reduced strength that could be caused by frost, freezing actions, or low temperatures.
 - 2. When average high and low temperature is expected to fall below 40 deg F (4.4 deg C) for three successive days, maintain delivered concrete mixture temperature within the temperature range required by ACI 301 (ACI 301M).
 - 3. Do not use frozen materials or materials containing ice or snow.
 - 4. Do not place concrete in contact with surfaces less than 35 deg F (1.7 deg C), other than reinforcing steel.
 - 5. Do not use calcium chloride, salt, or other materials containing antifreeze agents or chemical accelerators unless otherwise specified and approved in mixture designs.
- B. Hot-Weather Placement: Comply with ACI 301 (ACI 301M) and ACI 305.1 (ACI 305.1M), and as follows:
 - 1. Maintain concrete temperature at time of discharge to not exceed 95 deg F (35 deg C).
 - 2. Fog-spray forms, steel reinforcement, and subgrade just before placing concrete. Keep subgrade uniformly moist without standing water, soft spots, or dry areas.

1.9 WARRANTY

- A. Manufacturer's Warranty: Manufacturer agrees to furnish replacement sheet vapor retarder/termite barrier material and accessories for sheet vapor retarder/ termite barrier and accessories that do not comply with requirements or that fail to resist penetration by termites within specified warranty period.
 - 1. Warranty Period: 10 years from date of Substantial Completion.
- B. Provide 10 years warranty from waterproofing admixture manufacturer that surfaces treated with crystalline waterproofing admixture will remain free from water leakage.

PART 2 PRODUCTS

2.1 FORM-FACING MATERIALS

- A. Smooth-Formed Finished Concrete: Form-facing panels that will provide continuous, true, and smooth concrete surfaces. Furnish in largest practicable sizes to minimize number of joints.
 - 1. Plywood, metal, or other approved panel materials.
 - 2. Exterior-grade plywood panels, suitable for concrete forms, complying with DOC PS 1, and as follows:
 - a. High-density overlay, Class 1 or better.
 - b. Medium-density overlay, Class 1 or better; mill-release agent treated and edge sealed.
 - c. Structural 1, B-B or better; mill oiled and edge sealed.
 - d. B-B (Concrete Form), Class 1 or better; mill oiled and edge sealed.
- B. Rough-Formed Finished Concrete: Plywood, lumber, metal, or another approved material. Provide lumber dressed on at least two edges and one side for tight fit.
- C. Chamfer Strips: Wood, metal, PVC, or rubber strips, 3/4 by 3/4 inch, minimum.

- D. Rustication Strips: Wood, metal, PVC, or rubber strips, kerfed for ease of form removal.
- E. Form-Release Agent: Commercially formulated form-release agent that will not bond with, stain, or adversely affect concrete surfaces and will not impair subsequent treatments of concrete surfaces.
 - 1. Formulate form-release agent with rust inhibitor for steel form-facing materials.
- F. Form Ties: Factory-fabricated, removable or snap-off metal or glass-fiber-reinforced plastic form ties designed to resist lateral pressure of fresh concrete on forms and to prevent spalling of concrete on removal.
 - 1. Furnish ties with integral water-barrier plates to walls indicated to receive dampproofing or waterproofing.

2.2 STEEL REINFORCEMENT

- A. Reinforcing Bars: ASTM A 615/A 615M, Grade 40 for #3 bars and smaller, Grade 60 for #4 bars and larger, using deformed bars for #3 and larger.
- B. Welded Reinforcing Bars: Low-Alloy-Steel Reinforcing Bars, ASTM A 706/A 706M, deformed.
- C. Do not use reinforcement having any of the following defects:
 - 1. Bar lengths, depths, or bends exceeding the specified fabricating tolerances.
 - 2. Bends or kinks not indicated on the Drawings or required for this Work.
 - 3. Bars with cross-section reduced due to excessive rust or other causes.

2.3 REINFORCEMENT ACCESSORIES

- A. Bar Supports: Bolsters, chairs, spacers, and other devices for spacing, supporting, and fastening reinforcing bars and welded wire reinforcement in place. Manufacture bar supports from steel wire, plastic, or precast concrete according to CRSI's "Manual of Standard Practice," of greater compressive strength than concrete and as follows:
 - 1. For concrete surfaces exposed to view where legs of wire bar supports contact forms, use CRSI Class 1 plastic-protected steel wire or CRSI Class 2 stainless-steel bar supports.

2.4 CONCRETE MATERIALS

- A. Cementitious Material: Use the following cementitious materials, of the same type, brand, and source, throughout Project:
 - 1. Portland Cement: ASTM C 150, Type II. Supplement with the following:
 - a. Fly Ash: ASTM C 618, Class F.
 - 1. No fly ash to be used in slabs scheduled to receive polished concrete finishes.
- B. Supplementary Cementitious Materials
 - 1. For troweled interior slabs, do not use fly ash, slag, or other supplementary cementitious materials.
- C. Air-Entraining Admixture: Do not air-entrain interior floor slabs with troweled finish.
- D. Normal-Weight Aggregates: ASTM C 33.
 - 1. Coarse-Aggregate Size: 1 inch nominal aggregate size.
 - 2. Fine Aggregate: Free of materials with deleterious reactivity to alkali in cement.
- E. Lightweight Aggregate: ASTM C 330, 3/4-inch nominal aggregate size.

- F. Water: ASTM C 94 and potable.
- G. Source Limitations:
 1. Obtain all concrete mixtures from a single ready-mixed concrete manufacturer for entire Project.
 2. Obtain each type or class of cementitious material of the same brand from the same manufacturer's plant.
 3. Obtain aggregate from single source.
 4. Obtain each type of admixture from single source from single manufacturer.

2.5 ADMIXTURES

- A. Air-Entraining Admixture: ASTM C 260.
 1. Air-Entraining Admixture: Do not air-entrain interior floor slabs with troweled finish.
- B. Chemical Admixtures: Provide admixtures certified by manufacturer to be compatible with other admixtures and that will not contribute water-soluble chloride ions exceeding those permitted in hardened concrete. Do not use calcium chloride or admixtures containing calcium chloride.
 1. Water-Reducing Admixture: ASTM C 494/C 494M, Type A.
 2. Retarding Admixture: ASTM C 494/C 494M, Type B.
 3. Water-Reducing and Retarding Admixture: ASTM C 494/C 494M, Type D.
 4. High-Range, Water-Reducing Admixture: ASTM C 494/C 494M, Type F.
 5. High-Range, Water-Reducing and Retarding Admixture: ASTM C 494/C 494M, Type G.
 6. Plasticizing and Retarding Admixture: ASTM C 1017/C 1017M, Type II.

2.6 VAPOR BARRIERS

- A. Sheet Vapor Barrier: ASTM E 1745, Class A. 15 mils minimum. Maintain permeance of less than 0.01 Perms [grains/(ft² · hr · inHg)] as tested in accordance with mandatory conditioning tests per ASTM E1745 Section 7.1 (7.1.1-7.1.5 Include manufacturer's recommended accessories to achieve an ASTM E1643-compliant installation; i.e. sealing seams, penetrations, terminating edges, repairs.
 1. Products: Subject to compliance with requirements, acceptable products:
 2. Stego Industries, LLC: Stego Wrap 15 mil Class A.
 - a. Griffolyn (15 mil) Green by Reef Industries, www.reefindustries.com. Perminator (15 mil) by WR Meadows, www.wrmeadows.com. Moistop Ultra (15 mil) by Fortifiber Building Systems Group. Substitutions with Architect's approval, and pursuant to conditions of Divisions 00 and 01.
- B. Granular Fill: Clean mixture of crushed stone or crushed or uncrushed gravel; ASTM D 448, Size 57, with 100 percent passing a 1-1/2-inch sieve and 0 to 5 percent passing a No. 8 sieve.

2.7 CURING MATERIALS

- A. Absorptive Cover: AASHTO M 182, Class 2, burlap cloth made from jute or kenaf, weighing approximately 9 oz. /sq. yd. when dry.
- B. Moisture-Retaining Cover: ASTM C 171, polyethylene film or white burlap-polyethylene sheet.
- C. Water: Potable.
- D. Clear, Waterborne, Membrane-Forming Curing Compound: ASTM C 309.
 1. Shall not discolor concrete or other materials, shall not leave an oily residue upon evaporation of solvent.

2. Shall afford moisture loss not greater than 0.055 grams/cm² at minimum average of 300 square feet.
 3. Meet State of California Air Regulation Board Solvent Emission Standards.
 4. Temporary (dissipating) Film Forming Curing Compound to be used for all interior exposed concrete finishes
- E. Non-shrink Grout:
1. Factory premixed grout; ASTM C1107.
 2. Compressive strength: 5,000 psi at 28 days.
- F. Exterior Concrete Walks: Provide a capillary break consisting of 2" of clean dry sand, ASTM C33, evenly spread on top of the compacted subgrade.
- G. Chemical Hardener: Fluosilicate solution designed for densification of cured concrete slabs.
- H. Slip Resistant Aggregate: 95 percent minimum fused homogeneous aluminum oxide.

2.8 BONDING AND JOINTING PRODUCTS

- A. Latex Bonding Agent: Non-dispersible acrylic latex, complying with ASTM C 1059 Type II.
- B. Epoxy Bonding System: Complying with ASTM C 881/C 881M and of Type required for specific application.
- C. Waterproofing Admixture Slurry: Slurry coat of portland cement, sand, and crystalline waterproofing additive, mixed with water in proportions recommended by manufacturer to achieve waterproofing at cold joints in concrete.
- D. Waterstops: Rubber, complying with COE CRD-C 513.
1. Configuration: As indicated on the drawings.
 2. Size: As indicated on the drawings.
- E. Reglets: Formed steel sheet, galvanized, with temporary filler to prevent concrete intrusion during placement.
1. Size: As indicated on drawings.
 2. Size: 1/2 inch throat, 1/2 inch deep.
- F. Joint Filler: Nonextruding, resilient asphalt impregnated fiberboard or felt, complying with ASTM D 1751, 1/4 inch thick and 4 inches deep; tongue and groove profile.
- G. Slab Construction Joint Devices: Combination keyed joint form and screed, galvanized steel, with minimum 1 inch diameter holes for conduit or rebars to pass through at 6 inches on center; ribbed steel stakes for setting.
1. Provide removable plastic cap strip that forms wedge-shaped joint for sealant installation.
 2. Height: To suit slab thickness.
- H. Sealant and Primer: As recommended by manufacturer.

2.9 CONCRETE MIXTURES, GENERAL

- A. Prepare design mixtures for each type and strength of concrete, proportioned on the basis of laboratory trial mixture or field test data, or both, according to ACI 301.
1. Use a qualified independent testing agency for preparing and reporting proposed mixture designs based on laboratory trial mixtures.

2. All concrete mix designs shall be prepared and stamped by a California registered Civil Engineer.
- B. Cementitious Materials: Limit percentage, by weight, of cementitious materials other than portland cement in concrete as follows:
 1. Fly Ash: 15 percent.
 2. For troweled interior slabs, do not use fly ash, slag, or other supplementary cementitious materials.
- C. Admixtures: Use admixtures according to manufacturer's written instructions.
 1. Use water-reducing admixture in concrete, as required, for placement and workability.
 2. Use water-reducing and retarding admixture when required by high temperatures, low humidity, or other adverse placement conditions.
 3. Use water-reducing admixture in pumped concrete, concrete required to be watertight, and concrete with a water-cementitious materials ratio below 0.50.
- D. Color Pigment: Add color pigment to concrete mixture according to manufacturer's written instructions and to result in hardened concrete color consistent with approved mockup.

2.10 CONCRETE MIXTURES FOR BUILDING ELEMENTS

- A. Footings and Foundation Walls: Proportion normal-weight concrete mixture as follows:
 1. Minimum Compressive Strength: 3000 psi at 28 days unless otherwise noted.
 2. Maximum Water-Cementitious Materials Ratio: 0.55.
 3. Minimum Cementitious Materials Content: 5.5 sacks of cement per cubic yard.
 4. Slump Limit: 4 inches, plus or minus 1 inch.
- B. Interior Slabs-on-Grade: Proportion normal-weight concrete mixture as follows:
 1. Minimum Compressive Strength: 4000 psi at 28 days.
 2. Maximum Water-Cementitious Materials Ratio: 0.45.
 3. Minimum Cementitious Materials Content: 6.0 sacks of cement per cubic yard.
 4. Slump Limit: 4 inches, plus or minus 1 inch.
- C. Interior Suspended Slabs: Structural normal-weight concrete mixture as follows:
 1. Minimum Compressive Strength: 3000 psi at 28 days.
 2. Maximum Water-Cementitious Materials Ratio: 0.55.
 3. Minimum Cementitious Materials Content: 5.5 sacks of cement per cubic yard.
 4. Slump Limit: 4 inches, plus or minus 1 inch.

2.11 FABRICATING REINFORCEMENT

- A. Fabricate steel reinforcement according to CRSI's "Manual of Standard Practice."

2.12 CONCRETE MIXING

- A. Ready-Mixed Concrete: Measure, batch, mix, and deliver concrete according to ASTM C 94/C 94M, and furnish batch ticket information.
 1. When air temperature is between 85 and 90 deg F, reduce mixing and delivery time from 1-1/2 hours to 75 minutes; when air temperature is above 90 deg F, reduce mixing and delivery time to 60 minutes.

2.13 LIQUID FLOOR TREATMENTS

- A. Penetrating Liquid Floor Treatment:
 - 1. Clear, chemically reactive, waterborne solution of inorganic silicate or silicate materials and proprietary components; odorless; that penetrates, hardens, and densifies concrete surfaces:
 - a. Basis-of-design product: Subject to compliance with requirements, provide Moxie International Inc.; **Moxie Shield 1500 Concrete Sealer or Moxie Shield MFSII Flooring Sealer**, P.O. Box 838 Loomis, CA 95650; Contact Manufacturer's representative: P:916-251-0825, F: 877-330-1930 Email: info@moxieshield.com.
 - b. 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."

PART 3 EXECUTION

3.1 PREPARATION

- A. Preplacement Inspection: All trades and participants involved shall verify that preparations are in conformance with Contract documents. Use approved sign-off forms.
- B. Where new concrete is to be bonded to previously placed concrete, prepare existing surface by cleaning with steel brush and applying bonding agent in accordance with manufacturer's instructions.
 - 1. Use epoxy bonding system for bonding to damp surfaces, for structural load-bearing applications, and where curing under humid conditions is required.
 - 2. Use latex bonding agent only for non-load-bearing applications.
- C. Where new concrete with integral waterproofing is to be bonded to previously placed concrete, prepare surfaces to be treated in accordance with waterproofing manufacturer's instructions. Saturate cold joint surface with clean water, and remove excess water before application of coat of waterproofing admixture slurry. Apply slurry coat uniformly with semi-stiff bristle brush at rate recommended by waterproofing manufacturer.
- D. In locations where new concrete is doweled to existing work, drill holes in existing concrete, insert steel dowels and pack solid with non-shrink grout.

3.2 FORMWORK

- A. Design, erect, shore, brace, and maintain formwork, according to ACI 301, to support vertical, lateral, static, and dynamic loads, and construction loads that might be applied, until structure can support such loads.
- B. Construct formwork so concrete members and structures are of size, shape, alignment, elevation, and position indicated, within tolerance limits of ACI 117.
- C. Construct forms tight enough to prevent loss of concrete mortar.
- D. Retighten forms and bracing before placing concrete, as required, to prevent mortar leaks and maintain proper alignment.
- E. Coat contact surfaces of forms with form-release agent, according to manufacturer's written instructions, before placing reinforcement.

3.3 EMBEDDED ITEMS

- A. Place and secure anchorage devices and other embedded items required for adjoining work that is attached to or supported by cast-in-place concrete. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded. In no case shall any bolt or anchor be stabbed in place while or after the concrete is poured.
 - 1. Install anchor rods, accurately located, to elevations required and complying with tolerances in Section 7.5 of AISC's "Code of Standard Practice for Steel Buildings and Bridges."
 - 2. Coordinate placement of embedded items with erection of concrete formwork and placement of form accessories.

3.4 REMOVING AND REUSING FORMS

- A. General:
 - 1. Formwork for sides of beams, walls, columns, and similar parts of the Work that does not support weight of concrete may be removed after cumulatively curing at not less than 50 degrees F for 24 hours after placing concrete. Concrete has to be hard enough to not be damaged by form-removal operations and curing and protection operations need to be maintained:
 - a. Leave formwork for beam soffits, joists, slabs, and other structural elements that supports weight of concrete in place until concrete has achieved at least 75 percent of its 28-day design compressive strength.
 - b. Do not strip vertical concrete in less than seven (7) days.
 - c. Remove forms only if shores have been arranged to permit removal of forms without loosening or disturbing shores.
- B. Clean and repair surfaces of forms to be reused in the Work. Split, frayed, delaminated, or otherwise damaged form-facing material will not be acceptable for exposed surfaces. Apply new form-release agent.
- C. When forms are reused, clean surfaces, remove fins and laitance, and tighten to close joints. Align and secure joints to avoid offsets. Do not use patched forms for exposed concrete surfaces unless approved by Architect.

3.5 SHORES AND RESHORES

- A. Comply with ACI 318 and ACI 301 for design, installation, and removal of shoring and reshoring.
 - 1. Do not remove shoring or reshoring until measurement of slab tolerances is complete.
- B. Plan sequence of removal of shores and reshore to avoid damage to concrete. Locate and provide adequate reshoring to support construction without excessive stress or deflection.

3.6 VAPOR RETARDERS

- A. Sheet Vapor Barriers:
 - 1. Ensure that subsoil is approved by Architect or Geotechnical Engineer Level and compact base material.
 - 2. Place, protect, and repair sheet vapor barrier according to ASTM E1643 and manufacturer's written instructions:
 - a. Unroll vapor barrier with the longest dimension parallel with the direction of the concrete placement and face laps away from the expected direction of the placement whenever possible

- b. Extend vapor barrier to the perimeter of the slab. If practicable, terminate it at the top of the slab, otherwise (a) at a point acceptable to the structural engineer or (b) where obstructed by impediments, such as dowels, water stops, or any other site condition requiring early termination of the vapor barrier. At the point of termination, seal vapor barrier to the foundation wall, grade beam or slab itself
- c. Lap joints six inches (6") and seal with manufacturer's recommended tape.
- d. Apply seam tape/textured tape/double-sided tape to a clean and dry vapor barrier
- e. Seal all penetrations (including pipes) per manufacturer's instructions.
- f. No penetration of the vapor barrier is allowed except for reinforcing and permanent utilities. Avoid the use of stakes driven through vapor barrier by utilizing screed and forming systems that will not puncture the vapor barrier
- g. Repair damaged areas by cutting patches of vapor barrier, overlapping damaged area six inches (6") and taping all four sides with tape.
- h. Utilize vapor barrier sealing accessories from the same manufacturer as the vapor barrier membrane
- i. Protect all installed moisture barrier construction from precipitation and water penetration by covering and providing positive drainage away from the moisture barrier.
- j. Cover slab openings and block-outs around columns to prevent water penetration of moisture barrier.

3.7 STEEL REINFORCEMENT

- A. General:
 - 1. Comply with CRSI's "Manual of Standard Practice" for placing reinforcement:
 - a. Do not cut or puncture vapor retarder. Repair damage and reseal vapor retarder before placing concrete.
 - b. Clean reinforcement and remove loose dust and mill scale, earth, oil, and other materials that reduce bond or destroy bond with concrete.
 - c. Position, support, and secure reinforcement against displacement by forms, construction, and the concrete placement operations. Provide metal chairs, dobies, or other aids manufactured for this purpose.
 - d. Place reinforcement to obtain the required concrete coverages for concrete protection.

3.8 JOINTS

- A. General: Construct joints true to line with faces perpendicular to surface plane of concrete.
- B. Construction Joints: Install so strength and appearance of concrete are not impaired, at locations indicated or as approved by Architect.
- C. Contraction Joints in Slabs-on-Grade:
 - 1. Form weakened-plane contraction joints, sectioning concrete into areas as indicated. Construct contraction joints for a depth equal to at least one inch (1") as follows:
 - a. Grooved joints: Form contraction joints after initial floating by grooving and finishing each edge of joint to a radius of 1/8 inch. Repeat grooving of contraction joints after applying surface finishes. Eliminate groover tool marks on concrete surfaces.
 - b. Sawed joints: Form contraction joints with power saws equipped with shatterproof abrasive or diamond-rimmed blades. Cut 1/8-inch wide, 1/4 slab depth joints into concrete when cutting action will not tear, abrade, or otherwise damage surface and before concrete develops random contraction cracks. Saw cut slab as soon as surface has hardened to where it can support the equipment and operator, normally within two (2) hours after finishing. Use saw designed for cutting fresh concrete, such as "Soff-Cut" or equal.

- D. Doweled Joints: Install dowel bars and support assemblies at joints where indicated. Lubricate 1/2 of dowel length to prevent concrete bonding to one side of joint.
- E. Provide slab joints as indicated on Drawings.
 - 1. Use saws, blades, skid plates, and accessories by Soff-Cut (800) 288-5040 or approved equal.
 - 2. Provide at least two Soff-Cut saws with blades capable of achieving the required depth of saw cut. Employ number of saws and workers sufficient to complete cutting saw joints before shrinkage produces cracking.
 - 3. Start cutting sawed joints as soon as concrete has hardened sufficiently to prevent raveling or dislodging of aggregates. This will typically be from 1 hour in hot weather to 4 hours in cold weather after completing finishing of slab in that joint location.
 - 4. Adhere felt or similar material to the bottom of the saw base plate as necessary to minimize surface scratching and debris build up.
 - 1) Scratches along the joints due to cutting joints will not be acceptable on floors scheduled to receive exposed concrete finishes
 - 2) Contractor is responsible to employ necessary measures to prevent the saw base from causing scratches
 - 5. Saw cut to width of 1/8 inch by 1/4 the slab depth, unless noted otherwise on drawings.
 - 6. After saw cutting with attached vacuum system, immediately clean slab surface of all sawing residues using vacuum with HEPA-rated filter.
 - 7. Extend sawed joint to the slab boundaries and abutments, including columns, drains, and other penetrations in the path of a defined joint. Implement methods and timing of the saw cut beyond the limits of the SoffCut saw reach to provide a consistent depth of cut with minimal raveling of joint edges.
 - 8. See Drawings for additional requirements.
- F. Saw-Cut Control Joint Dust Collection: Connect one of the following dust collection systems directly to each Soff-Cut saw being used. Provide collection system model recommended by the manufacturer to maintain dust emissions below the permissible level. Immediately clean any remaining residue after cutting, prior to cure.
 - 1. Pulse Vac by BW Manufacturing.
 - 2. DustDroid by Dustless Technologies.
 - 3. Soff-Vac by Husqvarna USA.
 - 4. Or approved equal

3.9 CONVEYING

- A. Handle concrete from mixer to place of final deposit as rapidly as practicable and in manner which will assure obtaining specified quality of concrete.
- B. Re-tempering: Discard concrete which has already begun to set. Do not re-temper with water
- C. Equipment: Provide mixing and conveying equipment of proper size and design to ensure a continuous flow of concrete to delivery end. Do not use aluminum equipment in contact with concrete.

3.10 CONCRETE PLACEMENT

- A. Notify Architect not less than 24 hours prior to commencement of placement operations.
- B. Unless otherwise specified, place concrete in accordance with the requirements of ACI 301.
- C. The concrete supplier shall have a quality control representative at site for concrete placements.
- D. General Contractor and/or the superintendent shall be on site during placement of the concrete.

- E. Supervision for the General Contractor and the Concrete Floor Subcontractor shall be on site for the entire duration of each concrete slab placement.
- F. Before placing concrete, verify that installation of formwork, reinforcement, and embedded items is complete and that required inspections have been performed.
- G. Place concrete according to the pre-approved sequencing plan determined in the pre-pour meeting.
 - a. Placement sequencing must be approved by the Architect and/or CUSD project manager.
- H. Do not add water to concrete during delivery, at Project site, or during placement unless approved by Architect.
- I. Depositing Concrete.
 - 1. Deposit concrete continuously in one layer or in horizontal layers of such thickness that no new concrete will be placed on concrete that has hardened enough to cause seams or planes of weakness. If a section cannot be placed continuously, provide construction joints as indicated. Deposit concrete to avoid segregation.
 - 2. Deposit concrete in horizontal layers of depth to not exceed formwork design pressures and in a manner to avoid inclined construction joints.
 - 3. Deposit and consolidate concrete for floors and slabs in a continuous operation, within limits of construction joints, until placement of a panel or section is complete.
 - 1) Consolidate concrete during placement operations so concrete is thoroughly worked around reinforcement and other embedded items and into corners.
 - 2) Maintain reinforcement in position on chairs during concrete placement.
 - 3) Screed slab surfaces with a straightedge and strike off to correct elevations.
 - 4) Slope surfaces uniformly to drains where required.
 - 5) Begin initial floating using bull floats or darbies to form a uniform and open-textured surface plane, before excess bleedwater appears on the surface.
Do not further disturb slab surfaces before starting finishing operations.
 - 4. Consolidate placed concrete with mechanical vibrating equipment according to ACI 301.
 - 5. Do not use vibrators to transport concrete inside forms. Insert and withdraw vibrators vertically at uniformly spaced locations to rapidly penetrate placed layer and at least 6 inches into preceding layer. Do not insert vibrators into lower layers of concrete that have begun to lose plasticity. At each insertion, limit duration of vibration to time necessary to consolidate concrete and complete embedment of reinforcement and other embedded items without causing mixture constituents to segregate
 - 6. Do not deposit concrete which has partially hardened or has been contaminated by foreign matter.
 - 7. Deposit concrete continuously in layers of such thickness that no concrete will be deposited on concrete which has hardened sufficiently to cause seams or planes of weakness.
 - 8. Between construction joints, place concrete in a continuous operation such that concrete is plastic at all times and flows readily into spaces between reinforcement.
 - 9. Use placement procedures to avoid segregation.
 - 10. Deposit concrete as near as possible to its final position.
 - 11. Integral color concrete floor slabs:
 - 1) Clean tools to prevent contamination. Clean and bag boots when working on surface.
 - 2) Employ methods to prevent dust and air-borne debris from entering building and settling on slab surface during finishing operations.
 - 12. Do not place concrete over standing water, mud, frost, ice or snow.
 - 13. Do not use wet screeds.

- B. Consolidation:
 - 1. Consolidate concrete complying with ACI 301 by vibrating, spading or rodding so that concrete is thoroughly worked around reinforcing, embedded items and into the corner of forms.
 - 2. Consolidate each layer of concrete with previously placed layers in manner that will eliminate air or stone pockets which may cause honeycombing, pitting or places of weakness.
 - 3. Do not insert vibrator into portions of concrete that have begun to set.
 - 4. Do not use vibrators to transport concrete.
 - 5. Keep spare vibrator on job site during concrete operations.
 - 6. Use internal vibrator for formed elements, not form vibrators.
 - 7. Slabs:
 - a. Consolidate slabs with vibrating screed.
 - b. Use internal vibration along construction joints at both formed and slab abutments. Vibrate under plate dowels. Mark forms before concreting to properly locate dowels after concreting.
 - c. Do not use grate tampers, jitterbugs, or mesh rollers.
- J. After concrete placement, adjust forms and bracing as necessary to maintain proper alignment and eliminate leakage of cement paste.
- K. Maintain records of concrete placement. Record date, location, quantity, air temperature, and test samples taken.
- L. Do not place concrete floors and slabs in a checkerboard sequence.
- M. Saw cut joints within 2 hours after placing whenever possible. Use 1/8 inch thick blade, cut 1/4 depth of slab thickness.

3.11 FINISHING FORMED SURFACES

- A. Rough-Formed Finish:
 - 1. As-cast concrete texture imparted by form-facing material with tie holes and defects repaired and patched. Remove fins and other projections that exceed specified limits on formed-surface irregularities:
 - a. Apply to concrete surfaces not exposed to public view.
- B. Smooth-Formed Finish:
 - 1. As-cast concrete texture imparted by form-facing material, arranged in an orderly and symmetrical manner with a minimum of seams. Repair and patch tie holes and defects. Remove fins and other projections that exceed specified limits on formed-surface irregularities:
 - a. Apply to concrete surfaces exposed to public view, to receive a rubbed finish, to be covered with a coating or covering material applied directly to concrete.
- C. Rubbed Finish:
 - 1. Apply the following to smooth-formed finished as-cast concrete where indicated:
 - a. Smooth-rubbed finish: Not later than one (1) day after form removal, moisten concrete surfaces and rub with carborundum brick or another abrasive until producing a uniform color and texture. Do not apply cement grout other than that created by the rubbing process.

- b. Grout-cleaned finish: Wet concrete surfaces and apply grout of a consistency of thick paint to coat surfaces and fill small holes. Mix one-part portland cement to 1-1/2-parts fine sand with a 1:1 mixture of bonding admixture and water. Add white portland cement in amounts determined by trial patches so color of dry grout will match adjacent surfaces. Scrub grout into voids and remove excess grout. When grout whitens, rub surface with clean burlap and keep surface damp by fog spray for at least 36 hours.
 - c. Cork-floated finish: Wet concrete surfaces and apply a stiff grout. Mix one-part portland cement and one-part fine sand with a 1:1 mixture of bonding agent and water. Add white portland cement in amounts determined by trial patches so color of dry grout will match adjacent surfaces. Compress grout into voids by grinding surface. In a swirling motion, finish surface with a cork float.
- D. Related Unformed Surfaces: At tops of walls, horizontal offsets, and similar unformed surfaces adjacent to formed surfaces, strike off smooth and finish with a texture matching adjacent formed surfaces. Continue final surface treatment of formed surfaces uniformly across adjacent unformed surfaces unless otherwise indicated.

3.12 FINISHING FLOORS AND SLABS

- A. General:
 - 1. Do not add water to any slab surface during finishing operations.
 - 2. Do not add cement to any slab surface during finishing operations.
 - 3. Perform no finishing operation while water is present on slab surface.
- B. Comply with ACI 302.1R recommendations for screeding, restraighening, and finishing operations for concrete surfaces.
- C. Initial Leveling:
 - 1. Complete bull floating, darbying and straight-edging before any bleed water is present on slab surface.
 - 2. Use a checkrod or highway straightedge 10 feet wide minimum for initial and later leveling instead of bull float where overall floor tolerances specified are greater than FF 20 / FL15.
- D. Hand and Power Floating:
 - 1. Do not start floating until following conditions are met:
 - a. Bleeding is complete and water is gone, including water sheen on slab surface.
 - b. Mortar is not thrown by rotating blades of power float.
 - 2. The finisher shall determine the proper time to start finishing procedures for interior slab placements on the basis the above conditions. It is noted for advisory purposes, however, that typical setting of concrete materials will allow for initial power floating to begin 3-1/2 hour's $\pm$ 1 hour after initial strike-off (screeding), at which time the concrete should support a finisher on foot without more than a 1/4 inch indentation in the slab surface. Variations in concrete materials, nature and proportion of supplementary cementing materials, and concrete temperature will cause setting behavior to vary.
 - 3. Under no circumstances during the finishing process will foot traffic be permitted on slabs scheduled to receive polished concrete finishes. If absolutely necessary, sliders may be used for limited access with the approval of the Architect and/or CUSD project manager. This will need to be address in the pre-pour meetings.
 - a. Any foot traffic on slabs scheduled to receive polished concrete finishes or use of sliders without approval will be cause for automatic rejection of the concrete floor at the contractor's expense.
- E. Troweling for Interior Slabs:
 - 1. Hand or power float floor before starting troweling.
 - 2. Finisher is to delay initial power floating as long as it possible to avoid creating high and low areas from moving excessive surface mortar material around.

3. At this stage only minor adjustments in the surface are intended to be made and the concrete should be firm enough to prevent FF tolerances from being negatively affected.
 4. For first troweling, keep blade as flat as possible and use low speed, minimizing "washboard" or "chatter marks" and "pitting".
 5. Trowel two times minimum with first two trowelings at right angles. Some burn marks are acceptable. Cease troweling before trowel blades scratch surface.
 6. Allow time between trowelings for concrete to stiffen and water sheen to disappear.
 7. Do not add water to slab surface during troweling.
 - d. Adding water to the slab surface during finishing will be cause for automatic rejection of the concrete floor at the contractor's expense
 8. Do not run trowel machines on existing hardened concrete slabs. Trowels shall be carried off of slab surfaces. When parking power trowels on fresh concrete, place on top of plywood or spray area with evaporation retarder before placing trowel on top of slab.
 9. Trowel as many times as possible to enhance surface sheen, without scratching the slab surface but without creating surface burn marks or to cause surface delamination from overworking the surface
 10. Finished surface should be uniform in texture and appearance and free of any trowel marks, "chatter", ridges or any surface irregularity.
 11. Lead finisher/foreman who finished the field sample shall be present for entire fresh concrete finishing process until final troweling is completed.
- E. Pitch to drains: Form 18 inch radius around floor drains and pitch concrete surface to drains at rate of 1/4 inch per foot nominal, unless noted otherwise in Drawings.

3.13 CONCRETE FINISHES

- A. Scratch Finish: While still plastic, texture concrete surface that has been screeded and bull-floated or darbied. Use stiff brushes, brooms, or rakes to produce a profile amplitude of 1/4 inch in one direction.
 1. Apply scratch finish to surfaces that are to receive concrete floor toppings or mortar setting beds for bonded cementitious floor finishes.
- B. Float Finish: Consolidate surface with power-driven floats or by hand floating if area is small or inaccessible to power driven floats. Restraighten, cut down high spots, and fill low spots. Repeat float passes and restraightening until surface is left with a uniform, smooth, granular texture.
 1. Apply float finish to surfaces to receive trowel finish and to be covered with fluid-applied or sheet waterproofing, built-up or membrane roofing, or sand-bed terrazzo.
- C. Trowel Finish: After applying float finish, apply first troweling and consolidate concrete by hand or power-driven trowel. Continue troweling passes and restraighten until surface is free of trowel marks and uniform in texture and appearance. Grind smooth any surface defects that would telegraph through applied coatings or floor coverings.
 1. Conform to section 03 30 00 3.12 FINISHING FLOORS AND SLABS and comply with ACI 302.1R
 2. Apply a trowel finish to surfaces exposed to view or to be covered with resilient flooring, carpet, ceramic or quarry tile set over a cleavage membrane, paint, or another thin-film-finish coating system.
 3. Finish to specified FF/FL tolerances as well as measure surface so gap at any point between concrete surface and an unleveled, freestanding, 10-ft. long straightedge resting on two high spots and placed anywhere on the surface does not exceed 1/8 inch and 1/16 inch in 2 ft.

4. The contractor shall anticipate that grinding will be required as a result of curling or other slab defects. Grinding required to bring the slab surface into acceptable tolerances for finished flooring installation shall be included as part of the Work.
 - a. For all concrete specified to receive an exposed concrete finish, any grinding and which trade will perform the grinding must first be approved by the Architect/CUSD project manager
 - b. Grinding is not to be performed by the concrete contractor or the GC unless approved by the Architect/CUSD project manager
- D. Trowel and Fine-Broom Finish: Apply a first trowel finish to surfaces where ceramic or quarry tile is to be installed by either thickset or thin-set method. While concrete is still plastic, slightly scarify surface with a fine broom.
 1. Comply with flatness and levelness tolerances for trowel-finished floor surfaces.
- E. Broom Finish: Apply a broom finish to exterior concrete platforms, steps, ramps, and elsewhere as indicated.

3.14 CONCRETE PROTECTING AND CURING

- A. General: Protect freshly placed concrete from premature drying and excessive cold or hot temperatures. Comply with ACI 306.1 for cold-weather protection and ACI 301 for hot-weather protection during curing.
- B. Evaporation Retarder: Apply evaporation retarder to unformed concrete surfaces if hot, dry, or windy conditions cause moisture loss approaching 0.2 lb/sq. ft. x h before and during finishing operations. Apply according to manufacturer's written instructions after placing, screeding, and bull floating or darbying concrete, but before float finishing.
- C. Cure concrete according to ACI 308.1, by one or a combination of the following methods:
 1. Moisture Curing: Keep surfaces continuously moist for not less than seven days.
 2. Moisture-Retaining-Cover Curing: Cover concrete surfaces with moisture-retaining cover for curing concrete, placed in widest practicable width, with sides and ends lapped at least 12 inches, and sealed by waterproof tape or adhesive. Cure for not less than seven days. Immediately repair any holes or tears during curing period using cover material and waterproof tape.
 3. Curing Compound: Apply uniformly in continuous operation by power spray or roller according to manufacturer's written instructions. Recoat areas subjected to heavy rainfall within three hours after initial application. Maintain continuity of coating and repair damage during curing period.
 - a. Removal: After curing period has elapsed, remove curing compound without damaging concrete surfaces by method recommended by curing compound manufacturer unless manufacturer certifies curing compound will not interfere with bonding of floor covering used on Project.
 4. Curing and Sealing Compound: Apply uniformly to floors and slabs indicated in a continuous operation by power spray or roller according to manufacturer's written instructions. Recoat areas subjected to heavy rainfall within three hours after initial application. Repeat process 24 hours later and apply a second coat. Maintain continuity of coating and repair damage during curing period.

3.15 CONCRETE SURFACE REPAIRS

- A. For all concrete specified to receive an exposed concrete finish, all repairs must first be approved by the Architect and/or CUSD project manager
 1. Repairs are to be performed by the appropriate flooring contractor per the Architect/CUSD direction and approval.
 2. Repairs are not to be performed by the concrete contractor or the GC unless first approved by the Architect/CUSD

- B. For any specified floor finishes other than exposed concrete finishes, the following repair procedures apply
- C. Defective Concrete:
 - 1. Repair and patch defective areas when approved by Architect.
 - 2. Remove and replace concrete that cannot be repaired and patched to Architect's approval.
- D. Patching Mortar: Mix dry-pack patching mortar, consisting of 1 part portland cement to 2-1/2 parts fine aggregate passing a No. 16 (1.18-mm) sieve, using only enough water for handling and placing.
- E. Repairing Formed Surfaces: Surface defects include color and texture irregularities, cracks, spalls, air bubbles, honeycombs, rock pockets, fins and other projections on the surface, and stains and other discolorations that cannot be removed by cleaning.
 - 1. Immediately after form removal, cut out honeycombs, rock pockets, and voids more than 1/2 inch (13 mm) in any dimension to solid concrete.
 - a. Limit cut depth to 3/4 inch (19 mm).
Make edges of cuts perpendicular to concrete surface.
Clean, dampen with water, and brush-coat holes and voids with bonding agent.
Fill and compact with patching mortar before bonding agent has dried.
Fill form-tie voids with patching mortar or cone plugs secured in place with bonding agent.
 - 2. Repair defects on surfaces exposed to view by blending white portland cement and standard portland cement, so that, when dry, patching mortar matches surrounding color.
 - a. Patch a test area at inconspicuous locations to verify mixture and color match before proceeding with patching.
Compact mortar in place and strike off slightly higher than surrounding surface.
 - 3. Repair defects on concealed formed surfaces that will affect concrete's durability and structural performance as determined by Architect.
- F. Repairing Unformed Surfaces:
 - 1. Test unformed surfaces, such as floors and slabs, for finish, and verify surface tolerances specified for each surface.
 - a. Correct low and high areas.
 - b. Test surfaces sloped to drain for trueness of slope and smoothness; use a sloped template.
 - 2. Repair finished surfaces containing surface defects, including spalls, popouts, honeycombs, rock pockets, crazing, and cracks in excess of 0.01 inch (0.25 mm) wide or that penetrate to reinforcement or completely through unreinforced sections regardless of width, and other objectionable conditions.
 - 3. After concrete has cured at least 14 days, correct high areas by grinding.
 - 4. Correct localized low areas during, or immediately after, completing surface-finishing operations by cutting out low areas and replacing with patching mortar.
 - a. Finish repaired areas to blend into adjacent concrete.
 - 5. Correct other low areas scheduled to receive floor coverings with a repair underlayment.
 - a. Prepare, mix, and apply repair underlayment and primer in accordance with manufacturer's written instructions to produce a smooth, uniform, plane, and level surface.
 - b. Feather edges to match adjacent floor elevations.
 - 6. Correct other low areas scheduled to remain exposed with repair topping.
 - a. Cut out low areas to ensure a minimum repair topping depth of 1/4 inch (6 mm) to match adjacent floor elevations.

- b. Prepare, mix, and apply repair topping and primer in accordance with manufacturer's written instructions to produce a smooth, uniform, plane, and level surface.
- 7. Repair defective areas, except random cracks and single holes 1 inch (25 mm) or less in diameter, by cutting out and replacing with fresh concrete.
 - a. Remove defective areas with clean, square cuts, and expose steel reinforcement with at least a 3/4-inch (19-mm) clearance all around.
 - b. Dampen concrete surfaces in contact with patching concrete and apply bonding agent.
 - c. Mix patching concrete of same materials and mixture as original concrete, except without coarse aggregate.
 - d. Place, compact, and finish to blend with adjacent finished concrete.
 - e. Cure in same manner as adjacent concrete.
- 8. Repair random cracks and single holes 1 inch (25 mm) or less in diameter with patching mortar.
 - a. Groove top of cracks and cut out holes to sound concrete, and clean off dust, dirt, and loose particles.
 - b. Dampen cleaned concrete surfaces and apply bonding agent.
 - c. Place patching mortar before bonding agent has dried.
 - d. Compact patching mortar and finish to match adjacent concrete.
 - e. Keep patched area continuously moist for at least 72 hours.
- G. Perform structural repairs of concrete, subject to Architect's approval, using epoxy adhesive and patching mortar.
- H. Repair materials and installation not specified above may be used, subject to Architect's approval.
- I. Test Results: The testing agency shall report test results in writing to Architect and Contractor within 24 hours of test.

3.16 TOLERANCES AND FINISH REQUIREMENTS

- A. Construct concrete conforming to the tolerances specified in ACI 117 "Specifications for Tolerances for Concrete Construction and Materials", latest edition, as applicable, unless exceeded by requirements of regulatory agencies or otherwise indicated or specified.
- B. Floor Finish Tolerances: Except as otherwise designated, conform to the following:
 - 1. Interior slabs-on-grade:
 - a. Flatness: Overall FF 35, with a minimum local value of FF 24 (ASTM E1155).
 - Levelness: Overall FL 25, with a minimum local value of FL 17 (ASTM E1155).
 - 2. Fill over steel deck:
 - a. Flatness: Overall FF 35, with a minimum local value of FF 24 (ASTM E1155).
 - Levelness: Not applicable, per ACI 117.
 - 3. Interior Slabs to receive Polished Flooring:
 - a. Flatness: Overall FF 40, with a minimum local value of FF 28 (ASTM E1155).
 - b. Levelness: Overall FL 25, with a minimum local value of FL 17 (ASTM E1155).
 - 4. Slabs to receive adhered flooring shall also comply with the flooring manufacturer's requirements.
 - 5. Slabs in areas furnished with modular partitions shall also comply with the partition manufacturer's tolerance requirements.

6. Fill and/or grind completed floors as necessary to achieve specified finish tolerances and as otherwise required for proper installation of building components.
 - a. Any remediation work must be coordinated with the GC, Architect, Owner consultant, prior to repair work being performed.
 1. At the sole discretion of the Architect/Owner, the necessary remediation work shall be performed by the appropriate flooring contractor, not by the concrete contractor.
- C. In addition to specified tolerance requirements, finish and measure surface so gaps at any point between concrete surface and an unleveled, freestanding, 10-ft.-long straightedge resting on two high spots and placed anywhere on the surface does not exceed 1/8 inch and 1/16 inch in 2 feet (610 mm).
- D. Floors which are specified to receive any exposed concrete finish
 1. Concrete finish must be dense, smooth, and uniform in texture and appearance
 2. Free of surface voids
 3. Free of trowel marks including "chatter" and any ridges or gouges
 4. Free of knee board or slider impressions
 5. Finish surface to produce maximum sheen free of scratches and trowel marks.
 6. Random, mottled light burn marks are acceptable.
- E. For any floors receiving concrete polishing finishes, any local values below acceptable tolerances shall require polishing contractor to remediate, and all related costs will be the responsibility of the concrete contractor.
- F. At the sole discretion of the Architect and/or CUSD failure to comply with the Flatness F(F) specified and Levelness F(L) specified, or other specified finish requirements, shall result in the removal and replacement of the concrete floor.

3.17 CONCRETE PROTECTION

- A. Provide a "Concrete Floor Protection Plan" to CUSD and COM rep. prior to placement of interior slabs that addresses how the following tasks will be implemented:
 1. Communication of protection plan to subcontractors and vendors, including those directly contracted by CUSD.
 2. Keeping the slab clean of dirt and grime.
 3. Prevention of stored materials in exposed floor areas until completion of construction.
 4. When and how floor covering protection will be provided in high traffic areas.
 5. Condition, inspection, and operational procedures for construction equipment allowed on the slab surface, including but not limited to:
 - a. Diapering to contain any potential fluid leaks.
 - b. Use of non-marking tires
 - c. Inspection of tire treads for any debris that may mar the slab surface.
 6. Procedures for cleaning up slab spills, including use of and availability of cleaning chemicals and absorptive materials at the site.
- B. Slab Protection:
 1. Protect finished floors to prevent damage by construction traffic and activities until Owner possession.
 2. Protect concrete slabs from staining, gouges, and scratching.
 3. Diaper hydraulic powered equipment
 4. Protect from petroleum stains.
 5. Prohibit use of acids or acidic detergents over concrete surfaces.
 6. Prohibit vehicles from interior concrete slabs.
 7. Protect liquid floor treatment from damage and wear during the remainder of construction period. Use protective methods and materials, including temporary covering, recommended in writing by liquid floor treatments installer.

8. Protect concrete surfaces scheduled to receive surface hardener or polished concrete finish using Floor Slab Protective Covering.
 9. Place drop cloths or other breathable slab protection under parked vehicles.
 10. Do not store structural steel or metal fabrications on slab.
 11. Do not allow pipe cutting machine on slab.
 12. Adequately protect concrete inserts and other embedded items from movement, mechanical injury, or from damage by elements.
 13. Provide access ramps of compacted earth or other means along exposed concrete edges of floor slabs to prevent equipment and machinery from impacting edges. Barricade all other exposed edges to vehicular traffic which may damage edges.
- C. Traffic protect curing compound floor surfaces as follows:
1. Barricade concrete surfaces immediately after placing and finishing.
 2. 3 full days (72 hours) after placement:
 3. 7 full days (168 hours) after placement: Heavy loading permitted but not before concrete has attained, by test, its design strength as noted herein.

3.18 FIELD QUALITY CONTROL

- A. Testing and Inspecting: Owner will engage a qualified testing and inspecting agency to perform field tests and inspections and prepare test reports.
- B. Testing and Inspecting: Engage a qualified testing and inspecting agency to perform tests and inspections and to submit reports.
- C. CUSD will engage with COM team to produce concrete placement data in real-time during concrete slab pours as well as immediate FF/FL testing the day of each pour with reports to be made available within 72 hours following each pour.
- D. Inspections:
1. Steel reinforcement placement.
 2. Steel reinforcement welding.
 3. Headed bolts and studs.
 4. Verification of use of required design mixture.
 5. Concrete placement, including conveying and depositing.
 6. Curing procedures and maintenance of curing temperature.
 7. Verification of concrete strength before removal of shores and forms from beams and slabs.
- E. Concrete Tests: Testing of composite samples of fresh concrete obtained according to ASTM C 172 shall be performed according to the following requirements:
1. Testing Frequency: Obtain one composite sample for each day's pour of each concrete mixture exceeding 5 cu. yd., but less than 25 cu. yd., plus one set for each additional 50 cu. yd. or fraction thereof.
 2. Testing Frequency: Obtain at least one composite sample for each 50 cu. yd. or fraction thereof of each concrete mixture placed each day, but not less than once for each 2000 square feet of surface area for slabs or walls.
 - a. When frequency of testing will provide fewer than five compressive-strength tests for each concrete mixture, testing shall be conducted from at least five randomly selected batches or from each batch if fewer than five are used.
 3. Slump: ASTM C 143/C 143M; one test at point of placement for each composite sample, but not less than one test for each day's pour of each concrete mixture. Perform additional tests when concrete consistency appears to change.
 4. Air Content: ASTM C 231, pressure method, for normal-weight concrete; one test for each composite sample, but not less than one test for each day's pour of each concrete mixture.

5. Concrete Temperature: ASTM C 1064/C 1064M; one test hourly when air temperature is 40 deg F and below and when 80 deg F and above, and one test for each composite sample.
6. Unit Weight: ASTM C 567, fresh unit weight of structural lightweight concrete; one test for each composite sample, but not less than one test for each day's pour of each concrete mixture.
7. Compression Test Specimens: ASTM C 31/C 31M.
 - a. Cast and laboratory cure two sets of two standard cylinder specimens for each composite sample.
 - b. Cast and field cure two sets of two standard cylinder specimens for each composite sample.
8. Compressive-Strength Tests: ASTM C 39/C 39M; test one set of two laboratory-cured specimens at 7 days and one set of two specimens at 28 days.
 - a. Test one set of two field-cured specimens at 7 days and one set of two specimens at 28 days.
 - b. A compressive-strength test shall be the average compressive strength from a set of two specimens obtained from same composite sample and tested at age indicated.
9. When strength of field-cured cylinders is less than 85 percent of companion laboratory-cured cylinders, Contractor shall evaluate operations and provide corrective procedures for protecting and curing in-place concrete.
10. Strength of each concrete mixture will be satisfactory if every average of any three consecutive compressive-strength tests equals or exceeds specified compressive strength and no compressive-strength test value falls below specified compressive strength by more than 500 psi.
11. Test results shall be reported in writing to Architect, concrete manufacturer, and Contractor within 48 hours of testing. Reports of compressive-strength tests shall contain Project identification name and number, date of concrete placement, name of concrete testing and inspecting agency, location of concrete batch in Work, design compressive strength at 28 days, concrete mixture proportions and materials, compressive breaking strength, and type of break for both 7- and 28-day tests.
12. Nondestructive Testing: Impact hammer, sonoscope, or other nondestructive device may be permitted by Architect but will not be used as sole basis for approval or rejection of concrete.
13. Additional Tests: Testing and inspecting agency shall make additional tests of concrete when test results indicate that slump, air entrainment, compressive strengths, or other requirements have not been met, as directed by Architect. Testing and inspecting agency may conduct tests to determine adequacy of concrete by cored cylinders complying with ASTM C 42/C 42M or by other methods as directed by Architect.
14. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.
15. Correct deficiencies in the Work that test reports and inspections indicate do not comply with the Contract Documents.

- F. Measure floor and slab flatness and levelness according to ASTM E 1155 within 24 hours of finishing.

3.19 PROTECTION

- A. Protect concrete surfaces as follows:
1. Protect from petroleum stains.
 2. Diaper hydraulic equipment used over concrete surfaces.
 3. Prohibit vehicles from interior concrete slabs.
 4. Prohibit use of pipe-cutting machinery over concrete surfaces.
 5. Prohibit placement of steel items on concrete surfaces.
 6. Prohibit use of acids or acidic detergents over concrete surfaces.

7. Protect liquid floor treatment from damage and wear during the remainder of construction period. Use protective methods and materials, including temporary covering, recommended in writing by liquid floor treatments installer.
 8. Protect concrete surfaces scheduled to receive surface hardener or polished concrete finish using Floor Slab Protective Covering.
- B. Foot traffic not allowed on slabs to receive a polished concrete finish.
1. Equipment usage in these areas shall take necessary measures to avoid impressions. The use of sliders may be acceptable upon Architect review.

END OF SECTION

SECTION 05 12 00
STRUCTURAL STEEL FRAMING

PART 1 GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. This Section includes:
1. Furnish materials and perform labor required to execute this work as indicated on the Drawings, as specified herein, and as necessary to complete the work required by Project conditions, including but not limited to:
 - a. Structural steel.
 - b. Architectural steel.
 - c. All cast-in-place bolts, nuts, plates, etc.
 - d. Ten-gauge steel or 3/4-inch plywood templates for column anchor bolts.
 - e. Field filling of holes in steel beams and columns.
 - f. Field preparation, priming, and finish painting of all exposed exterior steel:
 - 1) Field preparation, priming, and painting of interior exposed steel, including but not limited to:
 - a) Structural steel.
 - b) Exposed columns, beams, etc.
 - c) Refer to Section 09 90 00: Painting and Coating and Drawings.
 - 2) Field preparation, priming, and painting of exterior exposed steel, including but not limited to:
 - a) Structural steel.
 - b) Exposed columns, beams, etc.
 - c) Refer to Section 09 90 00: Painting and Coating and Drawings.
 2. Coordinate the work of this Section with related trades.
 3. Verify applicable dimensions, clearances, and heights at the jobsite.
- B. Related Sections:
1. Section 01 74 19: Construction Waste Management and Disposal.
 2. Section 03 30 00: Cast-In-Place Concrete.
 3. Section 05 31 00: Steel Decking.
 4. Section 09 90 00: Painting and Coating.
- C. Reference Standards:
1. 2022 California Code of Regulations (CCR), Title 24, California Building Standards Commission (CBSC) www.bsc.ca.gov current edition at time of permit issuance:
 - a. (CCR) Title 24, (CBSC) Chapter 11 – California Green Building Standards Code:
 - 1) Non-residential new construction:
 - a) All occupancy types.
 - b) First time tenant improvements.
 2. ATBCB ADAAG - Americans with Disabilities Act Accessibility Guidelines, current version.
 3. Refer to Specifications, including, but not limited to California Building Codes. Associations, Standards, Definitions, and Miscellaneous Requirements.

4. American Institute of Steel Construction (AISC):
 - a. AISC Steel Construction Manual, including, but not limited to:
 - 1) Specification for Structural Steel Buildings, most current edition.
 - 2) RCSC Specification for Structural Joints.
 - 3) Code of Standard Practice for Steel Buildings and Bridges.
 - b. AISC Specifications for Architecturally Exposed Structural Steel.
 - c. AISC 303.
 - d. AISC 360.
5. American Society For Testing and Materials (ASTM):
 - a. ASTM A6 Standard Specification for General Requirements for Rolled Structural Steel Bars, Plates, Shapes, and Sheet Piling.
 - b. ASTM A36 Standard Specification for Carbon Structural Steel.
 - c. ASTM A53 Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless; Types E or S, Grade B.
 - d. ASTM A108 Standard Specification for Steel Bar, Carbon and Alloy, Cold-Finished.
 - e. ASTM A307 Standard Specification for Carbon Steel Bolts, Studs, and Threaded Rod 60000 PSI Tensile Strength.
 - f. ASTM A325 Standard Specification for Structural Bolts, Steel, Heat Treated, 120/105 ksi Minimum Tensile Strength.
 - g. ASTM A327 Standard Test Methods for Impact Testing of Cast Irons.
 - h. ASTM A500 Standard Specification for Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes; Grade B.
 - i. ASTM A563 Standard Specification for Carbon and Alloy Steel Nuts.
 - j. ASTM A992 Standard Specification for Structural Steel Shapes.
 - k. ASTM E23 Standard Test Methods for Notched Bar Impact Testing of Metallic Materials.
 - l. ASTM E94 Standard Guide for Radiographic Examination Using Industrial Radiographic Film.
 - m. ASTM E164 Standard Practice for Contact Ultrasonic Testing of Weldments.
 - n. ASTM F436 Standard Specification for Hardened Steel Washers Inch and Metric Dimensions.
 - o. ASTM F959 Standard Specification for Compressible-Washer-Type Direct Tension Indicators for Use with Structural Fasteners, Inch and Metric Series.
6. American Welding Society (AWS):
 - a. AWS Standard Code for Arc and Gas Welding in Building Construction.
7. Welding Procedures Specifications (WPS).
8. Steel Structures Painting Council (SSPC).

1.3 SUBMITTALS

- A. Refer to Section 01 33 00: Submittal Procedures and Section 01 25 00: Substitution Procedures and Form.
- B. Submit Manufacturer's Data and Shop Drawings:
 1. Product data: Include laboratory test reports and other data to show compliance with Specifications (include specified standards). Include certified copies of mill reports covering chemical and physical properties of each type of structural steel.
 2. Shop drawings:
 - a. Shop drawings shall include, but not be limited to:
 - 1) Complete details for fabrication and assembly of structural steel members, procedures, and diagrams.
 - 2) Complete schedules for fabrication and assembly of structural steel members, procedures, and diagrams.
 - 3) Include details of cuts, connections, camber, holes, and other pertinent data. Indicate welds by standard AWS symbols, and show size, length, and type of each weld.

- 4) Provide setting drawings, templates, and directions for installation of anchor bolts and other anchorage's to be installed by others.
 - b. Dimensions required for locating structural steel for manufactured items such as mechanical equipment, electrical equipment, dock levelers, etc., shall be coordinated and provided by the General Contractor. General Contractor shall also coordinate and provide dimensions to locate structural steel for window or equipment supports.
- C. Submit Procedures:
1. Provide weld procedures for both pre-qualified welds and special welds to be submitted to the Owner's testing laboratory and the Architect. All Group 4 and 5 shapes and plates greater than two inches (2") shall have additional weld procedures and pre-qualification by testing prior to fabrication.
 2. Provide installation procedure and inspection for direct tension indicator washers detailed in supplemental specifications provided by the manufacturer for approval.
 3. Procedures shall be submitted for both shop and field welds.
 4. Written description of preparation, priming, and finish painting of steel.
- D. Compliance Letter Pertaining to Primer and Painting of Steel, Extent of Work, Products, etc.:
1. Refer to Section 09 90 00: Painting and Coating.
- E. Coordination:
1. The following shall be provided; including, but not limited to:
 - a. General Contractor, floor framing fabricator, floor framing Installer, roof framing fabricator, roof framing installer, metal decking installer, and mechanical contractor shall coordinate the size/dimensioning and extent of all roof and floor openings for mechanical equipment, ductwork, and shafts as part of their submittal to the design team.

1.4 QUALITY ASSURANCE

- A. Refer to Section 01 40 00: Quality Requirements.
- B. AISC Group 4 and 5 shapes and built up members shall meet the requirements for joints in AISC Sections J1.7, J1.8, J2.6, and M2.2.
- C. All steel to be exposed and painted shall be repaired for an architectural finish.
- D. Performance, Testing, and Inspection:
1. General:
 - a. Comply with manufacturer's standards.
 - b. Comply with state and local building codes.
 - c. Jobsite inspections shall be done as herein specified and as listed in Drawings.
 - d. Testing shall be done as herein specified and as listed in Drawings.
 2. Standards:

Item	Name of Test	Performance	Testing Std.
Unidentified materials	Test Lab	Refer to Structural Plans	Refer to Structural Plans
Examine seam welds of structural tubes and pipes	Special Inspection	Refer to Structural Plans	Refer to Structural Plans
Material verification	Special Inspection	Refer to Structural Plans	Refer to Structural Plans
High-strength bolts, nuts and washers	Test Lab	Refer to Structural Plans	Refer to Structural Plans

Item	Name of Test	Performance	Testing Std.
Bearing type connections	Special Inspection	Refer to Structural Plans	Refer to Structural Plans
Slip critical connections	Special Inspection	Refer to Structural Plans	Refer to Structural Plans
Non-destructive testing of partial joint penetration welds and complete joint penetration welds	Ultrasonic or magnetic particle (Test Lab)	Refer to Structural Plans	Refer to Structural Plans
Comply with Standards, Codes, Drawings, Specifications, and in accordance with agencies having jurisdiction.			
Refer to Drawings and as herein specified.			

3. Testing and inspections:

a. General:

- 1) Shall comply with 2022 CBC, including but not limited to Chapter 22.

b. Testing laboratory:

- 1) An inspection and testing laboratory will be selected by the Owner for testing and inspection as required by the Contract Documents.
- 2) The selected laboratory shall conform to the requirements of ASTM E329.
- 3) Documentary evidence of such conformance shall be submitted to the Owner.

c. All materials, work, methods and equipment shall be subject to inspection at the mill, fabricating plant, and at the building site:

- 1) Material or workmanship not complying fully with the Contract Documents will not be accepted.
- 2) The General Contractor shall give the testing laboratory reasonable notice when ready for inspection and shall supply samples and test pieces and all facilities for inspection without extra charge.
- 3) The Owner will assume the expense of making the tests and inspection except as otherwise specified in Section 01 40 00: Quality Requirements.
- 4) All welding and high strength bolting shall be inspected. All high strength bolts shall be sampled and tested by an independent agency.

d. The testing laboratory will check field fabrication for conformance to the Drawings and the referenced standards.

e. Testing laboratory will inspect prime paint for thickness, coverage, and compliance with Specifications.

f. Cost of testing and inspection:

- 1) Costs of testing and inspection of structural steel, except as specified hereunder and in Section 01 45 23: Testing and Inspecting Services, will be paid for by the Owner
- 2) All transportation costs and per diem living costs for inspection at fabricators' plant further than 75 miles from the jobsite will be back charged to the General Contractor.
- 3) It is assumed that all fabrication will take place in one shop location only. All additional inspection costs will be back charged to the General Contractor.
- 4) All mill tests and costs of re-test of plain materials shall be at the expense of the General Contractor.
- 5) Tests required due to General Contractor's failure to provide steel identifiable in accordance with the indicated ASTM designation shall be at the expense of the General Contractor.
- 6) Re-testing of items that failed original tests due to General Contractor's poor and/or failed construction shall be at the expense of the Contractor.

- g. Structural steel testing and inspection:
- 1) For shapes, plates, bars, pipe and tubing, manufacturer's certified mill test reports, and analysis for each heat will be acceptable in lieu of testing for steel identifiable in accordance with indicated ASTM designation. Mill test reports shall indicate the physical and chemical properties of all structural steel used. Correlate individual heat numbers with each specified structural section. Tests shall also be reviewed for supplemental requirements S91 and S5 per materials in this Section.
 - 2) For unidentifiable steels listed above, one (1) tension and elongation test and one (1) bend or flattening test for each five (5) tons or fractional part thereof for each size will be performed by the testing laboratory:
 - a) Comply with 2022 CBC.
- h. Welding Inspection:
- 1) All shop and field welded operations will be inspected by a qualified welding inspector employed by the testing laboratory. Such inspector will be a person trained and thoroughly experienced in inspection of welds on work requiring unquestioned reliability. The inspector's ability to distinguish between sound and unsound welding will be reliably established.
 - 2) The welding inspector will make a systematic record of all welds. This record shall include:
 - a) Identification marks of welders.
 - b) List of defective welds.
 - c) Manner of correction of defects.
 - 3) The welding inspector will check the material, equipment, and procedure, as well as the welds. He will also check the ability of the welder. He will furnish the Architect with a report, duly verified by him, that the welding required to be inspected is proper and has been done in conformity with the Contract Documents, and that he has used all means to determine the quality of the welds.
 - 4) All full penetration groove welds will be subject to ultrasonic testing. All defective welds shall be repaired and retested with ultrasonic equipment at the General Contractor's expense.
 - 5) Column flanges: An area extending six inches (6") above and below point where girder flanges are attached will be inspected. Column flange edges will be inspected visually and entire area ultrasonically for laminations, plate discontinuities, and non-metallic inclusions.
 - 6) Ultrasonic testing will test all partial penetration groove welds.
 - 7) When ultrasonic indications arising from the weld root are interpreted as either a weld defect or the backing strip itself, the Engineer and Owner will be notified. The Owner may require the removal of backing strip. The backing strip will be removed at the expense of the General Contractor, and if no root defect is visible the weld will be retested. If no defect is indicated on this retest, and no significant amount of base and weld metal have been removed, no further repair of welding is necessary. If a defect is indicated, it will be repaired and retested at General Contractor's expense.
 - 8) The technician to evaluate the quality of the welds will calibrate the ultrasonic instrumentation.
 - 9) Other methods of inspection, for example, X-Ray, gamma ray, magnetic particle, or dye penetrant, may be used on welds if felt necessary by the inspection laboratory, and with the approval of the Owner:
 - a) Comply with 2022 CBC Chapter 17, including but not limited to Sections; 1704 & 1705.
 - 10) Base metal thicker than 1-1/2 inch, when subjected to through thickness weld shrinkage strains, shall be ultrasonically inspected for discontinuities directly behind such weld before and after joint completion.

- 11) Tests of end-welded studs:
 - a) Comply with 2022 CBC Section 1704 & 1705 and AWS D1.1.
 - b) Randomly test a minimum of ten (10) studs total with a minimum of three (3) from each heat. Physical properties shall conform to the minimums noted herein under Material Bolts.
- 12) Ultrasonic testing:
 - a) At the discretion of the Owner's testing agency, the ultrasonic testing frequency may be reduced but may not be less than the following:
 1. Initially, all welds requiring ultrasonic testing will be tested at the rate of 100 percent in order to establish the qualifications of each individual welder. If the reject rate is demonstrated to be less than five percent (5%) of the welds tested for each welder, then the frequency of testing for that welder may be reduced to 25 percent. If the reject rate increases to five percent (5%) or more, 100 percent testing will be re-established until the rate is reduced to less than five percent (5%). The percentage of rejects will be calculated for each welder independently.
 2. A sampling of at least 40 completed welds will be made for such reduction evaluation. Reject rate is defined as the number of welds containing rejectable defects divided by the number of welds completed. For evaluating the reject rate of continuous welds over three feet (3') in length, each 12 linear inch increment of welds, one inch (1") or less in thickness, will be considered as one (1) weld. For evaluating the reject rate of continuous welds greater than one inch (1") thickness, each six (6) linear inches will be considered one (1) weld.
- 13) See structural plans for additional inspection requirements.
- i. High strength bolting tests and inspection:
 - 1) Furnish certified test reports for each lot of bolts in accordance with Section 9 of ASTM A325:
 - a) Install bolts under the supervision of a qualified inspector in accordance with Section 9, Research Council using ASTM A325 bolts.
 - 2) Testing laboratory will visually inspect all high strength bolts for tension:
 - a) The bolts with the largest load indicator gaps (approximately ten percent [10%]) will be checked with a metal feeler gauge.
 - b) Comply with 2022 CBC Sections.
 - 3) Direct tension indicator washer testing:
 - a) Perform testing of not less than three (3) indicator washers for each diameter and grade of fastener in a calibration device capable of indicating bolt tension.
 - b) The test assembly shall include flat hardened washers, if required in the actual connection, arranged as those in the actual connections to be tensioned.
 - c) The calibration test shall demonstrate that the indicator washers indicates a tension not less than five percent (5%) greater than that required by Table 4 of the AISC Specification for Structural Joints using ASTM A325 bolts.
 - d) Manufacturer's installation procedure as required in Section 01 33 00: Submittal Procedures, shall be followed for installation of bolts in calibration device and in all connections.

1.5 WARRANTY

- A. Refer to Section 01 77 00: Closeout Procedures.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Refer to Section 01 60 00: Product Requirements.

- B. Store materials to permit easy access for inspection and identification:
 - 1. Keep steel members off the ground, using pallets, platforms, or other supports.
 - 2. Protect steel members and packaged materials from erosion and deterioration.
- C. Do not store materials on structure in a manner that might cause distortion or damage to members or supporting structures. Repair or replace damaged materials or structures as directed.

PART 2 PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

- A. Single Source Responsibility: Specified items shall be from one (1) manufacturer for each product type.
- B. Acceptable manufacturers shall be as herein listed and in Drawings:
 - 1. Substitutions and deviations shall require Architect's approval and shall be given in letterform.
 - 2. Refer to Section 01 33 00: Submittal Procedures.
 - 3. Proposed alternate products must be equal in terms of chemical composition, color, finish, configuration, performance standards, etc.
- C. All products and materials indicated shall be installed according to current listed Specification requirements and manufacturers specifications/recommendations.
- D. Refer to Drawings, details, and other related Specification Sections, whether listed or not.
- E. Details shall set basic requirements for size and configuration of systems.

2.2 MATERIALS

- A. Structural Steel:
 - 1. W shapes: ASTM A992 unless indicated otherwise on Drawings.
 - 2. Channels and other rolled shapes: ASTM A36 unless indicated otherwise on Drawings.
 - 3. Plates and bars: ASTM A36 unless indicated otherwise on Drawings.
- B. AISC Group 4 and 5 shapes and plates greater than two inches (2") thick:
 - 1. ASTM A36/ASTM A572 Grade 50 with supplementary requirements S91 Fine Austenitic Grain Size and S5 Charpy V-Notch (CVN) Impact Test.
 - 2. For location of CVN test, see AISC figure C-A3.1c.
 - 3. CVN test shall be per ASTM A673, frequency P and shall meet a minimum average value of 20 ft-lbs absorbed energy at 70°F.
 - 4. Elements of the moment frames only.
- C. Cold-Formed Steel Tubing: ASTM A500, Grade B.
- D. Steel Pipe: ASTM A53, Type E or S, Grade B.
- E. Anchor Bolts:
 - 1. All anchor bolts cast in concrete shall be headed bolts with cut threads conforming to:
 - a. ASTM A307 or ASTM A36 or ASTM F1554; Grade 36, or ASTM F1554; Grade 55 as indicated on Drawings.
- F. Machine Bolts: ASTM A307.

- G. High Strength Bolts, Nuts, and Washers:
1. Bolt specifications:
 - a. Bolts shall conform to the requirements of the most current adopted edition of the Specifications of the American Society for Testing and Materials for High-Strength Bolts for Structural Steel Joints, ASTM A325, Heat Treated Steel Structural Bolts, 150 ksi Minimum Tensile Strength, as indicated on Drawings.
 2. Bolt geometry:
 - a. Bolt dimensions shall conform to the current requirements of the American National Standards Institute for Heavy Hex Structural Bolts.
 - b. The length of bolts shall be such that the end of the bolt will be flush with or outside the face of the nut when properly installed.
 3. Nut specifications:
 - a. Nuts shall conform to the current chemical and mechanical requirements of the American Society for Testing and Materials Standard Specification for Carbon and Alloy Steel Nuts, ASTM A563.
 4. Washers:
 - a. Flat circular washers and square or rectangular beveled washers shall conform to the current requirements of the American Society for Testing and Materials Standard Specification for Hardened Steel Washers, ASTM F436.
 5. Direct tension indicator washers – ASTM F959: TurnaSure DTI (www.turnasure.com), Type 325.
 6. Tension control fastener system: Lohr (www.lohrfasteners.com), LeJeune Bolt (www.lejeunebolt.com), Nucor Fastener (www.nucor.com), or Cordova Bolt, Inc. (www.cordovabolt.com).
- H. Threaded Stud Bolts:
1. Comply with ASTM A108:
 - a. Tensile strength: 60,000 psi.
 - b. Elongation in two inches (2"): 20 percent.
 - c. Reduction of area: 50 percent.
- I. Headed Stud-Type Shear Connectors:
1. Comply with ASTM A108 Grade 1015 or 1020 cold-finished carbon steel with dimensions complying with AISC Specifications:
 - a. Tensile strength: 60,000 psi.
 - b. Elongation in two inches (2"): 20 percent.
 - c. Reduction of area: 50 percent.
- J. Provide hexagonal heads and nuts for all connections per ASTM A563, Appendix Table X1.1.
- K. Electrodes for Welding:
1. Comply with AWS Code, E70 Series minimum.
 2. Fabricator to select proper electrodes according to weld procedures as submitted.
- L. Powder Driven Fasteners:
1. Tempered steel pins with special corrosive resistant plating or coating.
 2. Pins shall have guide washers to accurately control penetration.
 3. Fastening shall be accomplished by low-velocity piston-driven power activated tool.
 4. Pins and tool shall be as manufactured by Hilti Fastening Systems (www.hilti.com).
- M. Expansion Bolts: Hilti Fastening Systems (www.hilti.com) or approved equal.
- N. Non-Shrink Grout: Refer to Section 03 30 00: Cast-In-Place Concrete.

- O. Shop Primer:
1. Primer shall be compatible with primer and finish coats for exposed steel per Section 09 90 00: Painting and Coating.
 2. Primers for concealed steel not to be painted per Section 09 90 00: Painting and Coating:
 - a. Type A material - Tnemec Company, Inc. Series 88HS Azerox H.S. Primer (www.tnemec.com):
 - 1) Exposed conditions use primer in accordance with Section 09 90 00: Painting and Coating.
 - b. Type B material - Tnemec Company, Inc. Series 90-97 Tnemec-Zinc:
 - 1) Exposed conditions use primer in accordance with Section 09 90 00: Painting and Coating.
 - c. All paints shall meet the California Air Resources Board Standards.
- P. Primers and Finish Paint: Refer to Section 09 90 00: Painting and Coating.
- Q. Hole Filler for Steel Columns and Beams: JB Weld (www.jbweld.com).

2.3 STEEL STRUCTURES PAINTING COUNCIL (SSPC)

- A. Cleaning Standards:
1. SSPC-Vis 1 Pictorial Surface Preparation Standards for Painting Steel Structures.
 2. SSPC-SP2 Hand Tool Cleaning.
 3. SSPC-SP3 Power Tool Cleaning.
 4. SSPC-SP6 Commercial Blast Cleaning.
 5. SSPC-PA2 Measurement of Dry Paint Thickness with Magnetic Gauges.
- B. Paint:
1. As herein indicated and in accordance with Section 09 90 00: Painting and Coating.
 2. Coordination of Work:
 - a. Review other Sections in which prime paints are to be provided to ensure compatibility of coatings system for various substrates.
 - b. Shop priming may be omitted if approved by Owner and covered under Section 09 90 00: Painting and Coating.
 3. Requirements of regulatory agencies: Comply with applicable rules and regulations of governing agencies for air quality control.
- C. Shop Primer:
1. All paints shall meet the California Air Resources Board Standards:
 2. Concealed steel: As herein listed.
 3. Exposed steel:
 - a. Comply with Section 09 90 00: Painting and Coating.
 - b. Shop priming may be omitted if approved by Owner and covered under Section 09 90 00: Painting and Coating.

PART 3 EXECUTION

3.1 JOB CONDITIONS

- A. All steel shall be dry and clean per paint manufacturer's recommendations as herein specified and listed in Section 09 90 00: Painting and Coating prior to field shop and/or field painting.

3.2 COORDINATION

- A. Refer to Section 01 31 00: Project Management and Coordination.
- B. General Contractor shall coordinate work as herein specified, in accordance with Drawings and as required to complete scope of work with all related trades.

3.3 SEQUENCING/SCHEDULING

- A. Cooperate and coordinate this work with other trades for anchor bolts, and other required inserts, templates, painting, etc.:
 - 1. Align this work prior to installation of other materials.

3.4 INSPECTION/EXAMINATION

- A. Verification of Conditions:
 - 1. Examine areas and conditions under which work is to be performed.
 - 2. Identify conditions detrimental to proper or timely completion of work and coordinate with General Contractor to rectify.
 - 3. Do not proceed until unsatisfactory conditions are corrected.
 - 4. Proceeding with the work signifies that Contractor accepts the substrate, surfaces, and conditions, and any problems related to the substrate shall be repaired to the satisfaction of the Owner's representative without any additional cost to the Owner.

3.5 PREPARATION

- A. Prepare work, substrates, etc. in accordance with manufacturer's recommendations.
- B. Protection:
 - 1. Protect finish surfaces at all times from surfaces and material adjacent to them.
 - 2. Finish work defaced with other materials on surface shall be replaced.
 - 3. Protect work under this Section from damage by other trades.

3.6 FABRICATION

- A. Exterior Steel: All exterior exposed steel shall be welded watertight to all steel including, but not limited to, steel columns, beams, outriggers, eave beams, metal decking, etc.
- B. Shop Fabrication and Assembly:
 - 1. Fabricate and assemble structural assemblies in shop to greatest extent possible. Fabricate items of structural steel in accordance with AISC Specifications and as indicated on final shop drawings. Provide camber in structural members where indicated:
 - a. Properly mark and match-mark materials for field assembly. Fabricate for delivery sequence that will expedite erection and minimize field handling of materials.
 - b. Where finishing is required, complete assembly, including welding of units, before start of finishing operations. Provide finish surfaces of members exposed in final structure free of markings, burrs, and other defects.
- C. Connections: Weld or bolt shop connections, as indicated. Bolt field connections, except where welded connections or other connections are indicated.

- D. High Strength Bolts: Install in accordance with requirements for A325 and A490 slip critical and snug tight conditions as indicated on Drawings. Tighten nuts by the turn-of-the nut method or by use of a direct tension indicator. Install hardened washers in conformance with AISC Specifications. Mark bolts that have been completely tightened with an identifying symbol. Final tightening of high strength bolts in webs of beam to column moment connection shall be performed after completion of flange welding.
- E. Install high strength bolts with snug tight type connections with threads excluded from shear plane except as otherwise noted. Holes are 1/16 inch larger unless noted otherwise in Drawings. Tighten high strength bolts to the bolt tension required by the referenced AISC standard using direct tension indicators.
- F. Unless noted otherwise, make holes 1/16 inch larger than the nominal bolt diameter unless noted otherwise in Drawings.
- G. Welding, Shop, and Field: Weld by Shielded Metal Arc Welding (SMAW) method, submerged arc method, Flux Core Arc Welding (FCAW) method, or other method approved by AWS. Perform welding in accordance with AWS Code. All welders, both manual and automatic, shall be certified in accordance with AWS "Standard Qualification Procedure" for the Work to be performed. See paragraph "welding" herein, for detailed requirements. If sizes of fillet welds are not shown on Drawings, use AWS minimum weld size but not less than 3/16-inch fillet welds.
- H. Bolt Holes for Other Work:
 - 1. Provide holes required for securing other work to structural steel framing:
 - a. Provide threaded nuts welded to framing and other specialty items as indicated to receive other work.
 - b. Cut, drill, or punch holes perpendicular to metal surfaces and remove all burrs. Do not flame cut holes or enlarge holes by burning. Drill holes in bearing plates.
- I. High Strength Bolts:
 - 1. Installation and tightening:
 - a. Handling and storage of fasteners - Fasteners shall be protected from dirt and moisture at the jobsite. Only as many fasteners as are anticipated to be installed and tightened during a work shift shall be taken from protected storage. Fasteners not used shall be returned to protected storage at the end of the shift. Fasteners shall not be cleaned of lubricant that is present in as-delivered condition.
 - b. Tension calibrator - A tension measuring device shall be required at all jobsites where bolts in slip-critical joints are being installed and tightened. The tension measuring device shall be used to confirm (1) the suitability to satisfy the requirements of AISC for the complete fastener assembly, including lubrication if required to be used in the work, (2) calibration of wrenches, if applicable, and (3) the understanding and proper use by the bolting crew of the method to be used. The frequency of confirmation testing, the number of tests to be performed, and the test procedure shall be as specified below, as applicable. The accuracy of the tension measuring device shall be confirmed through calibration by an approved testing agency at least annually.
 - c. Joint assembly and tightening of shear/bearing connections - Bolts in connections not within the slip-critical category shall be installed in properly aligned holes, but need only be tightened to the snug tight condition. The snug tight condition is defined as the tightness that exists when all plies in a joint are in firm contact. This may be attained by a few impacts of an impact wrench or the full effort of a man using an ordinary spud wrench. If a slotted hole occurs in an outer ply, a flat hardened washer or common plate washer shall be installed over the slot.

- d. Joint assembly and tightening of connections requiring full pre-tensioning - Slip-critical connections shall be installed in properly aligned holes and tightened by one of the following methods:
- 1) Turn-of-nut tightening: When turn-of-nut tightening is used, hardened washers are not required except as specified in the AISC. A representative sample of not less than three (3) bolts and nuts of each diameter, length, and grade to be used in the Work shall be checked at the start of work in a device capable of indicating bolt tension. The test shall demonstrate that the method of estimating the snug-tight condition and controlling turns from snug tight to be used by the bolting crews develops a tension not less than five percent (5%) greater than the tension required for slip-critical connections.
 - 2) Installation of alternate design bolts: A representative sample of not less than three (3) bolts of each diameter, length, and grade shall be checked at the jobsite in a device capable of indicating bolt tension. The test assembly shall include flat hardened washers, if required in the actual connection, arranged as in the actual connections to be tensioned. The calibration test shall demonstrate that each bolt develops a tension not less than five percent (5%) greater than the tension required by AISC. Manufacturer's installation procedure shall be followed for installation of bolts in the calibration device and in all connections. When alternate design features of the fasteners involve an irreversible mechanism such as yield or twist-off of an element, bolts shall be installed in all holes of the connection and initially brought to a snug tight condition. All fasteners shall then be tightened, progressing systematically from the most rigid part of the connection to the free edges in a manner that will minimize relaxation of previously tightened fasteners prior to final twist-off or yielding of the control or indicator element of the individual fasteners. In some cases, proper tensioning of the bolts may require more than a single cycle of systematic tightening.
 - 3) Mark bolts that have been completely tightened with an identifying symbol. Final tightening of high strength bolts in webs of beam to column moment connections shall be performed after completion of flange welding.

3.7 WELDING

- A. General:
1. Quality of materials and design and fabrication of all welded connections shall conform to AISC "Specifications for the Design, Fabrication and Erection of Structural Steel for Building," "AWS Code for Welding in Building Construction," and requirements of this Section:
 - a. Location and type of all welds shall be as shown. Make no other welded splices, except those shown on Drawings, without prior approval of the Architect and Engineer.
- B. Exterior Steel: All exterior steel metal decking shall be welded continuous and watertight to steel connections.
- C. Automatic Welding: Use electrode wire and flux for automatic and semi-automatic welding acceptable to Architect. All methods, sequences, qualification and procedures, including preheating, and post heating if necessary, shall be detailed in writing and submitted to the Architect for review.
- D. Qualification of Welders:
1. Structural steel welding: Manual and automatic welds for structural steel construction shall be made only by operators who have been previous qualified by tests to perform type of work required.

2. Welders shall be checked by welding inspector. Those not doing satisfactory work may be removed and may be required to pass qualification tests again. All qualification testing shall be at the General Contractor's expense.
 3. Only welders whose weld procedures and pre-qualification by testing that have passed shall be considered qualified for such welds.
- E. Control cooling process after weld is completed by either step down post heat or thermal blankets as determined by procedures and pre-qualification.
- F. Flame cut surfaces shall be ground to remove contaminated steel layer to provide welds proper fusion without impurities.
- G. Preparation of Surface: Surfaces to be welded shall be free of loose scale, slag, rust, grease, paint, and any other foreign material.
- H. Welding Equipment: Welding equipment to be used in each case shall be acceptable to welding inspector. Use equipment with suitable devices to regulate speed and manually adjust operating amperage and voltage. The amperage capacity shall be sufficient to overcome line drop and to give adequate welding heat.
- I. Remove runoffs tabs and grind surfaces smooth where the tabs would interfere with fireproofing and architectural finishes.
- J. Automatic End-Welded Studs: Automatically end-weld in accordance with the manufacturer's recommendations in such a manner as to provide complete fusion between the end of the stud and the plates. There shall be no porosity or evidence of lack of fusion between the welded end of the stud and the plate. The stud shall decrease in length during welding approximately 1/8 inch for 5/8 inch, and 3/16 inch for 3/4-inch diameter. Stud sizes indicated on Drawings represent the finish stud height.
- K. Welding requirements shall be as follows:
1. The General Contractor shall be required to furnish a fabrication/erection inspector and the Owner to employ a verification inspector. Visual inspection means that the inspector visually inspects the welding for adherence to the approved weld procedure specification starting with fit-up and proceeding through the welding process. Reliance only upon use of Non-Destructive Examination (NDE) at the end of the welding should be avoided. Use visual inspection in conjunction with NDE for a sound weld.
 2. A Welding Procedure Specifications (WPS) shall be submitted to the Owner and the enforcement agency for acceptance prior to the start of work. The WPS shall be used in providing the required special inspection. The WPS shall contain the actual values to be used for the welding parameters and variable so that instruction is provided to welders; as a minimum the WPS shall list the position, electrode type, and size, travel speed, electrode stick-out, voltage and amperage with acceptable limits, bead size, weld sequence, stress relieving, and other pertinent data. A copy of the filler metal manufacturer's technical data sheet shall be submitted with each WPS. Welding consumables must be used within the positions, thickness, temperatures, and other parameters provided by the manufacturer. For WPSs requiring qualification, Procedure Qualification Records (PQRs) shall also be submitted for acceptance. Production welding heat input should be limited based on the PQR.
 3. WPSs for FCAW shall be qualified by testing. The tests shall include CVN tests to the weld metal.
 4. SMAW and FCAW, both self-shielded (FCAW-SS) and gas shielded (FCAW-G), are suitable processes.
 5. The maximum diameter for the flat and horizontal position shall be limited to 7/64 inch.
 6. Maximum width and thickness of weld layers shall be:
 - a. The thickness of a root layer shall not exceed 1/4 inch.

- b. The maximum width of a layer in any position shall not exceed 5/8 inch.
 - c. The width of a weave bead shall not exceed three times the electrode (wire) diameter, d , when $d > 3/32$ inch, or five times the electrode diameter when $d < 5/64$ inch.
7. The filler metal used shall have a notch toughness not less than of 20 ft-lbs as measured by a standard CVN test, ASTM E23. The CVN test temperature shall be at least 0°F. The minimum required energy absorption is 20 ft-lbs average. One (1) specimen may be less than the minimum average, but not less than 15 ft-lbs. The test shall be conducted in accordance with the applicable filler metal specification and may be performed by the manufacturer.
 8. For highly restrained joints, or where shrinkage is likely to cause problems, the General Contractor shall submit a weld shrinkage and distortion control plan to the Engineer/Owner for review to determine compliance with design intent.
 9. All welds shall be started and ended with a full cross section weld for a minimum length of one inch (1") on weld tabs ("run off" tabs) except at access holes in beam/girder webs. All weld tabs shall be removed, the affected area ground smooth and magnetic particle tested for defects. Minimum weld tab length shall be the greater of one inch (1") or 1.5 times the beam flange thickness but need not exceed four inches (4").
 10. If backing bars are used under the bottom beam flange to column flange CJP groove weld, the backing bar shall be removed, the removal area ground to sound, bright metal and the area magnetic particle tested for defects. A reinforcing fillet weld, at least 1/4 of the bottom flange thickness but not greater than 3/8 inch, shall be placed in this location.
 11. If a backing bar is used under the top beam flange to column CJP groove weld and is not removed, the backing bar shall be attached to the column and beam flanges by either a fillet weld along the complete bar length on the underside of the bar, or by a partial penetration weld from the underside of the bar, for the full length of the bar. Other methods of welding the bar to the column and beam may be used subject to the Engineer's and Owner's approval.
 12. Weld dams are not allowed. Weld dams are weld tabs not aligned in such a manner to provide an extension of the joint preparation. Weld dams are typically perpendicular to proper weld tabs.
 13. All tack welds shall be of the same quality as the final welds. This includes requirements for preheat. All tack welds not incorporated into the final welds shall be removed.
 14. Preheat, if required by the following requirement, shall be used for all welds including tack welds. Preheat and interpass temperatures shall be determined using the hydrogen controlled method. The maximum interpass temperature shall not exceed 550 degrees. Welds for sections in ASTM A6 Shape Size Groups 4 and 5 and plates with a thickness greater than 2-1/2 inches shall have a minimum preheat of 350°F. To ensure that the work piece is properly heated, the temperature of the part shall be measured at a distance from the axis of the weld equal to twice the thickness of the thickest part being welded, but in no case less than three inches (3") in all directions, including the through thickness dimension of the part being welded, for the full length of the weld joint. Preheat shall be verified by the inspector before welding commences. The cooling rate of the weldment shall be controlled with thermal insulation or other appropriate methods to a maximum of 250°F/hr.

15. An acceptable method for installing flat reinforcing plates aligned parallel to the top or bottom flange is as follows: The reinforcing plate for the bottom flange shall be welded to the column in the fabricating shop using a complete penetration, two-sided, double joint. This weld shall be inspected by ultrasonic examination. The balance of the welding is to be done in the field. The reinforcing plate for the top flange shall be shipped loose. After the top flange has been welded to the column, ultrasonically examined, and accepted, the top flange weld surface shall be prepared, and the reinforcing plate fitted for welding to the column. The reinforcing plate shall be restrained from rotation during welding to the column. After completion of the reinforcing plate to the column weld, the reinforcing plate shall be welded to the top flange.
 16. Welders that will make welds with restricted access, such as, but not limited to, the beam bottom flange to column welds through a cope hole or access hole in the beam web, or where access to the bottom of a groove weld is restricted by the presence of a column flange, shall be qualified by the General Contractor using the same welding procedure as will be used for production and a mock-up assembly that simulates the construction configuration.
 17. Mill scale shall be removed from the column in the area where the beam flange will be welded to the column.
 18. General Contractor shall submit to the structural Engineer, for acceptance, a quality control or inspection plan that addresses all inspection issues, including in-process and final inspection.
 19. The qualification of the General Contractor's Inspectors and NDE personnel shall be submitted to the Owner for acceptance.
 20. In cases of differences of opinion between the Owner's inspector and the General Contractor's inspector regarding conformance of a weld with the Specifications, the issue shall be brought to the Owner's structural Engineer and the enforcement agency as part of the resolution process.
 21. All groove welds in the girder-to-column connection shall be ultrasonically examined for the full length. Backing bar removal areas and fillet welds on continuity plates shall be examined for the full length by the magnetic particle testing (MPT) method.
 22. Shear connection plates shall be sized so that they do not interfere with welders' access to make flange welds or to perform work that is required to install or remove backing or to place reinforcing fillet welds.
- L. Cleaning, Priming, and Finish Painting:
1. All exterior steel and other locations indicated to be exposed or painted shall be sandblasted.
 2. All interior steel shall be cleaned in accordance with SSPC guidelines:
 - a. Exposed steel shall be sandblasted for architectural appearance.

3.8 INSTALLATION/ERECTION

- A. Exterior Steel: All construction shall be for a watertight assembly, including, but not limited to, metal filler putty and welding.
- B. Structural Steel Erection: Comply with AISC "Specification for the Design, Fabrication and Erection of Structural Steel for Building", current adopted edition at time of permit issuance.
- C. Erection Sequence: Erect steel in accordance with special erection sequences where special erection sequences are indicated on the Contract Documents.
- D. Before and during erection, keep all structural steel clean. Ship, handle, and store steel in manner to avoid injury to members. Steel members showing evidence to rough handling or injury will be rejected.

- E. Mark each member with erection identification corresponding to mark shown on erection drawings. When marking steel in exposed conditions, the markings shall be made with easily removable chalk or similar pencil to avoid bleed through after painting. Carefully plan erection of structural steel so that no cutting and removal of material will be necessary. Do not torch burn in the field, unless specifically permitted by Engineer.
- F. Provide sufficient bracing, shoring, and guys to effect safe and satisfactory erection. Provide bracing and shoring capable of holding steel work plumb and properly aligned while field connections are being made and until lateral force resisting elements are deemed by Architect capable of bracing structure. Temporary bracing shall be adequate to resist lateral forces from wind or seismic prior to the completion of the lateral resisting system.
- G. Set bearing and base plates with extreme care. Bring level to line and grade with leveling plates or by leveling nuts and bolts. Grout solid under plates with a flowable non-shrink grout per Section 03 30 00: Cast-In-Place Concrete prior to applying vertical loads.
- H. Field Assembly:
 - 1. Set structural framing accurately to the lines and elevations indicated. Align and adjust the various members forming a part of a complete frame or structure before permanently fastening. Before assembly, clean bearing surfaces and other surfaces that will be in permanent contact. Perform necessary adjustments to compensate for discrepancies in elevations and alignment:
 - a. Level and plumb individual members of the structure within specified AISC tolerances except as noted herein.
- I. All welds shall be full and clean and conform to AISC and AWS specifications.
- J. Erection Tolerances:
 - 1. Individual pieces shall be erected so that the deviation from plumb, level, and alignment shall not exceed 1 to 500 except that:
 - a. The maximum overall height displacement of the centerline of columns at elevator shafts, from the established column line, shall not be more than one inch (1") at any point, measured from base of shaft to top of shaft.
 - b. In order to provide a true, flat plane for the exterior elevations, install all steel framing at the exterior walls of the building so that the center lines of such framing do not vary by more than one inch (1") for the length of the building.
 - c. All columns and beams shall adhere to Section M2.7 of the referenced "Specification for Structural Steel for Buildings," which states that completed members shall be free of twists, bends, and open joints. Take special care that column base plates are parallel and perpendicular to faces of columns and that bolt holes are accurately placed.
- K. Temporary Flooring:
 - 1. Provide planking and scaffolding necessary in connection with erection of structural steel, support of erection machinery, and construction materials. Temporary floors and use of steel shall be as required by applicable regulatory requirements.
 - 2. If steel decking is used as a working platform, it shall be temporarily tack-welded to supports to extent necessary for such use in accordance with applicable regulatory requirements. The concentrated loading from welding machines and other heavy machinery required for steel erection shall be distributed by planking or other approved means. Metal decking that becomes damaged as the result of being used as a working platform shall be replaced at no additional cost to the Owner.

3.9 PAINTING AND REPAIR/TREATMENT

- A. General:
1. Prior to paint applications, clean all loose rust, mill scale, oil, dirt, and all other materials from all steel to be left exposed.
 2. Clean contact surfaces of high strength bolts of all burrs and material that might prevent solid seating of the parts.
 3. After erection, field touch up all welded areas, high strength bolts, and damaged areas. For all steel to remain exposed, remove all blemishes, paint drips, and touch up prime coat.
 4. After erection of steel to be exposed and painted, fill in all dimples and like defects from steel rolling and other sources prior to finishing.
 5. Shop prime all steel except the following:
 - a. Steel encased in concrete.
 - b. Contact surfaces for high strength bolts.
 - c. Areas within four inches (4") of field welds.
 - d. Steel to be fireproofed.
 - e. Surfaces to be galvanized.
 - f. Steel that will be primed and finish painted under Section 09 90 00: Painting and Coating:
 - 1) Coordinate with Section for type and schedule of painting.
- B. Exposed Interior Steelwork - When approved by Architect, use the following cleaning and priming/finish painting schedule/method:
1. Use primer and finish paint as required under Section 09 90 00: Painting and Coating.
 2. Surface preparation:
 - a. Sequence:
 - 1) First, use hand tool (SP-2) as required to assist with preparation.
 - 2) Second, use power tool (SP-3) as required to assist with preparation.
 - 3) Third, use chemical cleaning (SP-8) as required to assist with preparation.
 - 4) Fourth, use SSPC-SP6 Commercial Blast Cleaning as final preparation method.
 3. Application - Follow coating manufacturer's printed directions:
 - a. Apply two (2) shop prime coats to areas that will be inaccessible after erection.
 - b. Finish painting in field in accordance with Section 09 90 00: Painting and Coating:
 - 1) Apply finish paint to area's concealed when installed in the field.
 4. Material:
 - a. Exposed: Refer to Section 09 90 00: Painting and Coating.
 5. Number of Coats:
 - a. Exposed: Refer to Section 09 90 00: Painting and Coating.
 6. Dry Film Thickness:
 - a. Exposed: Refer to Section 09 90 00: Painting and Coating.
 7. Volume Solids:
 - a. Exposed: Refer to Section 09 90 00: Painting and Coating.
- C. Concealed Interior Steelwork - When approved by Architect, use the following cleaning and primer painting schedule/method:
1. For concealed conditions not to be finish painted, use primer paint as required under Section 09 90 00: Painting and Coating.
 2. Surface Preparation:
 - a. Sequence:
 - 1) First, use hand tool (SP-2) as required to assist with preparation.
 - 2) Second, use power tool (SP-3) as required to assist with preparation.
 - 3) Third, use chemical cleaning (SP-8) as required to assist with preparation.
 3. Application - Follow coating manufacturer's printed directions:
 - a. Apply two (2) shop prime coats to areas that will be inaccessible after erection.

4. Material:
 - a. Exposed: Refer to Section 09 90 00: Painting and Coating.
 5. Number of Coats:
 - a. Exposed: Refer to Section 09 90 00: Painting and Coating.
 6. Dry Film Thickness:
 - a. Exposed: Refer to Section 09 90 00: Painting and Coating.
 7. Volume Solids:
 - a. Exposed: Refer to Section 09 90 00: Painting and Coating.
- D. Exposed Exterior Steelwork - When approved by Architect, use the following cleaning and priming/finish painting schedule/method:
1. Use primer and finish paint as required under Section 09 90 00: Painting and Coating.
 2. Surface Preparation:
 - a. Sequence:
 - 1) First, use hand tool (SP-2) as required to assist with preparation.
 - 2) Second, use power tool (SP-3) as required to assist with preparation.
 - 3) Third, use chemical cleaning (SP-8) as required to assist with preparation.
 - 4) Fourth, use SSPC-SP6 Commercial Blast Cleaning as final preparation method.
 - b. Fill holes for watertight assembly:
 - 1) First, weld all holes as approved by structural Engineer
 - 2) Second, holes not approved to be welded shall be filled with INDUSTRO WELD by JB Industries.
 - 3) Install in accordance with manufacturers printed instructions.
 3. Application - Follow coating manufacturer's printed directions:
 - a. Apply two (2) shop prime coats to areas that will be inaccessible after erection.
 - b. Finish painting in field in accordance with Section 09 90 00: Painting and Coating:
 - 1) Apply finish paint to area's concealed when installed in the field.
 4. Material:
 - a. Exposed: Refer to Section 09 90 00: Painting and Coating.
 5. Number of Coats:
 - a. Exposed: Refer to Section 09 90 00: Painting and Coating.
 6. Dry Film Thickness:
 - a. Exposed: Refer to Section 09 90 00: Painting and Coating.
 7. Volume Solids:
 - a. Exposed: Refer to Section 09 90 00: Painting and Coating.
- E. Concealed Exterior Steelwork - When approved by Architect, use the following cleaning and primer painting schedule/method:
1. For concealed conditions not to be finish painted, use primer paint as required under Specification Section 09 90 00: Painting and Coating or as approved alternate by Architect.
 2. Surface preparation:
 - a. Sequence:
 - 1) First, use hand tool (SP-2) as required to assist with preparation.
 - 2) Second, use power tool (SP-3) as required to assist with preparation.
 - 3) Third, use chemical cleaning (SP-8) as required to assist with preparation.
 3. Application - Follow coating manufacturer's printed directions:
 - a. Apply two (2) shop prime coats to areas that will be inaccessible after erection.
 4. Material:
 - a. Exposed: Refer to Section 09 90 00: Painting and Coating.
 5. Number of Coats:
 - a. Exposed: Refer to Section 09 90 00: Painting and Coating.
 6. Dry Film Thickness:
 - a. Exposed: Refer to Section 09 90 00: Painting and Coating.

- 7. Volume Solids:
 - a. Exposed: Refer to Section 09 90 00: Painting and Coating.

3.10 HOISTING AND BRACING

- A. Provide all hoisting and erecting equipment and power.
- B. Provide and maintain any and all safety railings, toe boards, etc. required for the erection of steel framing and metal decking.
- C. Brace the erected frame in a manner that will assure safety and proper alignment to receive the metal decking and until the concrete slabs have been poured and have set.
- D. Erect building frame true and level. Erect columns in a manner to allow for movement due to welding shrinkage and thermal expansion and contraction of framing. Check plumbness after erection of each level. Maintain structural stability of frame during erection. Provide temporary bracing where necessary to maintain frame stability and to support required loads, including equipment and its operation.

3.11 PROTECTION AND CLEAN UP

- A. Subcontractor will keep the work areas in a clean and safe condition so his rubbish, waste, and debris do not interfere with the work of others.
- B. Protect work and materials of this Section prior to and during installation, and protect the installed work and materials of other trades:
 - 1. Clean adjacent surfaces free of rust and oil, flux with mechanical action or solvent as necessary, avoiding damage to other materials.
- C. Perform work in accordance with manufacturer's recommendations, as herein specified, and in accordance with Drawings.
- D. In the event of damage, immediately make all repairs and replacements necessary to the approval of the Architect and at no cost to the Owner.
- E. After completion of work in this Section, remove all erection equipment and implements of service, and debris:
 - 1. Leave entire area in a neat, clean, acceptable condition.
- F. Provide guarantee/warranties and bonds as required in this Section.
- G. Provide record drawings in accordance with Section 01 77 00: Closeout Procedures and Section 01 78 39: Project Record Documents.
- H. Closeout onsite inspection will be at the discretion of the Architect after he receives the General Contractor's notice of Certificate of Substantial Completion.

END OF SECTION 05 12 00

SECTION 07 01 51

MAINTENANCE OF MODIFIED BITUMINOUS MEMBRANE ROOFING

1. PART 1 GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including the Conditions of the Contract and Division 01 Specification Sections apply to this Section.
- B. Related Sections:
 - 1. Section 07 05 00 - Common Work Results for Thermal and Moisture Protection.
 - 2. Roof Insulation: Section 07 22 00 - Roof Insulation.
 - 3. Quality Assurance: Section 01 43 33.75 - Roofing Manufacturer's Field Services.

1.2 SUMMARY

- A. Section includes products and procedures for properly maintaining existing roofing assets in accordance with maintenance agreements and warranty provisions in effect. Maintenance activities include but are not limited to the following:
 - 1. At affected/designated areas, manually fasten ¼" DensDeck Prime.
 - 2. Install SA Base IV or HPR Torch Base per manufacturer guideline extending 6" into existing field
 - 3. Install StressPly IV Plus Mineral per manufacturer guideline extending 9" into existing field
 - 4. Apply Cool-Sil BleedBlock Primer at 1.0 gal/square extending 12" into existing field.
 - 5. Apply Cool-Sil HB White at 3.0 gal/square extending 12" into existing field.
- B. Related Sections:
 - 1. Division 07 Section Common Work Results for Thermal and Moisture Protection.
 - 2. Division 07 Section Sheet Metal Flashing and Trim.

1.3 REFERENCES

- A. The following resource documents will be provided by the Owner for the Contractor's use in maintaining the roofing system:
 - 1. Record Drawings
 - 2. Record Specifications
 - 3. Operation and maintenance manuals
 - 4. Manufacturer's warranty
 - 5. Installer warranty.
 - 6. Construction progress documentation
 - 7. Roofing maintenance records

8. Existing maintenance agreements

9. Insurance records

1.4 SUBMITTALS FOR REVIEW

- A. Product Data: Provide manufacturer's technical product data for each type of roofing product specified. Include data substantiating that materials comply with specified requirements.

1.5 SUBMITTALS FOR INFORMATION

- A. Manufacturer's Installation Instructions: Submit installation instructions and recommendations indicating special precautions required for installing the membrane.
- B. Manufacturer's Certificate: Certify that materials are manufactured in the United States and conform to requirements specified herein, are chemically and physically compatible with each other, and are suitable for inclusion within the total roof system specified herein.
- C. Manufacturer's Certificate: Submit a certified copy of the roofing manufacturer's ISO 9001 compliance certificate.
- D. Test Reports: Submit test reports, prepared by an independent testing agency, for all modified bituminous sheet roofing, indicating compliance with ASTM D5147.
- E. Written certification from the roofing system manufacturer certifying the applicator is currently authorized for the installation of the specified roof system.
- F. Qualification data for firms and individuals identified in Quality Assurance Article below.

1.6 CONTRACT CLOSEOUT SUBMITTALS

- A. General: Comply with Requirements of Division 01 Section - Closeout Submittals.
- B. Special Project Warranty: Provide specified warranty for the project, executed by the authorized agent of the manufacturer.
- C. Roofing Maintenance Instructions. Provide a manual of manufacturer's recommendations for maintenance of installed roofing systems.
- D. Insurance Certification: Assist owner in preparation and submittal of roof installation acceptance certification as may be necessary in connection with fire and extended coverage insurance on roofing and associated work.
- E. Demonstration and Training Schedule: Provide a schedule of proposed dates and times for instruction of Owner's personnel in the maintenance requirements for completed roofing work. Refer to Part 3 for additional requirements.

1.7 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this Section with not less than [12] years documented experience [and have ISO 9001 certification].
- B. Installer Qualifications: Company specializing in modified bituminous roofing installation with not less than [5] years experience and authorized by roofing system manufacturer as qualified to install manufacturer's roofing materials.
- C. Installer's Field Supervision: Maintain a full-time Supervisor/Foreman on job site during all phases of roofing work while roofing work is in progress. Maintain proper supervision of workmen.

- D. Maintain a copy of the contract documents in the possession of the Supervisor/Foreman and on the roof at all times.
- E. Source Limitations: Obtain all components of roof system from a single manufacturer. Secondary products that are required shall be recommended and approved in writing by the roofing system manufacturer.
 - 1. Upon request of the architect or owner, submit manufacturer's written approval of secondary components in list form, signed by an authorized agent of the manufacturer.
- F. Source Quality Control: Manufacturer shall have in place a documented, standardized quality control program such as ISO-9001.

1.8 DELIVERY, STORAGE AND HANDLING

- A. Deliver products to site with seals and labels intact, in manufacturer's original containers, dry and undamaged.
- B. Store and handle roofing sheets in a dry, well-ventilated, weather-tight place to prevent moisture exposure. Store rolls of felt and other sheet materials on pallets or other raised surface. Stand all roll materials on end. Cover roll goods with a canvas tarpaulin or other breathable material (not polyethylene).
- C. Do not leave unused materials on the roof overnight or when roofing work is not in progress unless protected from weather and other moisture sources.
- D. Secure all material and equipment on the job site. If any material or equipment is stored on the roof, assure that the integrity of the deck is not compromised at any time. Damage to the deck caused by the Contractor's actions will be the sole responsibility of the Contractor, and the deck will be repaired or replaced at his expense.

1.9 PRE-INSTALLATION CONFERENCE

- A. Pre-Installation Roofing Conference: Convene a pre-roofing conference approximately two (2) weeks before scheduled commencement of modified bituminous roofing system installation and associated work.
- B. Require attendance of installer of each component of associated work, installers of deck or substrate construction to receive roofing work, installers of rooftop units and other work in and around roofing that must precede or follow roofing work (including mechanical work if any), Architect, Owner, roofing system manufacturer's representative, and other representatives directly concerned with performance of the work, including (where applicable) Owner's insurers, testing agencies and governing authorities. Objectives of conference include:
 - 1. Review foreseeable methods and procedures related to roofing work, including set up and mobilization areas for stored material and work area.
 - 2. Tour representative areas of roofing substrates (decks), inspect and discuss condition of substrate, roof drains, curbs, penetrations and other preparatory work performed by others.
 - 3. Review structural loading limitations of deck and inspect deck for loss of flatness and for required attachment.
 - 4. Review roofing system requirements (drawings, specifications and other contract documents).
 - 5. Review required submittals both completed and yet to be completed.
 - 6. Review and finalize construction schedule related to roofing work and verify availability of materials, installer's personnel, equipment and facilities needed to make progress and avoid delays.
 - 7. Review required inspection, testing, certifying and material usage accounting procedures.
 - 8. Review weather and forecasted weather conditions and procedures for coping with unfavorable conditions, including possibility of temporary roofing (if not mandatory requirement).

9. Record discussion of conference including decisions and agreements (or disagreements) reached and furnish copy of record to each party attending. If substantial disagreements exist at conclusion of conference, determine how disagreements will be resolved and set date for reconvening conference.
 10. Review notification procedures for weather or non-working days.
- C. The Owner's Representative will designate one of the conference participants to record the proceedings and promptly distribute them to the participants for record.
 - D. The intent of the conference is to resolve issues affecting the installation and performance of roofing work. Do not proceed with roofing work until such issues are resolved to the satisfaction of the Owner and Engineer of record. This shall not be construed as interference with the progress of work on the part of the Owner or Engineer of record.

1.10 MANUFACTURER'S INSPECTIONS

- A. When the project is in progress, the roofing system manufacturer will provide the following:
 1. Report progress and quality of the work as observed.
 2. Provide periodic job site inspections.
 3. Report to the Architect [and/or Owner] in writing any failure or refusal of the Contractor to correct unacceptable practices called to the Contractor's attention.
 4. Confirm after completion that manufacturer has observed no application procedures in conflict with the specifications other than those that may have been previously reported and corrected.

1.11 PROJECT CONDITIONS

- A. Proceed with roofing work only when existing and forecasted weather conditions will permit a unit of work to be installed in accordance with manufacturer's recommendations and warranty requirements.
- B. Do not apply roofing insulation or membrane to damp deck surface.
- C. Do not expose materials subject to water or solar damage in quantities greater than can be weatherproofed during same day.
- D. All slopes greater than 2:12 require back-nailing to prevent slippage of the ply sheets. Use ring or spiral-shank one (1) inch cap nails, or screws and plates at a rate of one (1) fastener per ply (including the membrane) at each insulation stop. Place insulation stops at 16 ft o.c. for slopes less than 3:12 and four (4) ft o.c. for slopes greater than 3:12. On non-insulated systems, nail each ply directly into the deck at the rate specified above. When slope exceeds 2:12, install all plies parallel to the slope (strapping) to facilitate backnailing. Install four (4) additional fasteners at the upper edge of the membrane when strapping the plies.

1.12 SEQUENCING AND SCHEDULING

- A. Sequence installation of roofing with related units of work specified in other Sections to ensure that roof assemblies, including roof accessories, flashing, trim and joint sealers, are protected against damage from effects of weather, corrosion and adjacent construction activity.
- B. Complete all roofing field assembly work each day. Phased construction will not be accepted.

1.13 WARRANTY

- A. Upon completion of installation, and acceptance by the Owner and Architect, the Manufacturer will supply to the Owner the appropriate warranty.

- B. Installer will submit a [two (2)]-year warranty to the membrane manufacturer with a copy directly to Owner.

2. PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

- A. When a particular trade name or performance standard is specified it shall be indicative of a standard required.
- B. Provide maintenance products as manufactured by

The Garland Company
3800 East 91st Street
Cleveland, Ohio 44105
Austin Hansen 714-745-5317
ahansen@garlandco.com
- C. No substitutions will be permitted that will compromise the terms of the Owner's warranty and maintenance agreements.

2.2 TEMPORARY ROOFING MATERIALS

- A. Sheathing Paper: Red-rosin type, minimum 3 lb/100 sq. ft. (0.16 kg/sq. m).
- B. Base Sheet: ASTM D4601, Type II, nonperforated, asphalt-coated, glass-fiber sheet.
- C. Glass-Fiber Felts: ASTM D2178, Type IV, asphalt-impregnated, glass-fiber felt.
- D. Asphalt Primer: ASTM D41.
- E. Roofing Asphalt: ASTM D312, Type III or IV.
- F. Would we add roofing mastic here or anything else?

2.3 MAINTENANCE MATERIALS

- A. Base flashing ply:
 - 1. Base Flashing Ply: HPR Torch Base or SA Base IV - One (1) layer of torch applied base sheet covered by an additional layer of torch-applied modified membrane.
 - 2. Modified Membrane: STRESSPLY IV PLUS MINERAL 195 mil SBS (Styrene-Butadiene-Styrene) mineral surfaced rubber modified roofing membrane with a fiberglass and polyester composite scrim. This membrane is designed for torch applications and has a burn-off backer that indicates when the material is hot enough to be installed.

2.4 BITUMINOUS MATERIALS

- A. Asphalt Primer: V.O.C. compliant, ASTM D41.
- B. Asphalt Roofing Mastic: V.O.C. compliant, ASTM D4586, Type II.
- C. Aluminum Roofing Mastic: V.O.C. compliant, ASTM D4586, Type II.

2.5 SHEET MATERIALS

A. Reinforcing Fabric:

1. Fiberglass mesh.
2. Polyester fabric.

B. Base Flashing Ply: 40 mil SBS modified membrane with woven fiberglass scrim reinforcement with the following minimum performance requirements according to ASTM D5147. Properties (Finished Membrane):

1. Tensile Strength (ASTM D5147):
 - (a) 2 in/min. @ 73.4 ± 3.6°F: MD 215 lbf/in CMD 215 lbf/in
 - (b) 50mm/min. @ 23 ± 3°C MD 37.5 kN/m CMD 37.5 kN/m
2. Tear Strength (ASTM D5147)
 - (a) 2 in/min. @ 73.4 ± 3.6°F MD 275 lbf CMD 275 lbf
 - (b) 50mm/min. @ 23 ± 3°C MD 1223 N CMD 1223 N
3. Elongation at Maximum Tensile (ASTM D5147)
 - (a) 2 in/min. @ 73.4 ± 3.6°F MD 4.5% CMD 4.5%
 - (b) 50mm/min. @ 23 ± 3°C MD 4.5% CMD 4.5%

C. Modified Flashing Ply: STRESSPLY IV PLUS MINERAL

1. Tensile Strength (ASTM D5147)
 - (a) 2 in/min. @ 73.4 ± 3.6°F MD 500 lbf/in CMD 550 lbf/in
 - (b) 50 mm/min. @ 23 ± 3°C MD 87.5 kN/m CMD 96.2 kN/m
2. Tear Strength (ASTM D5147)
 - (a) 2 in/min. @ 73.4 ± 3.6°F MD 900 lbf CMD 950 lbf
 - (b) 50 mm/min. @ 23 ± 3°C MD 4003 N CMD 4226 N
3. Elongation at Maximum Tensile (ASTM D5147)
 - (a) 2 in/min. @ 73.4 ± 3.6°F MD 6.0% CMD 6.0%
 - (b) 50 mm/min. @ 23 ± 3°C MD 6.0% CMD 6.0%
4. Low Temperature Flexibility (ASTM D5147): Passes -30°F (-34°C)

2.6 SURFACINGS

A. White Elastomeric Roof Coating: Cool-Sil HB White

1. Weight/Gallon 10.47 lbs./gal. (1.43 g/cm³)
2. Non-Volatile % (ASTM D 1644) 47.7 min
3. Reflectance 90%

3. PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrate surfaces and conditions under which roofing maintenance will be performed. Do not proceed with roofing until unsatisfactory conditions have been corrected in a manner acceptable to Roofing System Manufacturer and Maintenance Contractor.

3.2 DOCUMENTING EXISTING CONDITIONS

- A. Document existing conditions with high-resolution photographic equipment and provide supplemental written reports for the Owner's records.

3.3 SAMPLING AND TESTING

- A. Prepare samples, such as core cuts, and deliver to a qualified testing agency for evaluation.
 - 1. Samples shall be of adequate size to perform testing procedures. Confer with the Owner's testing agency to assure adequate sampling.
 - 2. Place samples in containers approved by the Roofing System Manufacturer and ship in a manner that preserves their condition.

3.4 MAINTENANCE MEETING

- A. Prior to executing maintenance procedures, meet with the Owner and/or Owner's Facility Manager to review maintenance records, field reports, photographs, and certified test reports, and detailed proposals describing the extent of maintenance procedures and repairs required.
- B. Do not proceed with maintenance procedures and repairs without the approval of the Owner and/or Owner's Facility Manager

3.5 MAINTENANCE REQUIREMENTS, GENERAL

- A. Cooperate with manufacturer, inspection and test agencies engaged or required to perform services in connection with the Owner's roofing maintenance programs.
- B. Insurance/Code Compliance: Comply with governing regulations and the Owner's insurance requirements.
- C. Protect other work from spillage of roofing materials and prevent materials from entering or clogging drains and conductors. Replace or restore surfaces damaged during maintenance.
- D. Apply roofing materials as specified herein unless recommended otherwise by manufacturer's instructions. Keep roofing materials dry before and during application.

3.6 ROOFING MAINTENANCE PROCEDURES

- A. Blister Repairs:
 - 1. Spud all gravel back twelve (12) inches around blister.
 - 2. Clean and prime the area.
 - 3. Cut and open blisters down to solidly-adhered plies of the existing roof system. Use a roofer's knife to open the blister with an "X" or "H" cut. Fold the flaps and remove moisture. Permit the area to dry before applying repair materials.
 - 4. Apply a liberal coating of specified mastic into the blister. Firmly press the flaps into the bituminous material and trim the edges to ensure proper fit.

5. Apply a coating of bituminous material over the repaired area extending a minimum of eight (8) inches beyond the cuts. Embed a strip of fiberglass mesh into the bituminous material and brush or roll firmly. Apply a second coat of bituminous material over the fabric and onto the roof surface.
6. Apply one (1) ply of torch applied membrane. Strip in the edges with a three-course mastic and mesh application.

B. Flashing Reinforcement:

1. Remove or adjust all metal counter flashing to permit access to the top of the membrane flashing.
2. Clean the surface and prime with an asphalt primer at a rate of one (1) gallon per one hundred (100) square feet.
3. Apply a uniform coating of an asphalt-based emulsion at a rate of two and one half (2.5) to three (3) gallons per one hundred (100) square feet.
4. Embed a strip of polyester fabric covering the entire flashing and extending three (3) inches onto the roof surface into the coating.
5. Apply a second coat of emulsion over the entire area at a rate of two and one half (2.5) to three (3) gallons per one hundred (100) square feet.
6. Allow a minimum of thirty (30) days and apply surfacing.
7. Replace or readjust the original counter flashing. Install and seal a termination bar in the event there was no original counter flashing.

C. Edge Detail Repair:

1. Spud back all gravel and built-up bitumen twelve (12) inches onto the roof.
2. Remove all loose dirt and debris along the edge detail and prime with an asphalt primer.
3. Secure all loose metal to the wood nailer.
4. Install a bond breaker at moving joints.
5. Apply a liberal coat of mastic over the prepared area and embed fiberglass mesh into the mastic.
6. Apply mastic over the fabric at the manufacturer's recommended spreading rate. Fully embed fiberglass mesh so that no portion is exposed.
7. Apply surfacing to the repaired area.

D. Pitch Pocket Repair:

1. Fill pitch pocket with an approved elastomeric roof cement. Taper the mastic at the edge of the pitch pocket to ensure water run-off.
2. Spud back all gravel and heavy built-up areas of bitumen eighteen (18) inches onto the field of the roof, clean and prime the area with an asphalt primer.
3. Apply a coating of mastic around the pitch pocket at the manufacturer's recommended spreading rate extending a not less than twelve (12) inches onto the horizontal roofing surface.
4. Cut four (4) strips of fiberglass mesh. Each strip should be twelve (12) inches wide and be of sufficient length so as to extend a minimum of twelve (12) inches beyond the pitch pan.
5. Embed a strip into the mastic along each side of the pitch pocket. Brush or roll the fabric into place to ensure proper embedment.

6. Top dress the area with mastic.
7. Install rain bonnet, draw band and caulk.

E. Flashing Replacement:

1. Remove or adjust the existing counter flashing to permit access to the top of the flashing.
2. Remove all loose, deteriorated or rotted flashing in the areas designated for replacement. Remove all loose dust and debris with hand brooms or compressed air.
3. Prepare all walls, penetrations and expansion joints to be flashed and where shown on the drawings, with asphalt primer at the rate of one hundred (100) square feet per gallon. Allow primer to dry tack free.
4. Adhere plies with one of the following:
 - (a) Mastic method: The modified membrane will be used as the flashing and nailed off eight (8) inches O.C. at all vertical surfaces.
 - (b) Torch method: The modified membrane will be used as the flashing and nailed off eight (8) inches O.C. at all vertical surfaces.
5. The entire sheet of flashing membrane must be solidly adhered to the substrate.
6. Seal all vertical laps of flashing membrane with a three-course application of Flashing Bond and fiberglass mesh and aluminize.
7. Counter flashing, cap flashings, expansion joints, and similar work to be coordinated with roofing work are specified in other sections.
8. Roof accessories, miscellaneous sheet metal accessory items, including piping vents and other devices to be coordinated with the roofing system are in other sections.

F. Soil Stack and Vent Repair:

1. Spud back gravel and heavily built-up areas of bitumen. Clean and prime the area with an approved asphalt primer.
2. Apply a liberal coating of mastic in an area six (6) to eight (8) inches on the horizontal surface surrounding the stack or vent.
3. Cut four (4) strips of fiberglass mesh in sufficient length to cover the horizontal roof surface on each side of the stack or vent.
4. Embed the strips of fabric into the mastic and top dress with a second coat of mastic.
5. Cut a piece of fabric sufficient to extend a minimum of twelve (12) inches around the perimeter of the vent or stack. Cut a hole in the center of the mesh slightly smaller than the diameter of the vent. Position the mesh by pulling it down over the vent and into the mastic. Top dress with another coat of mastic.

G. Drain Repair:

1. Plug drain to prevent debris from entering the drain.
2. Remove all loose dirt and debris, spud back gravel and prime with an asphalt primer in an area approximately four (4) feet square around the drain.
3. Apply a coating of mastic at the manufacturer's recommended spreading rate to an area six (6) inches around the drain.

4. Embed six (6) inch strips of fiberglass mesh into the mastic on all sides of the drain.
5. Apply a coating of mastic at the manufacturer's recommended spreading rate to an area twenty-four (24) inches in all directions from the center of the drain.
6. Cut a forty-two (42) inch piece of mesh and embed into the mastic. Trim the fabric along the drain ring.
7. Apply a top coating of mastic.
8. Remove plug from drain and install strainer.

H. Gutter Edge Detail:

1. Remove all loose dirt and debris along the gutter edge. Spud all embedded gravel twelve (12) inches from the gutter and prime with an approved asphalt primer.
2. Mastic Method:
 - (a) A liberal coating of mastic to an area six (6) inches along the gutter edge.
 - (b) Cut and fully embed mesh into mastic.
 - (c) Top dress with another coat of mastic.
3. Torch method:
 - (a) Apply a six (6) inch piece of a torch applied membrane.

3.7 SURFACING

- A. Fibered Aluminum Roof Coating: Silver-Shield; installed at a rate of two and one half (2 ½) gallons per square. This shall be a one-coat application with the finished stroke in one direction.
- B. Non-Fibered Aluminum Paint: Garla-Brite; installed at a rate of three quaters (¾) gallon per square per coat. This shall be a two-coat application with the finished stroke in one direction.
- C. Acrylic Roof Coating: Pyramic; installed at a rate of one (1) to one and one half (1 ½) gallon per square per coat. This shall be a two-coat application.
- D. Acrylic Roof Coating: Solex; installed at a rate of one half (1/2) gallon per square with a base coat of one and one half (1½) gallons per square of an acrylic roof coating: Pyramic.

3.8 CLEANING

- A. Remove bitumen adhesive drippings from all walls, windows, floors, ladders and finished surfaces.
- B. In areas where finished surfaces are soiled by work of this Section, comply with the cleaning instructions of the manufacturer of surfaces.
- C. Repair or replace defaced or disfigured finishes caused by work of this section.

3.9 CONSTRUCTION WASTE MANAGEMENT

- A. Remove and properly dispose of waste products generated during maintenance procedures. Comply with requirements of authorities having jurisdiction

3.10 FINAL INSPECTION

- A. Upon completion of roofing maintenance work, meet with Installer, installer of associated work, Owner, roofing system manufacturer's representative, and other representatives directly concerned with performance of roofing system.
- B. Walk roof surface areas of the building, inspect perimeter building edges as well as flashing of roof penetrations, walls, curbs and other equipment. List all items requiring correction or completion and furnish copy of list to each party in attendance.
- C. At the manufacturer's discretion a thermographic scan of the roof during final inspection may be performed to determine the presence of damp or wet materials installed. The thermographic scan shall be provided at a price negotiated between the Contractor and the Owner and paid for by the Owner by means of a change order.
- D. If core cuts verify the presence of damp or wet materials, the Contractor shall be required to replace the damaged areas at his own expense.
- E. Repair or replace (as required) deteriorated or defective work discovered at time of inspection to a condition free of damage and deterioration at time of Substantial Completion and according to warranty requirements.
- F. The Contractor shall notify the Owner upon completion of corrections.
- G. Following the final inspection, acceptance will be made in writing by the material manufacturer.

3.11 FINAL DOCUMENTATION AND REPORTING

- A. Submit final documentation of procedures and recommendations to the Owner for record.

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 crevices in exterior wall.
- C. Batt sound insulation in interior walls and partitions and above ceiling.

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 and Roof: 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 R13 at walls.
- B. 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 6-1/2 inch thickness.
- C. Insulation to be formaldehyde-free.
- D. Nails or Staples: Steel wire; electroplated; type and size to suit application.
- E. Tape: Bright aluminum self-adhering type, mesh reinforced, 2 inch wide.
- F. Support Wire: 16 gauge steel wire.
- G. Support Rods: 13 gauge, pointed spring steel length as required for stud spacing.
- H. Spindle Fasteners: Steel impale spindle and clip on flat metal base, [spot welded to substrate] [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 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. Trim insulation neatly to fit spaces.
- I. 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.

- J. Install with factory applied membrane facing warm side of building spaces.
- K. Lap ends and side flanges of vapor barrier membrane over face of framing members.
- L. Extend vapor barrier on to any adjacent construction and tape seal edge of vapor barrier.
- M. Seal butt ends, lapped flanges, and tears or cuts in membrane with tape or another layer of membrane.
- N. Seal joints in vapor barrier caused by pipes, conduits, electrical boxes, and similar items penetrating vapor barrier.
- O. Friction fit sound insulation between studs and fill as required to completely fill space between the wall finishes.

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. Control and expansion joints in ceramic and quarry tile.
 - 3. Control and expansion joints in soffits, ceilings and overhead surfaces.
 - 4. Joints on underside of precast beams and planks.
 - 5. Perimeter joints in exterior openings.
 - 6. Joints between ceiling surfaces and frames for doors and windows.
 - 7. Joints in flashing and sheet metal.
 - 8. Perimeter joints of plumbing fixtures.
 - 9. Acoustical isolation joints between head and sill of walls and floor and ceiling surfaces.
 - 10. Joints between countertops and wall surfaces.
 - 11. Joints in skylights and framing.
 - 12. Joints between thresholds and floors.
 - 13. Isolation joints in plaster soffits and ceilings.
 - 14. Joints between dissimilar materials and those listed above.
 - 15. Other joints as indicated.
- B. Joints in vertical surfaces:
 - 1. Expansion and isolation joints in cast-in-place concrete.
 - 2. Control and expansion joints in ceramic and quarry tile.
 - 3. Perimeter joints in exterior openings.
 - 4. Joints in flashing and sheet metal.
 - 5. Perimeter joints of plumbing fixtures.
 - 6. Acoustical isolation joints of walls.
 - 7. Joints between cabinets and walls.

8. Joints between wall surfaces and door and window frames.
9. Isolation joints in plaster walls.
10. Joints between dissimilar materials and those listed above.
11. 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 F - Mildew-Resistant Silicone	Interior joints in ceramic tile and at plumbing fixtures.	White
D.	Type G - Multi-part Pourable Urethane	Exterior and interior joints in horizontal surfaces of concrete.	To match adjacent material
E.	Type H - Acoustical Sealant	Interior walls between stud track/runner and adjacent construction. Between outlet boxes and gypsum board.	White

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 light frames.

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. ANSI/SDI A250.11 - 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 [, panel] 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.

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 and product data 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 17.

- 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. Steel: Commercial quality cold rolled steel conforming to ASTM A653 galvanized to A60 or G60 coating class or Type B, A40 (ZF120) according to ASTM A924 with minimized spangle, mill phosphatized.
- B. Provide reinforcing steel with a minimum post-consumer recycled content of 50 percent.
- C. Exterior Doors: ANSI A250.8, Level 3, extra heavy-duty, Model 2, continuous welded seam, beveled edges, minimum 0.053 inch thick faces.
- D. Interior Doors: ANSI A250.8, Level 2 heavy duty, Model 1, beveled edges, minimum 0.042 inch thick faces.
- E. Exterior Frames: ANSI A250.8, Level 3, 0.067 inch thick material, core thickness.
- F. Interior Frames: ANSI A250.8, Level 2, 0.053 inch thick material, core thickness.
- G. [Panels: Same materials and construction as specified for doors.]

2.3 DOOR CORE

- A. Interior Door Core: Impregnated cardboard honeycomb.

2.4 ACCESSORIES

- A. Rubber Silencers: Resilient rubber as supplied by Section 08 71 00.
- B. Glazing Stops: Rolled steel channel shape, mitered corners; prepared for countersink style tamperproof screws at door installations, square butt at light frames.

- C. 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. Metal Stud Anchor: Z type anchor, welded to frame, 0.053 inch thick steel, UL listed as required for fire rating.
- B. 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.
- C. 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.
- D. 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. Dust cover boxes or mortar guards of 0.016 inch thick steel shall be provided at all hardware mortises on frames.
- I. 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.
- J. 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.
- K. 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.
- L. Attach fire rated label to each frame and door unit.
- M. 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 custom color selected by Architect. Finished paint film thickness shall be not less than 1.25 mil dry film thickness. Comply with ANSI A250.3 criteria for acceptance of finish.
- 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 ANSI/SDI A250.11.
- 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.
 - 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 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. 2010 Americans with Disabilities Act (ADA) Standards for Accessible Design.
- B. BHMA - Builders' Hardware Manufacturers Association.
- C. CBC - California Building Code, (CCR) California Code of Regulations, Title 24, Part 2, California State Accessibility Standards.
- D. DHI - Door and Hardware Institute.
- E. NFPA 80 - Fire Doors and Windows.
- F. 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. Conform to CBC for requirements applicable to fire rated doors and frames.
- B. Fire-Rated Openings: Comply with 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 panic 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".

- 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.
- D. Exit Doors: Openable at all times from the inside without the use of a key or any special knowledge or effort.
- E. Doors/doorways as part of an accessible route shall comply with CBC Sections 11B-404.
- F. The clear opening width for a door shall be 32" 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 it below 34" and 4" maximum projections into it between 34" and 80" above the finish floor or ground. Door closers and stops shall be permitted to be 78" minimum above the finish floor or ground. CBC Section 11B-404.2.3.
- G. 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 shall not require tight grasping, pinching, or twisting of the wrist. Operable parts of such hardware shall be 34" minimum and 44" maximum above 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.
- H. 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 pounds (22.2 N) maximum. Required fire doors: the minimum opening force allowable by the DSA authority, not to exceed 15 pounds (66.7N). 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.
 - 2. The force required for activating any operable parts, such as lever hardware, or disengaging other devices shall be 5 pounds (22.2N) maximum to comply with CBC Section 11B-309.4.
- I. Door closing speed 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.
- J. Thresholds shall comply with CBC Section 11B-404.2.5.
- K. Floor stops shall not be located in the path of travel and 4" maximum from walls.
- L. Hardware (including panic hardware) 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).

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.
 - 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>	<u>Acceptable Substitute</u>
A.	Hinges	[]	[]	[]
B.	Pivots	[]	[]	[]
C.	Locks	[]	[]	[]
D.	Bolts	[]	[]	[]
E.	Push/Pulls	[]	[]	[]

<u>Item</u>	<u>Manufacturer</u>	<u>Acceptable Substitute</u>
F. Exit Devices	[]	[]
G. Overhead Closers	[]	[]
H. Surface Closers	[]	[]
I. Floor Closers	[]	[]
J. Smoke Activated Closers	[]	[]
K. Electric Strikes	[]	[]
L. Flush Bolts	[]	[]
M. Coordinators	[]	[]
N. Silencers	[]	[]
O. Protection Plates	[]	[]
P. Stops and Holders	[]	[]
Q. Thresholds	[]	[]
R. Seals and Bottoms	[]	[]
S. Key Cabinets	[]	[]
T. Padlocks	[]	[]
U. Alum. Door Locks	[]	[]
V. Sliding Door Hardware	[]	[]
W. Bifold Door Hardware	[]	[]

2.2 MATERIALS

- A. Locksets: Mortise type. 16 gage steel strikebox, bronze or brass strikes with 2 inch deep box construction, with lips of sufficient length to clear trim and protect clothing.
1. Locks: Minimum 3/4 inch throw. Dead bolts: 1 inch minimum throw.
 2. Comply with requirements of local security ordinances.
 3. 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.
- B. Floor Hinges: Shall have maximum degree dead stop permitted by trim of adjacent structure. Furnish special pins and longer spindles as may be required.
- C. Hinges: Outswinging exterior doors shall have non-removable (NRP) pin. All 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. Exterior hinges with prime finish shall have Stanley K base.
 3. Size listed in Hardware Sets indicates height x width.
 4. Provide extra heavy weight hinges on doors over 3'-4" width.

- D. Panic Hardware: Furnish all sets at wood doors with sex bolts. Lever handle trim shall match locksets. All touch bar type devices shall have deadlocking latch bolt, and be non-handed. The Division of the State Architect may increase the maximum effort to operate fire doors to achieve positive latching, but not to exceed 15 lbs. maximum pressure. Maximum effort to release device on non fire rated door shall not exceed 5 lbs. for exterior doors and 5 lbs for interior doors. When the latched door is subjected to a horizontal force of 250 lbs applied against the latching edge adjacent to the latch in the direction in which the door opens a force of 15 lbs or less shall actuate the release bar. Device shall bear UL label for fire and or panic as may be required.
- E. Surface Door Closers: Full rack and pinion type with removable non-ferrous case. Provide sex bolts and grommets at all 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. Provide size 2 through 6 unless otherwise specified at exterior and interior fire rated doors.
 - 2. Provide size 1 through 4 at interior non-rated doors.
 - 3. Flush transom offset brackets shall be used where parallel arm closers are listed for doors with fixed panels over.
 - 4. Drop bracket are required at narrow head rails.
 - 5. Maximum effort to operate doors shall not exceed 5 lbs. for exterior doors and 5 lbs. for interior doors, such pull or push effort being applied at right angles to hinged doors and at the center plane of sliding or folding doors. Compensating devices or automatic door operators may be utilized to meet the above standards. When fire doors are required, the maximum effort to operate the door may be increased not to exceed 15 lbs.
 - 6. Sweep period of closer to be adjusted so that from an open position of 70 degrees, the door will take at least 3 seconds to move to a point 3 inches from the latch.
- 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. 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.
- H. Silencers: Furnish silencers for interior hollow metal frames, 3 for single doors, 4 for pairs of doors. Omit where sound or light seals occurs, or for fire-resistive-rated door assemblies.
- I. 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. Door Locks: Keyed in like-groups control keying for core removable cylinders.
- B. Supply 2 keys for each lock.

2.4 FINISHES

- A. Generally to be BHMA 626 Satin Chromium.
- B. Areas using BHMA 626 shall have push, pulls and kickplates of BHMA 630, Satin Stainless Steel, unless otherwise noted.
- C. The interior finish of areas such as toilets, kitchens, locker rooms and gymnasiums shall be BHMA 626, Satin Chromium.
- D. Spray door closers to match other hardware, unless otherwise noted.
- E. Aluminum items to be finished AL unless otherwise noted.

2.5 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.

2.6 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. Install hardware in accordance with manufacturer's instructions and requirements of DHI.
- B. Use the templates provided by hardware item manufacturer.
- 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 09. 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 thresholds for exterior doors in full bed of butyl-rubber sealant.
- G. If hand 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 Architectural Hardware Consultant, 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. Hinges:
 - 1. Bottom Hinges: 10 inches from door bottom to bottom of hinge.

2. Top Hinge: 5 inches from door top to top of hinges.
 3. Center Hinge: Center between top and bottom hinge.
 4. Extra Hinge: 6 inches from bottom of top hinge to top of extra hinge.
- B. Lock: 38 inches from bottom of door to center of lever or knob.
 - C. Push Bar: 44 inches from bottom of door to center of bar.
 - D. Push Plate: 44 inches from bottom of door to center of plate.
 - E. Pull Plate: 42 inches from bottom of door to center of pull.
 - F. Panic Device: 39-13/16 inches from bottom of door to center of pad.
 - G. Deadlock Strike: 44 inches from floor, centered.
 - H. Floor Stops: 4 inches maximum distance from any adjacent wall surface.
 - I. Conform to CBC, California Building Code (CCR) California Code of Regulations, Title 24, Part 2, and the 2010 ADA Standards for Accessible Design for 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. Numeric legend of listed manufacturers. The last column of numbers in the schedule of finish hardware refers to the manufacturer listed in the following schedule:

IVE	IVES
SCH	SCHLAGE
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:

HARDWARE GROUP NO. 01

For use on Door #(s):

A119

Provide each SGL door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
1	EA	CONT. HINGE	112XY	628	IVE
1	EA	CLASSROOM SECURITY W/ INSIDE INDICATOR	ND78TD RHO IS-CRS	626	SCH
3	EA	FSIC CORE	23-030	626	SCH
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS	630	IVE
1	EA	GASKETING	188FSBK PSA	BK	ZER

OPENING TO HAVE FREE EGRESS

VERIFY KEYWAY REQUIRED WITH DISTRICT LOCKSMITH

END OF SECTION

SECTION 09 21 16

GYPSUM BOARD ASSEMBLIES

1. PART 1 GENERAL

1.1 WORK INCLUDED

- A. Gypsum board.
- B. Impact resistant gypsum board.
- C. Acoustically enhanced gypsum board.
- D. Taped and sanded joint treatment.
- E. Surface primer.
- F. Texture finish.
- G. Resilient furring channels.

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 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.

1.6 DEFINITIONS

- A. Refer to ASTM C11 for definitions of terms related to gypsum board assemblies.

1.7 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. 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 / Annex A1, Level 2.
 - 5. Mold / Mildew Resistance: ASTM D3273, with a score of 10.
- J. Fire Rated 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 / Annex A1, Level 2.
 - 5. Mold / Mildew Resistance: ASTM D3273, with a score of 10.

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, clear anodic finish. Similar to products manufactured by Fry Reglet Co., www.fryreglet.com.
- G. Spot Grout: ASTM C475, setting-type joint compound.
- H. 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.
- I. 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.
- J. Primer: Flat latex basecoat paint equivalent to First Coat manufactured by United States Gypsum Company.
- K. Primer-Surfacer: Vinyl acrylic latex-based primer and surfacer equivalent to Tuff-Hide manufactured by United States Gypsum Company.
- L. Spray Texture Finish: Equivalent to USG Spray Texture Finish, 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 MEMBRANE INSTALLATION

- A. Install membrane over wall studding where moisture resistant gypsum board is to be installed.
- B. Install membrane over substrate; weatherlap horizontal edges 4 inches and vertical edges 6 inches.

3.3 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.

3.4 CEILING 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.

3.5 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. All joints and angles shall have tape embedded in joint compound and two separate coats of joint compound shall be applied over all joints, angles, fastener heads and accessories.
2. Apply a skim coat of topping compound over entire surface.
3. All compound shall be smooth and free of tool marks and ridges.
4. Use for all surfaces that are scheduled to receive a texture and painted finish over impact resistant gypsum board.

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.

3.6 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.

3.7 TOLERANCES

- A. Maximum Variation from True Flatness: 1/8 inch in 10 feet in any direction.

3.8 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. 2022 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 SUBMITTALS

- A. Submit product data under provisions of Section 01 33 00.

1.4 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.

1.5 REGULATORY REQUIREMENTS

- A. Conform to 2022 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.

1.6 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., www.cemcosteel.com.
- B. Consolidated Fabricators Corp., www.confabbd.com.
- C. ClarkDietrich Building Systems, www.clarkdietrich.com.
- D. Frametek Steel Products, www.frameteksteel.com.
- E. Steel Stud Manufacturing Co., www.scafco.com.
- F. United Metal Products, Inc., www.unitedmetalproducts/info.
- 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, as scheduled on the drawings.
 - 1. Thickness: 0.0329 inch unless otherwise indicated. 0.0428 inch and 0.0538 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) BST, as manufactured by BlazeFrame Industries, www.blazeframe.com.
 - (b) CST, SLP-TRK, as manufactured by CEMCO, www.cemcosteel.com
 - (c) Max Trax as manufactured by ClarkDietrich Building Systems, www.clarkdietrich.com.
 - (d) The System, Slotted Angle System, as manufactured by Metal-Lite, Inc. www.metal-lite.net.
 - (e) SLT standard slotted track as manufactured by Steel Stud Manufacturing C., 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, 4 inch depth.
- 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: Drilled expansion bolts.
- 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.

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 thinset application method.
- B. Threshold at door opening.

1.2 REFERENCES

- A. ANSI/TCNA A108.5 - Installation of Ceramic Tile with Dry-Set Portland Cement Mortar or Latex Portland Cement Mortar.
- B. ANSI/TCNA A108.11 - Interior Installation of Cementitious Backer Units.
- C. ANSI/TCNA A118.1 - American National Standard Specification for Dry-Set Cement Mortar.
- D. ANSI/TCNA A118.4 - American National Standard Specification for Modified Dry-Set Cement Mortar.
- E. ANSI/TCNA A118.7 - American National Standard Specification for High Performance Cement Grouts for Tile Installation.
- F. ANSI/TCNA A118.9 - American National Standard Specification for Test Methods and Specification for Cementitious Backer Units.
- G. ANSI/TCNA A118.12 - American National Standard Specification for Crack Isolation Membranes for Thin-Set Ceramic Tile and Dimension Stone Installation.
- H. ANSI/TCNA A137.1 - Specifications for Ceramic Tile.
- I. ASTM A1064 - Carbon-Steel Wire and Welded Wire Reinforcement, Plain and Deformed, for Concrete.
- J. ASTM D4551 - Poly (Vinyl Chloride) (PVC) Plastic Flexible Concealed Water-Containment Membrane.
- K. MIA - Marble Institute of America.
- L. TCNA (Tile Council of North America) - Handbook for Ceramic, Glass, and Stone 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/TCNA 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 REGULATORY REQUIREMENTS

- A. Ceramic Tile Flooring shall be stable, firm, and slip resistant. CBC Section 11B-302.1.

1.5 QUALITY ASSURANCE

- A. Conform to ANSI/TCNA A137.1 for tile material.
- B. Conform to ANSI/TCNA A137.1 DCOF AcuTest for coefficient of friction.
- C. Conform to ANSI/TCNA Standards and TCNA Handbook for tile installation.

1.6 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.

1.7 ENVIRONMENTAL REQUIREMENTS

- A. Maintain 50 degrees F during installation of mortar materials.

1.8 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.pantheontile.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/TCNA A137.1, conforming to the following:

Manufacturer and Pattern	Equivalent to Interceramic Re-plain
Size	All sizes available.
Color	As selected.
Coefficient of Friction According to ANSI A137.1 DCOF AcuTest	Not less than 0.42 average value wet and dry.

- B. Base: Schluter System - Aluminum - Coved.

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 GROUT MATERIALS

- A. Portland Cement Grout Materials : ANSI/TCNA A118.7.
- B. Latex-Portland Cement Grout: ANSI/TCNA 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.

2.5 ACCESSORIES

- A. Thin Load Bearing Direct Bond Membrane: Chlorinated polyethylene elastomer sheet material laminated with fabric on both sides meeting requirements of ANSI A118.12.
1. Dal-Tile Corp., Dal Seal TS, www.daltile.com.
 2. Compotite Corp., Composeal Gold, www.compotite.com.
 3. Mapei, Mapelastic Aqua Defense, www.mapei.com.
 4. NAC Products, Inc., ECB Membrane, www.nac-anti-fracture.com.
 5. Noble Company, Noble Seal TS, www.nobelcompany.com.
 6. Pasco Manufacturing, Inc., Baseline, www.pascospecialty.com.
 7. Substitutions: Under provisions of Section 01 25 13.

- B. 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.
- C. Sealant: Type specified in Section 07 92 00.

2.6 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.

2.7 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, bond coat, tile, and grout in accordance with ANSI/TCNA 108.5 and applicable tile installation standards of the TCNA Handbook.
- B. Set marble thresholds at interior door openings.
- C. Install thin load bearing direct bond membrane.
- D. Apply bond coat.
- E. Lay tile to pattern indicated on Drawings or if not indicated, request pattern from Architect. Do not interrupt tile pattern through openings.
- F. Cut and fit tile tight to penetrations through tile. Form corners and bases neatly. Align floor, base, and wall joints.
- G. 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.
- H. Sound tile after setting. Replace hollow sounding units.
- I. Provide control joints, vertical and horizontal, at not-to-exceed 20'-0" oc. Keep control joints free of adhesive or grout. Install joints in accordance with TCA Handbook. 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 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. Cementitious backing board.

1.2 REFERENCES

- A. ANSI/TCNA A108.5 - Installation of Ceramic Tile Installed with Dry-Set Portland Cement Mortar or Latex Portland Cement Mortar.
- B. ANSI/TCNA A108.11 - Interior Installation of Cementitious Backer Units.
- C. ANSI/TCNA A118.1 - American National Standard Specification for Dry-Set Cement Mortar.
- D. ANSI/TCNA A118.4 - American National Standard Specification for Modified Dry-Set Cement Mortar.
- E. ANSI/TCNA A118.7 - American National Standard Specification for High Performance Cement Grouts for Tile Installation.
- F. ANSI/TCNA A118.9 - American National Standard Specification for Test Methods and Specifications for Cementitious Backer Units.
- G. ANSI/TCNA 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. TCNA (Tile Council of North America) - Handbook for Ceramic, Glass, and Stone 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/TCNA A137.1 for tile material.
- B. Conform to ANSI/TCNA Standards and TCNA 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.pantheontile.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/TCNA A137.1, conforming to the following:

Moisture Absorption	0 to 0.5 percent.
Manufacturer and Pattern	Equivalent to Daltile Fabrique and Showscape
Size	12x24.
Color	As selected by Architect.
Wainscott Cap:	All types available.

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 GROUT MATERIALS

- A. Portland Cement Grout Materials: ANSI/TCNA A118.7.
- B. Latex-Portland Cement Grout: ANSI/TCNA 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.

2.5 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/TCNA 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 TCNA.
- D. Sealant: Type specified in Section 07 92 00.

2.6 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.

2.7 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/TCNA 108.5 and applicable tile installation standards of the TCNA 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/TCNA 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 square.
- 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.

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.
- 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 Fine Fissured Second Look II, manufactured by Armstrong.

(a)	Type	:	1766
(b)	Form	:	Angled Teqular
(c)	Size	:	24 x 48 inches
(d)	Thickness	:	3/4 inches
(e)	Composition	:	Mineral
(f)	Light Reflectance	:	84 percent
(g)	NRC Range	:	.55 to .60
(h)	CAC Range	:	35 to 40
(i)	STC Range	:	.50 to .55
(j)	Edge	:	Rabbetted
(k)	Surface Color	:	White
(l)	Flame Spread	:	ASTM E-84 (0-25) Class A, UL 25 or under
(m)	Smoke Density	:	Not to exceed 450 when tested in accordance with CBC Standard No. 12-8-1
(n)	Mold/Mildew Inhibitor	:	Biocide treatment that inhibits mold and mildew when tested according to ASTM D3273.

3. PART 3 EXECUTION

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 51 33

DIRECT APPLIED ACOUSTICAL CEILINGS

1. PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Acoustical tile.

1.2 REFERENCES

- A. ASTM E 84 - Test Method for Surface Burning Characteristics of Building Materials.
- B. ASTM E1264 - Classification of Acoustical Ceiling Products.
- C. ASTM D1779 - Adhesive for Acoustical Materials.
- D. ASTM D3273 - Standard Test Method for Resistance to Growth of Mold on the Surface of Interior Coatings in an Environmental Chamber.
- E. UL - Underwriters Laboratories Building Materials Directory.

1.3 QUALITY ASSURANCE

- A. Manufacturer: Company specializing in manufacture of ceiling tile with five years experience.
- B. Installer: Company with five years minimum documented experience.

1.4 SUBMITTALS

- A. Submit product data under provisions of Section 01 33 00.
- B. Provide product data on acoustic units.

1.5 ENVIRONMENTAL REQUIREMENTS

- A. Maintain uniform temperature of minimum 60 degrees F, and humidity of 50 percent prior to, during, and after installation.

2. PART 2 PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

- A. Armstrong Ceiling Systems, www.armstrongceilings.com.
- B. Certainteed, www.certainteed.com.
- C. USG Interiors, Inc., ww.usg.com.
- D. Substitutions: Under provisions of Section 01 25 13.

2.2 MATERIALS

- A. Acoustic Tile: ASTM E1264, equivalent to Fine Fissured as manufactured by Armstrong World Industries and conforming to the following:

1.	Type	:	III
2.	Form	:	2
3.	Pattern Designation	:	CE
4.	Size	:	12 x 12 inches
5.	Thickness	:	1/2 inch
6.	Composition	:	Mineral.
7.	Light Reflectance	:	0.85 percent
8.	NRC Range	:	0.55
9.	CAC Range	:	35]
10.	Flame Spread	:	ASTM E 84 (0-25) Class A, UL 25 or under
11.	Joint	:	Interlocking
12.	Edge	:	Tongue and Groove
13.	Surface Finish	:	Painted white color
14.	Mold/Mildew Inhibitor	:	Biocide treatment that inhibits mold and mildew when tested according to ASTM D3273
15.	Smoke Developed Index	:	50 or less

- B. Adhesive: ASTM D1779; waterproof, gun or knife grade; type recommended by tile manufacturer.

3. PART 3 EXECUTION

3.1 INSPECTION

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

3.2 INSTALLATION

- A. Install acoustic units in accordance with manufacturer's instructions and as supplemented below.
- B. Locate acoustic units on room axis according to reflected ceiling plan.
- C. Fit acoustic units in place, free from damaged edges or other defects detrimental to appearance and function.
- D. Lay directional patterned units to match existing pattern.
- E. Lay directional patterned units one way in room.
- F. Fit border units neatly against abutting surfaces.
- G. Install acoustic units level, in uniform plane, and free from twist, warp and dents.

3.3 TOLERANCES

- A. Variation from Flat and Level Surface: 1/8 inch in 10 ft.

END OF SECTION

SECTION 09 67 26

QUARTZ FLOORING

1. PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Fluid applied epoxy flooring and base with epoxy top coat.
- B. Quartz chip aggregate.
- C. Base cap edging and divider strips.

1.2 REFERENCES

- A. 2022 CBC - California Building Code, (CCR) California Code of Regulations, Title 24, Part 2, California State Accessibility Standards.
- B. ASTM C307 - Standard Test Method for Tensile Strength of Chemical-Resistant Mortar, Grouts, and Monolithic Surfacing.
- C. ASTM C580 - Standard Test Method for Flexural Strength and Modulus of Elasticity of Chemical-Resistant Mortars, Grouts, Monolithic Surfacing, and Polymer Concretes.
- D. ASTM D413 - Standard Test Method for Rubber Property - Adhesion to Flexible Substrate.
- E. ASTM D579 - Standard Specification for Greige Woven Glass Fabrics.
- F. ASTM D635 - Standard Test Method for Rate of Burning and/or Extent and Time of Burning of Plastics in a Horizontal Position.
- G. ASTM D648 - Standard Test Method for Deflection Temperature of Plastics Under Flexural Load in the Edgewise Position.
- H. ASTM D790 - Standard Test Methods for Flexural Properties of Unreinforced and Reinforced Plastics and Electrical Insulating Materials.
- I. ASTM D1004 - Standard Test Method for Initial Tear Resistance of Plastic Film and Sheeting.
- J. ASTM D2047 - Standard Test Method for Static Coefficient of Friction of Polish-Coated Floor Surfaces as Measured by the James Machine.
- K. ASTM D2240 - Standard Test Method for Rubber Property - Durometer Hardness.
- L. ASTM F710 - Practice for Preparing Concrete Floors and other Monolithic Floors to Receive Resilient Flooring.
- 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. ACI Committee No. 503.1PP - Bond Strength.
- P. MIL - D - 3134F - Indentation.
- Q. UL - Underwriters' Laboratories.

1.3 QUALIFICATIONS

- A. Applicator: Company specializing in epoxy matrix floor applications with five years documented experience.
- B. Supervisor: Trained by product manufacturer.

1.4 REGULATORY REQUIREMENTS

- A. Conform to applicable codes for flooring flame/fuel/smoke ratings in accordance with UL.
- B. Products supplied for flooring installation shall comply with regulations controlling use of volatile organic compounds (VOC).
- C. Flooring 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, 2022 California Building Code, (CCR) Title 24, Part 2.

1.5 SUBMITTALS

- A. Submit product data under provisions of Section 01 33 00.
- B. Submit product data for base cap.
- C. Submit samples under provisions of Section 01 33 00.
- D. Submit two samples 4 x 4 inch in size illustrating color, chip size and variation, and matrix color.

1.6 OPERATION AND MAINTENANCE DATA

- A. Submit cleaning and maintenance data under provisions of Section 01 77 00.
- B. Include procedures for stain removal, repairing surface, and cleaning.

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Deliver, store, and protect products under provisions of Section 01 61 00.
- B. Store materials in a dry, secure area.
- C. Maintain temperature of 55 degrees F.
- D. Keep products away from fire or open flame.

1.8 ENVIRONMENTAL REQUIREMENTS

- A. Do not install flooring when temperature is below 60 degrees F or above 90 degrees F.
- B. Maintain this temperature range, 24 hours before, during, and 72 hours after installation of flooring.
- C. Ventilate area where flooring is being installed. Post and enforce NO SMOKING or OPEN FLAME signs until flooring has cured.
- D. Provide uniform lighting of 50 fc in area of installation.
- E. Restrict traffic from area where flooring is being installed or is curing.

F. Moisture Testing: Perform tests as recommended by flooring materials 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.

1.9 WARRANTY

- A. Provide one year warranty under provisions of Section 01 77 00.
- B. Warranty: Include coverage for delamination of floor and base materials from substrate, degradation of surface finish.

2. PART 2 PRODUCTS

2.1 MANUFACTURERS

- A. General Polymers Corporation, TPM No. 115 Upgraded, www.generalpolymers.com.
- B. Crossfield Products Corp., (Dex-O-Tex) Cheminert CFS, K-D, www.dex-o-tex.com.
- C. Dudick, Inc., Steri-Quartz B, www.dudick.com.
- D. Dur-A-Flex, Inc., Dura-A-Quartz, www.dur-a-flex.com.
- E. RBC Industries, Inc., HE1484, www.rbcepoxy.com.
- F. Sunbelt Flooring, Inc., Flooring No. 1100, www.sunbeltflooring.com.
- G. Stonhard Inc., Stoneshield HRI, www.stonhard.com.
- H. Tenemec, Series 201-223-284, www.stratashield.com.
- I. Westcoat, EC Mortar Quartz, www.westcoat.com.
- J. Substitutions: Under provisions of Section 01 25 13.

2.2 PERFORMANCE REQUIREMENTS

- A. Conform to the following:

<u>Property</u>	<u>Test</u>	<u>Result</u>
Tensile Strength	ASTM C307	1,650 psi
Compressive Strength (7 days)	ASTM D579	10,000 psi
Flexural Strength	ASTM C580	4,300 psi
Flexural Modulus of Elasticity	ASTM D790	2.0 x 10 ⁶ psi
Hardness	ASTM D2240	85-90 Shore Durometer
Indentation	MIL-D3134F	No Indentation

<u>Property</u>	<u>Test</u>	<u>Result</u>
Coefficient of Friction	ASTM D2047	0.7
Heat Deflection Temperature	ASTM D648	100 degrees F/ 38 degrees C
Water Absorption	ASTM D413	0.10 percent
Fire Resistance	ASTM D635	Self Extinguishing. Extent of Burning, .25 inches maximum
Bond Strength	ACI 503.1	400 psi minimum
Abrasion Resistance	ASTM D1004	Maximum weight loss of 0.10 gm/1000 cycles

2.3 MATERIALS

- A. Primer: A two-component, penetrating, moisture tolerant, epoxy primer.
- B. Base: A three-component, integral troweled mortar base consisting of epoxy resin, curing agent and finely graded silica aggregate.
- C. Undercoat: A two-component, thixotropic epoxy undercoat sealer.
- D. Aggregate: Brightly colored, quartz aggregate broadcast onto the surface.
- E. Sealer: A high performance, two-component, clear UV resistant epoxy sealer.

2.4 ACCESSORIES

- A. Subfloor Filler: White premix Portland Cement latex type as recommended by flooring material manufacturer.
- B. Divider Strips: 0.0478 inch thick zinc T and L shaped strips with perforated flanges as manufactured by the Manhattan American Strip Company, www.ntma.com.
- C. Base Cap: 0.0478 inch thick zinc L shaped strip with perforated flange as manufactured by the Manhattan American Strip Company, www.ntma.com.

2.5 COLORS

- A. Resin and Aggregate: Color as selected by Architect from manufacturer's entire color range.

3. PART 3 EXECUTION

3.1 EXAMINATION

- A. Do not begin work until concrete substrate has cured 90 days minimum.
- B. Verify that substrate is ready to receive work, and that subfloor surface is clean, dry, and free of substances which could affect bond.
- C. Verify that concrete slabs comply with ASTM F710 and are as specified herein.
- D. Verify concrete floors exhibit acceptable moisture emission rate and humidity level; and exhibit negative alkalinity, carbonization, or dusting.
- E. Verify that surfaces are smooth and flat and are ready to receive Work.
- F. Beginning of installation means acceptance of existing substrate and site conditions.

3.2 PROTECTION

- A. Protect elements surrounding the work of this Section from damage or disfiguration.

3.3 PREPARATION

- A. Prepare concrete substrate according to ASTM F710.
- B. Topping Slab below Quartz flooring shall be Ardex K-521 according to ASTM 1708 where occurs.
- C. Remove sub-floor ridges and bumps. Fill low spots, cracks, joints, holes, and other defects with subfloor filler.
- D. Apply, trowel, and float filler to leave a smooth, flat, hard surface.
- E. Clean substrate surface free of foreign matter and scrub with manufacturer supplied detergent.
- F. Control, expansion joints and cracks in concrete floor substrate shall be routed out and filled with resilient sealant and reinforced with 20 x 20 fiberglass mesh.
- G. Prohibit traffic from area until filler is cured.
- H. Vacuum clean substrate.

3.4 INSTALLATION - ACCESSORIES

- A. Install strips straight and level to locations indicated.
- B. Install terminating cap strip at top of base; attach securely to wall substrate.

3.5 INSTALLATION - FLOORING

- A. Apply primer to concrete slab surfaces.
- B. Apply flooring in accordance with manufacturer's instructions.
- C. Apply to a minimum thickness of 1/4 inch.
- D. Finish to smooth level surface sloped to drains.
- E. Provide 3/8 inch cove fillet at vertical surfaces.
- F. Extend up vertical surface to form base.
- G. Apply final sealer in two coats.

3.6 TOLERANCES

- A. Maximum Variation from Flat Surface: 1/8 inch in 10 feet.

3.7 PROTECTION

- A. Protect finished installation under provisions of Section 01 61 00.
- B. Do not permit traffic over finished floor surfaces.

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).

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 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.

1.10 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.

1.11 EXTRA MATERIAL

- A. Provide a one 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, manufacturer's catalog names and numbers of paint types in this Section are based on products manufactured or distributed by the Dunn-Edwards Corporation (www.dunnedwards.com) and shall serve as the basis of design against which the Architect will judge equivalency. The quantity of titanium dioxide, the use of clays, aluminum silicate, talc and the purity of acrylic materials are a few of the criteria which will be used by the Architect in determining equivalency of materials. Therefore, Prime Pigment Content must be clearly stated on each Technical Data Sheet.
 - 1. Products, to include colorants must not contain Silica.
 - 2. Products: Containers Labels, and Technical data sheets must all contain the same product numbers. The word "Series" will not be accepted.
- 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 - GENERAL

- 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. 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.
- G. 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.
- H. 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.
- I. Uncoated Steel and Iron: Remove grease, scale, dirt, and rust. Where heavy coatings of scale are evident, remove by wire brushing or sandblasting; clean by washing with solvent. Apply a treatment of phosphoric acid solution, ensuring weld joints, bolts, and nuts are similarly cleaned. Prime paint after repairs.
- J. 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.
- K. 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.
- L. Exterior Wood: Remove dust, grit, and foreign matter. Seal knots, pitch streaks, and sappy sections. Fill nail holes with tinted exterior caulking compound after prime coat has been applied.
- M. Glue-Laminated Beams: Prior to finishing, wash surfaces with solvent, remove grease and dirt.
- N. Wood Doors: Seal top and bottom edges with 2 coats of spar varnish sealer.
- O. Existing surfaces to be recoated shall be thoroughly cleaned and deglossed by sanding or other means prior to painting. Patched and bare areas shall be spot primed with same primer as specified for new work.

3.3 SURFACE PREPARATION - MODERNIZATION

- A. Properly prepare all existing surfaces to receive new paint.
- B. Prior to application of any new paint, existing surfaces to be cleaned free of damaged paint, dust, corrosion, and other foreign matter which will destroy bond or mar appearance of new paint.
- C. Sand, scrape, fill and repair surfaces flush with suitable fillers. Patch and repair; feather edges to provide smooth transitions; match existing surfaces.
- D. Remove hardware and accessories, machined surfaces, plates, lighting fixtures, and similar items in place and not-to-be-finish painted, or provide surface-applied protection. Reinstall removed items upon completion of work in each area.
- E. Existing surfaces to be painted shall be thoroughly cleaned and deglossed by sanding or other means prior to painting. Patched and bare areas shall be shall be spot primed with same primer as for new work.
- F. Existing paint removal:
 - 1. Remove loose, blistered, scaled, oxidized, cracked, alligatored, or defaced paint down to a sound surface.
 - 2. Brush and clean free all loose material.
 - 3. Feather edges of removal areas to provide a smooth transition between surfaces.
- G. Perform preparation and cleaning procedures in strict accordance with coating manufacturer's instructions for each substrate condition.

- H. Washing and Cleaning:
1. Remove all loose and foreign materials.
 2. At building interiors, wash all surfaces clean with approved cleaner and rinse with clean water.
 3. At building interiors, vacuum existing ceiling panels to remove all dirt and dust from the material surface. Utilize caution so as not to mar or damage the finish surface in any way.
 4. Completely remove wax from surfaces which receive new paint.
- I. Remove dust, grit, and foreign matter from existing wood surfaces. Sand surfaces and dust clean. Spot coat knots, pitch streaks, and sappy section with pigmented stain sealer when surfaces are to be painted. Fill nail holes, cracks, and other defects after priming and spot prime repairs when fully cured.
- J. Repair and crack filling:
1. Wood: Putty cracks and holes flush at stained and or varnished work, color putty to match. Sand smooth any rough spots. Seal knots and pitch pockets.
 2. Gypsum Wallboard: Fill all nail heads, screw heads, holes, cracks, or defects with drywall joint compound or spackle. Sand any rough spots smooth; do not raise nap on paper covering. Remove dust. Skim coat drywall must be sealed with a suitable sealer recommended by the coating manufacturer.
 3. Plaster:
 - (a) Cracks exceeding 1/16 inch wide shall be V-grooved out, and then filled flush.
 - (b) Interior Plaster: Fill with spackle or patching plaster.
 - (c) Exterior Plaster: Small defects may be filled with exterior spackle. Cracks more than 1/16 inch wide shall be filled with cement grout, textured to match adjacent surfaces.
 4. Concrete / Masonry: Fill as specified for exterior plaster.
- K. Natural / Stain Finished Wood Doors:
1. Typically, fully strip existing natural finish clear coat, fill all dents, gouges, scrapes, etc., and finish sand to prepare surface to receive a complete new finish coat system.
 2. All patching materials shall be natural wood dough tinted to match existing natural wood color.
 3. Doors shall appear as new when work is finished.
- L. Concrete and masonry surfaces shall be dry, clean, and free of dirt, efflorescence, encrustation, mortar spots, and other foreign matter. Glazed surfaces on concrete shall be roughened or etched to uniform texture.
- M. Ferrous metal shall be cleaned of oil, grease, and foreign matter. Cleaning method: SSPC-SP No. 1 "Solvent Cleaning".
- N. Ferrous Steel: Where raw metal surface is exposed, proceeds follows:
1. Cleaning method: SSPC-SP No. 2 "Hand Cleaning" or No. 3 "Power Brush Cleaning" as required to remove corrosion, loose paint, and rust.
 2. Priming: Prime immediately after cleaning.
- O. Galvanized Metal: Where galvanizing is exposed, proceed as follows:
1. Cleaning: Solvent clean per SSPC-SP No. 1 "Solvent Cleaning".

2. Pre-Treatment; Apply Supreme Chemical Metal Clean and Etch SC-ME01, follow manufacturer's recommendations and the following:
 - (a) Application: Brush apply in a thin even coat. Remove excessive solution from surface with rags, squeegee, or sponge. When using full strength, rinse surface with water.
 - (b) Thinning: Use water, do not reduce solution beyond 3 parts water to 1 part Supreme Chemical Metal Clean and Etch SC-ME01.
 - (c) Drying: Allow to dry for 10 minutes, rinse thoroughly with water and wipe dry with rags.
3. Cleaned and treated galvanized metal should be primed within 48 hours.

- P. Thoroughly back paint all surfaces of exterior and interior finish lumber and millwork, including doors and window frames, trim, cabinetwork, etc., which will be concealed after installation. Back paint items to be painted with a priming coat. Use a clear sealer for back priming where transparent finish is required.
- Q. Pipes, ducts, hangers, exposed steel and ironwork, and primed metal surfaces of equipment installed under mechanical and electrical work shall be cleaned prior to priming.

3.4 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.

3.5 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 over Underwriters Laboratories, Factory Mutual or other code-required labels or identifications.

3.6 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.

3.7 FINISHING MECHANICAL AND ELECTRICAL EQUIPMENT

- A. Refer to mechanical and electrical specifications 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.

3.8 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.

3.9 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.

3.10 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.

3.11 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.

3.12 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. 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.

3.13 SCHEDULE - EXTERIOR SURFACES

- A. Wood - Painted (Semi-Gloss Acrylic)
 - 1st coat: EZPROO EZ Prime Premium
 - 2nd coat: SSHL50 Spartashield
 - 3rd coat: SSHL50 Spartashield
- B. Concrete (Eggshell Acrylic)
 - 1st coat: ESPROO Eff-Stop Premium
 - 2nd coat: EVSH30 Evershield
 - 3rd coat: EVSH30 Evershield

3.14 SCHEDULE - INTERIOR SURFACES

- A. Wood - Painted (Semi-Gloss Acrylic)
 - 1st coat: UGPROO Ultra-Grip Premium
 - 2nd coat: SPMA50 Suprema
 - 3rd coat: SPMA50 Suprema
- B. 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
- C. Concrete (Eggshell, Acrylic)
 - 1st coat: UGPROO Ultra-Grip Premium
 - 2nd coat: SPMA30 Suprema
 - 3rd coat: SPMA30 Suprema
- D. Concrete Masonry Units (Eggshell, Acrylic)
 - 1st coat: SBPROO Smooth Blocfil Premium
 - 2nd coat: SPMA30 Suprema
 - 3rd coat: SPMA30 Suprema

- E. Steel - Primed or Unprimed (Gloss Urethane Alkyd Enamel)
- | | |
|-----------|--------------------------|
| 1st coat: | BRPR00 Bloc-Rust Premium |
| 2nd coat: | ASHL70 Aristoshield |
| 3rd coat: | ASHL70 Aristoshield |

- F. Gypsum Board (Eggshell Acrylic)
- | | |
|-----------|---------------------------|
| 1st coat: | VNPROO Vinylastic Premium |
| 2nd coat: | SPMA30 Suprema |
| 3rd coat: | SPMA30 Suprema |

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.

1.2 REFERENCES

- A. 2022 CBC - California Building Code, (CCR) California Code of Regulations, Title 24, Part 2.

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 2022 CBC - California Building Code, (CCR), Title 24, Part 2.
- B. Raised characters shall comply with CBC Section 11B-703.2:
 - 1. Depth: Raised characters shall be 1/32-inch (0.8 mm) minimum above their background and shall be sans-serif uppercase and be duplicated in Braille.
 - 2. Height: Raised character height shall be 5/8-inch (15.9 mm) minimum and 2 inches (51 mm) maximum based on the height of the uppercase letter "I". CBC Section 11B-703.2.5.
 - 3. Finish and Contrast: Characters and their background shall have a non-glare finish. Character shall contrast with their background with either light characters on a dark background or dark characters on a light background. CBC Section 11B-703.5.1.
 - 4. Proportions: Raised character proportions shall be selected from fonts where the width of the uppercase letter "O" is 60% minimum and 110% maximum of the height of the uppercase letter "I". Stroke thickness of the uppercase letter "I" shall be 15% maximum of the height of the character. CBC Section 11B-703.2.4 and 11B-703.2.6.
 - 5. Character Spacing: Spacing between individual raised characters shall comply with CBC Section 11B-703.2.7.
 - 6. Line Spacing: Spacing between individual raised characters shall comply with CBC Section 11B-703.2.8.
 - 7. Format: Text shall be in a horizontal format. CBC Section 11B-703.2.9.

8. Braille: Braille shall be contracted (Grade 2) and shall comply with CBC Sections 11B-703.3 and 11B-703.4. Braille dots shall have a domed or rounded shape and shall comply with CBC Figure 11B-703.3.1.
9. Mounting Height: Tactile characters on signs shall be located 48" minimum to the baseline of the lowest Braille cells and 60" maximum to the baseline of the highest line of raised characters above the finish floor or ground surface. CBC Section and Figure 11B-703.4.1.
10. Mounting Location: A tactile sign shall be located per CBC Section and Figure 11B-703.4.2 as follows:
 - (a) alongside a single door at the latch side.
 - (b) on the inactive leaf at double doors with one active leaf.
 - (c) to the right of right hand at double doors with two active leaves.
 - (d) on the nearest adjacent wall when there is no wall space at the latch side of a single door.
 - (e) at the right side of double doors with two active leaf's.

(For all cases, a clear floor space of 18" x 18" minimum, centered on the tactile characters, shall be provided beyond the arc of any door swing between the closed position and 45-degree open position.)

- C. Visual characters shall comply with CBC Section 11B-703.5 and shall be 40" minimum above finish floor or ground. Visual character stroke thickness of the uppercase letter "I" shall be 10% minimum and 20% maximum of the height of the character. CBC Section 11B-703.5.7.
 1. Line Spacing between the baselines of separate lines of characters within a message shall be 135% min. and 170% max. of the character height per CBC Section 11B-703.5.9.
 2. Character Spacing between individual adjacent characters shall be 10% min. and 35% max. of character height per CBC Section 11B-703.5.8.
- D. Pictograms shall comply with CBC Section 11B-703.6.
- E. Symbols of accessibility shall comply with CBC Section 11B-703.7.
- F. Variable message signs shall comply with CBC Section 11B-703.8.

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. 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.

2.2 MANUFACTURED UNITS

- A. 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 Century Gothic 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 2022 CBC, California Building Code (CCR), Title 24, Part 2, Section 11B-703.
- B. 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 Century Gothic 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 2022 CBC, California Building Code (CCR), Title 24, Part 2, Section 1011.4 and 11B-703.
- C. 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 2022 CBC, California Building Code (CCR), Title 24, Part 2, Section 11B-703.
- D. 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 2022 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 2022 CBC, California Building Code (CCR), Title 24, Part 2, Section 11B-216.6 and 11B-703.7.2.1.
- E. 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 2022 CBC, California Building Code (CCR), Title 24, Part 2, Section 11B-216.9.2 and 11B-703.5.
- F. 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 2022 CBC, California Building Code (CCR), Title 24, Part 2, Section 11B-206.4.7 and 11B-404.1.1.
- G. 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 2022 CBC, California Building Code (CCR), Title 24, Part 2, Section 703.7.
- H. 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 2022 CBC, California Building Code (CCR), Title 24, Part 2, Section 1028.5.
- I. 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 2022 CBC, California Building Code, (CCR), Title 24, Part 2, Section 3005.4. 1. 6.

J. Traffic Signage:

1. Van Parking Stall: 12 inch x 18 inch 0.080 inch thick aluminum accessible sign in accordance with 2022 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 2022 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 2022 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.

K. 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 Century Gothic lettering: adhesive and mechanical mounting with copy centered on plate.
3. Signage to conform to the requirements of the 2022 CBC, California Building Code, (CCR) California Code of Regulations, Title 24, Part 2, Section 1004.3.

L. 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 floor mounted. headrail braced.
- B. Urinal screens, wall mounted.
- C. Hardware.
- D. Attachments screws and bolts.

1.2 REFERENCES

- A. 2022 CBC - California Building Code, (CCR) California Code of Regulations, Title 24, Part 2, California State Accessibility Standards.
- B. ASTM A167 - Stainless and Heat-Resisting Chromium-Nickel Steel Plate, Sheet, and Strip.
- C. ASTM E84 - Test Method of Surface Burning Characteristics of Building Materials.
- D. 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 2022 CBC, California Building Code, (CCR), Title 24, Part 2.
- 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.
- C. Accessible Toilet Compartments:
 - 1. Wheelchair accessible compartment shall comply with CBC Section 11B-604.8.1.

2. Toe clearance for at least one side partition of a wheelchair accessible compartment shall comply with CBC Section and Figure 11B-604.8.1.4. It shall be 9" high minimum above the finish floor and 6" deep minimum beyond the compartment side face of the partition, exclusive of partition support members. It shall be 12" high minimum above the finish floor for children's use. Partition components at toe clearances shall be smooth without sharp edges or abrasive surfaces. Toe clearance at the side partition is not required in a compartment greater than 66" wide.
3. Ambulatory accessible compartments shall be provided where there are six or more toilet compartments, or where the combination of urinals and water closets totals six or more fixtures. Such compartments shall be provided in the same quantity as wheelchair accessible compartments per CBC Section 11B-213.3.1 and shall comply with CBC Section 11B-604.8.2.
4. Door and door hardware for accessible compartments shall be self-closing and shall comply with CBC Section 11B-404 except that if the approach is to the latch side of an ambulatory compartment door, clearance between the door side of the compartment and any obstruction shall be 44" minimum. CBC Figure 11B-604.8.2.
5. A door pull complying with CBC Section 11B-404.2.7 shall be placed on both sides of the accessible compartment door near the latch.
6. Ambulatory Accessible Toilet Compartment doors shall not swing into the clear floor space or clearance required for any fixture or into the minimum required compartment area. CBC Section 11B-604.8.2.2.

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. Headrail: 1 x 1-5/8 inch anodized extruded aluminum; with anti-grip configuration; with stainless steel wall brackets.
- C. Attachments, Screws, and Bolts: Stainless steel; tamperproof type.
- D. 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. Height: 58 inch.
 - 6. 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 and floors using appropriate anchor devices.
- D. Attach panels and pilasters to brackets with through bolts and nuts.
- E. Anchor urinal screen panels to walls with continuous brackets.
- F. Provide 1/2 inch space between wall surface and panels or pilasters.
- G. Provide for adjustment of floor variations with screw jack through steel saddles integral with pilaster. Conceal floor fastenings with pilaster shoes.
- H. Equip each toilet stall door with hinge, door latch, and pull.
- I. 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.
- J. Install door strike keeper on each pilaster in alignment with door latch.
- K. 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.
- L. 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 28 13

TOILET ACCESSORIES

1. PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Toilet and accessories.
- B. Framed mirror units.
- C. Concealed anchor devices and backing plate reinforcements furnished to other Sections.
- D. Attachment hardware.

1.2 REFERENCES

- A. 2022 CBC - California Building Code, (CCR) California Code of Regulations, Title 24, Part 2, California State Accessibility Standards.
- B. ASTM A123 - Zinc (Hot-Dip Galvanized) Coatings on Products Fabricated from Rolled, Pressed, and Forged Steel Shapes, Plates, Bars and Strips.
- C. ASTM A167 - Stainless and Heat-Resisting Chromium-Nickel Steel Plate, Sheet and Strip.
- D. ASTM A366 - Steel, Carbon, Cold-Rolled Sheet, Commercial Quality.
- E. ASTM A386 - Zinc Coating (Hot-Dip) on Assembled Steel Products.
- F. ASTM B456 - Electrodeposited Coatings of Copper Plus Nickel Plus Chromium and Nickel Plus Chromium.
- G. 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 2022 CBC, California Building Code, (CCR) Title 24, Part 2.
- B. Structural strength of grab bars, shower seats, fasteners and mounting devices shall conform to requirements of the 2022 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.
- C. Elements of Sanitary facilities shall be mounted at locations in compliance with CBC Sections 11B-602 through 11B-612.

- D. Grab bars in toilet facilities and bathing facilities shall comply with CBC Section 11B-609. Grab bars and any wall or other surfaces adjacent to grab bars shall be free of sharp or abrasive elements and shall have rounded edges. The space around the grab bars shall be as follows:

- 1. 1 ½" between the grab bar and the wall.
- 2. 1 ½" minimum between the grab bar and projecting objects below and at the ends.
- 3. 12" minimum between the grab bar and projecting objects above.

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.

3.4 SCHEDULE

- A. Model numbers refer to Bobrick items.

END OF SECTION

SECTION 10 44 00

FIRE PROTECTION SPECIALTIES

1. PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Fire extinguishers.
- B. Non-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.
- B. Fire Extinguisher Cabinets must comply with CBC Sections 11B-307, 11B-308, 11B-309, and 11B-403.

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.

2.3 CABINETS

- A. Non-rated cabinets equivalent to J.L. Industries Academy Model No. 1027V10 with vertical duo with SAF-T-LOK and recessed pull doors, laminated safety glazing and red vertical F. E. letters.
- B. Fire rated cabinets, equivalent to J.L. Industries Academy Model No. FX2 with vertical duo with SAF-T-LOK doors laminated safety glazing and red vertical F. E. letters. Cabinet to be fabricated according to ASTM E814 and be listed and labeled by Warnock-Hersey for one and two 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: Type 304 stainless steel with No. 4 finish.

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.

END OF SECTION

SECTION 10 51 13

METAL LOCKERS

1. PART 1 GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 specifications apply to this section.

1.2 SECTION INCLUDES

- A. Metal Lockers.
- B. Locker room benches.

1.3 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, Zinc-Coated (Galvanized) by the Hot-Dip Process.
- C. ASTMA 1008: Specification for Steel, Sheet, Cold-Rolled, Carbon, Structural, High-Strength Low-Alloy and High-Strength Low-Alloy with Improved Formability.
- D. 2022 CBC – California Building Code, (CCR) California Code of Regulations, Title 24, Part 2, California State Accessibility Standards.

1.4 SUMMARY

- A. This Section includes the following
 - 1. Core Athletic Lockers (Basis of Design), including the following
 - (a) Single Tier
 - (b) Multiple Tier
 - (c) Provide fasteners and anchorage devices to install lockers provided under this section.
 - (d) Provide metal filler panel to fill between banks of lockers and adjacent construction.

1.5 SUBMITTALS

- A. Product Data: Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for each type of locker and bench.
- B. Shop Drawings: Show lockers in detail, method of installation, fillers, trim, base, and accessories. Include locker numbering sequence information.
- C. Samples for verification: Submit one full-size locker sample for evaluation. Adherence to the specification is required. Locker submitted must meet specification regardless of manufacturer's standard product. Submit manufacturer's technical data and installation instructions for metal locker units.
- D. Maintenance Data: For adjusting, repairing and replacing locker doors and latching mechanisms to include in maintenance manuals specified in Division 1.

1.6 QUALITY ASSURANCE

- A. Uniformity and Single Manufacturer Requirements: Provide each type of metal locker as produced by a single manufacturer, including necessary mounting accessories, fittings, and fastenings.
- B. All of the locker products in this specification as well as all of the materials used to manufacture this product to be produced in the United States of America. No exceptions will be allowed.
- C. Installers Qualifications: Lockers to be installed by an experienced agent of the manufacturer.

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Packing and Shipping: Do not deliver metal lockers until building is enclosed and ready for locker installation.
- B. Storage and Protection: Protect materials from damage during delivery, handling, storage and installation.

1.8 WARRANTY

- A. Locker manufacturers shall warrant the lockers for the lifetime use of the original purchaser from date of shipment. Warranty shall include all defects in material and workmanship, excluding finish, vandalism and improper installation.

2. PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Acceptable Manufacturers: Subject to compliance with requirements of the Contract Documents, acceptable manufacturers are as follows.
 - 1. DeBourgh Manufacturing Company - local CA dealer is: H2I Group, Mike Kurnik, mkurnik@h2igroup.com, 949-239-5145 or Jerry Rivera, jrivera@h2igroup.com, 840-999-1638.

2.2 FABRICATION

- A. Locker Construction
 - 1. Lockers to be welded unibody construction with exposed welds sanded smooth.
 - 2. No bolts, screws or rivets used in assembly of locker units.
 - 3. Ship lockers set-up, ready to be anchored in place in accordance with manufacturer's instructions.
 - 4. Door Size to be: 15" Wide x 15" Deep x 24" High, 3-Tier (Total 72" Tall)
- B. Body of Lockers
 - 1. Sides and Intermediate Partitions: Exterior sides constructed of 16-gauge domestic cold rolled sheet steel for maximum durability with 18-gauge intermediate partitions. Intermediate partitions to be diamond perforated for maximum ventilation.
 - 2. Backs: Solid sheet of 18-gauge cold rolled sheet steel welded to frames of sides and intermediate partitions.
 - 3. Shelves and Tier Dividers: Constructed of 18-gauge cold rolled sheet steel welded to sides and intermediate partition construction. Shelves provided in lockers 60 inches and taller, located to provide a minimum of 12 inches clearance.
- C. Continuous Door Strike
 - 1. Tier dividers, tops and bottoms constructed to provide four-sided, continuous door strike for a secure, sanitary and intrusion-free locker while door is in closed position.

D. Doors

1. Doors are 16-gauge CRS formed outer panel with double bends on both sides and a single bend on top and bottom with 18-gauge steel formed stiffener panel.
2. Door stiffener runs top to bottom on hinge side of door and is securely welded to outer door to form a reinforced channel for additional torque-free strength and sound reduction when closing door.

E. Door Ventilation

1. Secur-N-Vent doors with three-dimensional vertical vents formed on fronts and backs of door providing 21% ventilation per square inch.

F. Latching

1. Sentry III Single-Point Latch with Facia, S3 Standard Cup
 - (a) Eleven-gauge stationary latch welded securely to locker frame.
 - (b) Latch extends no more than 1-1/4 inch into locker opening, penetrating through cup.
 - (c) Flush-mounted, recessed stainless steel cup in a formed door with 18-gauge vertical back panel stiffener.

G. Hinges

1. 16-gauge continuous piano hinge on the right side of the opening.
2. Hinges welded to door and riveted to locker frame.

H. Slope Tops

1. Provide 18 gauge all welded slope top with 25-degree pitch, attached at factory with concealed fasteners. Slope top to be in addition to standard 16-gauge flat top.

I. Closed Base

1. Provide 4 inch high, 14 gauge welded steel base enclosed on all four sides securely welded to locker bottom.

J. Reinforced Bottom

1. Provide 16-gauge spacer channel welded to locker bottom from front to back for a more secure installation. Spacer channel to have full height 1/2 inch ID tube welded over anchor holes to eliminate deflection upon locker installation. Spacer channel meets all California installation seismic requirements. (When closed bases are not used).

K. Filler Panels and Boxed End Panels: Manufacturer's standard fabricated from 18-gauge solid steel finished to match lockers.

L. Finish

1. Complete locker unit to be thoroughly cleaned, phosphatized and sealed.
2. Finish to be baked powder coat with a minimum 2-3 mil thickness.
3. Color of lockers shall be chosen from manufacturer's 25 standard colors.

2.3 LOCKER ACCESSORIES

A. Hooks

1. Hooks to be heavy duty forged steel with ball ends and zinc plated.
2. Provide two single ceiling hooks and one double ceiling hook in each locker opening 20 inches or taller.

B. Numbering

1. Furnish each locker with black anodized laser-etched aluminum number plate.
2. Locate number plate near center of each door.
3. Owner to furnish numbering sequence.

C. Locks

1. Provide standard Master Lock 1525, Black Dial, with Padlock Control Keys.

2.4 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 indicted 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.

2.5 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 INSTALLATION

A. Wall Installation

1. Securely anchor every locker to wall and/or floor before use.
2. Anchoring to be determined by conditions at time of installation.
3. The adjacent locker units by bolting at four points, two at top and two at bottom, using 1/4 inch cadmium plated bolts.

B. Install benches in positions as indicated.

- C. 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.

3.2 ADJUSTING

- A. General Requirements: Upon completion of installation, inspect lockers and adjust for proper door and locking mechanism operation.

3.3 CLEANING

- A. General Requirements
 - 1. Clean interior and exposed exterior surfaces, removing debris, dust, dirt, and foreign door and locking mechanism operation.
 - 2. Touch up scratches and abrasions to match original finish.
 - 3. Polish stainless and non-ferrous metal surfaces.
 - 4. Replace locker units that cannot be restored to factory-finished appearance.
 - 5. Use only materials and procedures recommended or furnished by locker manufacturer.

END OF SECTION

SECTION 22 00 00

GENERAL PLUMBING PROVISIONS

PART 1 GENERAL

1.1 GENERAL CONDITIONS

- A. The foregoing General and Special Conditions shall form a part of this Division with the same force and effect as though repeated herein. The provisions of this Section shall apply to all the Sections of Division 22.

1.2 CODES AND REGULATIONS

- A. All work and materials shall be in full accordance with current rules and regulations of applicable codes and all California Amendments. Nothing in these drawings or specifications is to be construed to permit work not conforming to these codes. Should the drawings or specifications call for material or methods of construction of a higher quality or standard than required by these codes, the specifications shall govern. Applicable codes and regulations are:
 - 1. California Code of Regulations – CCR:
 - a. Title 8, Industrial Relations.
 - b. Title 24, Building Standards.
 - 2. California Building Code – CBC.
 - 3. California Mechanical Code – CMC.
 - 4. California Plumbing Code – CPC.
 - 5. California Fire Code – CFC.
 - 6. California Green Building Code.
 - 7. American Gas Association – AGA.
 - 8. American National Standards Institute – ANSI.
 - 9. American Society of Heating, Refrigerating and Air Conditioning Engineers – ASHRAE.
 - 10. American Society of Mechanical Engineers – ASME.
 - 11. American Society for Testing and Materials – ASTM.
 - 12. American Water Works Association – AWWA.
 - 13. Cast Iron Soil Pipe Institute – CISPI.
 - 14. California Electrical Code – CEC.
 - 15. National Electrical Manufacturers Association – NEMA.
 - 16. National Fire Protection Association – NFPA.
 - 17. National Sanitation Foundation – NSF.
 - 18. Plumbing and Drainage Institute – PDI.
 - 19. Sheet Metal and Air Conditioning Contractors National Association – SMACNA.
 - 20. Underwriters' Laboratory – UL.
 - 21. Occupational Safety and Health Act - OSHA.
 - 22. California Assembly Bill 1953 (AB1953).
 - 23. ASCE 7-16, Chapter 13.

1.3 PERMITS AND FEES

- A. The Contractor shall take out all permits and arrange for all tests in connection with his work as required by local ordinances. All charges are to be included in the work. Permits for equipment connected to a particular system are to be considered as a part of the work included under each system; for example, permits for electric motor connection are part of electrical work, permits for domestic water or gas connections are part of plumbing work. All charges for service connections, meters, etc. by utility companies or districts shall be included in the work.

1.4 COORDINATION OF WORK

- A. Layout of materials, equipment and systems is generally diagrammatic unless specifically dimensioned. The actual locations of all materials, piping, fixtures, equipment, supports, etc. shall be carefully planned, prior to installation of any work, to avoid all interferences with each other, or with structural, electrical or architectural elements. Verify the proper voltage and phase of all equipment with the electrical plans. All conflicts shall be called to the attention of the Engineer prior to the installation of any work or the ordering of any equipment.

1.5 GUARANTEE

- A. Guarantee shall be in accordance with the General Conditions. These specifications may extend the period of the guarantee for certain items. Where such extensions are called for, or where items are normally provided with guarantee periods in excess of that called for in the General Conditions, the Certificate of Guarantee shall be furnished to the Owner through the Engineer.

1.6 EXAMINATION OF SITE

- A. The Contractor shall examine the site, compare it with plans and specifications, and shall have satisfied himself as to the conditions under which the work is to be performed. No allowance shall subsequently be made in his behalf for any extra expense to which he may be put due to failure or neglect on his part to make such an examination.

1.7 SUBMITTALS

- A. Submit shop drawings in accordance with Division 01.
- B. Shop Drawings: Within 30 days of contract award, the Contractor shall submit six copies of shop drawings for all materials, equipment, etc. proposed for use on this project. Material and equipment shall not be ordered or installed until written review is processed by the Engineer. Any item omitted from the submittal shall be provided as specified without substitution. All shop drawings must comply with the following:
 - 1. Shop drawings are required for all material and equipment items and shall include manufacturer's name and catalog numbers, dimensions, capacities, performance curves, and all other characteristics and accessories as listed in the specifications or on the drawings. Descriptive literature shall be current factory brochures and submittal sheets. Capacities shall be certified by the factory.
 - 2. All shop drawings shall be submitted at one time in a neat and orderly fashion in a suitable binder with title sheet including Project, Engineer and Contractor; Table of Contents; and indexed tabs dividing each group of materials or item of equipment. All items shall be marked with the specification paragraph number for which they are proposed. All equipment shall also be identified by the mark number as indicated on the drawings.

3. All capacities, characteristics, and accessories called for in the specifications or on the drawings shall be highlighted, circled, or underlined on the shop drawings. Calculations and other detailed data indicating how the item was selected shall be included for items that are not scheduled. Data must be complete enough to permit detailed comparison of every significant characteristic which is specified, scheduled, or detailed.
- C. Substitutions: Manufacturers and model numbers listed in the specifications or on the drawings represent the standard of quality and the features desired. Unless otherwise noted, alternate manufacturers may be submitted for review by the Engineer. Calculations and other detailed data indicating how the item was selected shall be included. The Contractor shall assume full responsibility that substituted items or procedures will meet the specifications and job requirements and shall be responsible for the cost of redesign and modifications to the work caused by these items.
- D. Review: Submittals will be reviewed for general conformance with the design concept, but this review does not guarantee quantity shown, nor does it supersede the responsibility of the Contractor to provide all materials, equipment, and installation in accordance with the drawings and specifications. The Contractor shall agree that shop drawing submittals processed by the Engineer are not Change Orders; that the purpose of shop drawing submittals by the Contractor is to demonstrate to the Engineer that the Contractor understands the design concept; that he demonstrates his understanding by indicating which equipment and material he intends to furnish and install and by detailing the fabrication and installation methods he intends to use. The Contractor shall agree that if deviations, discrepancies or conflicts between shop drawings and design drawings and specifications are discovered either prior to or after shop drawing submittals are processed by the Engineer, the design drawings and specifications shall control and shall be followed.

1.8 OPERATION AND MAINTENANCE INSTRUCTIONS

- A. Submit one electronic pdf copy for review and after approved submit three hard copies of the Operation and Maintenance Instructions and Wiring Diagrams for all equipment and parts lists for all equipment, etc. shall be submitted to the Engineer. All instructions shall be clearly identified by marking them with the same designation as the equipment item to which they apply (e.g. WH-1). All wiring diagrams shall agree with revised shop drawings and indicate the exact field installation. All instructions shall be submitted at the same time and shall be bound in a suitable binder with tabs dividing each type of equipment (e.g. Water Heaters, Pumps, Motors, etc.). Each binder shall be labeled indicating "Operating and Maintenance Instructions, Project Title, Contractor, Date" and shall have a Table of Contents listing all items included. **(These submittals shall be submitted with regular submittals at start of job so Commissioning Contractor can start on the commissioning check list for Title 24 Requirements)**
- B. Verbal: The Contractor shall verbally instruct the Owner's maintenance staff in the operation and maintenance of all equipment and systems. The controls contractor shall present that portion of the instruction that applies to the control system. The Engineer's office shall be notified 96 hours prior to this meeting.
- C. Acknowledgment: The Contractor shall prepare a letter indicating that all operation and maintenance instructions (printed, verbal and posted) have been given to the Owner, to the Owner's satisfaction. This letter shall be acknowledged (signed) by the Owner and submitted to the Engineer.

1.9 RECORD DRAWINGS

- A. The Contractor shall maintain a set of prints for the project as a record of all construction changes made. As the Work progresses, the Contractor shall maintain a record of all deviations in the Work from that indicated on the drawings. Final location of all underground work shall be recorded by depth from finished grade and by offset distance from permanent surface structures, i.e. buildings, curbs and walks. In addition, the water, gas, sewer, etc. within the building shall be recorded by offset distances from building walls. The original drawings will be made available to the Contractor from which he shall have a set of reproducible drawings made. The Contractor shall then transfer the changes, notations, etc. from the marked-up prints to the reproducible drawings. The record drawings (marked-up prints and reproducibles) shall be submitted to the Engineer for review (as an alternative, the marked-up prints may be photocopied full size on reproducible stock).

PART 2 PRODUCTS

2.1 PROTECTIVE COATING FOR UNDERGROUND PIPING

- A. All ferrous pipe below grade (except cast iron) shall have a factory applied protective coating of extruded high density polyethylene, 35 to 70 mils total thickness, X-Tru Coat, Scotchkote. All fittings and areas of damaged coating shall be covered with two layer double wrap of 10 mil polyvinyl tape to total thickness of 40 mils. Manville Corporation. Protective coating shall be extended 6" above surrounding grade.

2.2 CONCRETE ANCHORS

- A. Concrete Anchors shall comply with CBC 1901A.3. Steel stud with expansion anchor requiring a drilled hole; powder driven anchors are not acceptable. Minimum concrete embedment shall be 4-1/2 diameters. Minimum spacing shall be 10 diameters center-to-center and 5 diameters from center to edge of concrete. Maximum allowable stresses for tension and shear shall be 80% of the test report values "with special inspection". Anchors shall be Hilti, Philips - or Approved equal.

2.3 SEISMIC RESTRAINTS

- A. All plumbing systems (all equipment, piping, etc.) shall be provided with seismic restraints in accordance with "Seismic Restraint Systems Guidelines" OPM-0052-13 by Eaton/ Tolco.

2.4 SYSTEM IDENTIFICATION

- A. Above Grade Piping: Provide markers on piping which is either exposed or concealed in accessible spaces. For piping systems, other than drain and vent lines, indicate the fluid conveyed or its abbreviation, either by preprinted markers or stenciled marking, and include arrows to show the direction of flow. Comply with ANSI A13.1 for colors. Locate markers at ends of lines, near major branches and other interruptions including equipment in the line, where lines pass through floor, walls or ceilings or otherwise pass into inaccessible spaces, and at 50' maximum intervals along exposed portion of lines. Marking of short branches and repetitive branches for equipment connections is not required.
- B. Equipment: All equipment shall be identified with a plastic laminated, engraved nameplate which bears the unit mark number as indicated on the drawings (e.g. WH-1). Provide 1/2" high lettering, white on black background. Nameplates shall be permanently secured to the unit.

- C. Valves: Provide valve tags on all valves of each piping system, excluding check valves, valves within equipment, faucets, stops and shut-off valves at fixtures and other repetitive terminal units. Provide brass tags or plastic laminate tags. Prepare and submit a tagged valve schedule, listing each valve by tag number, location, and piping service. Mount in glazed frame where directed.

2.5 EQUIPMENT SUPPORT FRAMES

- A. Unless specifically noted otherwise, it shall be the responsibility of Plumbing Contractor to furnish and install all support frames for its equipment.

PART 3 EXECUTION

3.1 SCHEDULING OF WORK

- A. All work shall be scheduled subject to the approval of the Engineer and Owner. No work shall interfere with the operation of the existing facilities on or adjacent to the site.

3.2 CONDUCT OF WORK

- A. The Contractor shall have at all times, as conditions permit, a sufficient force of workmen and quantity of materials to install the work contracted for as rapidly as possible consistent with good work and shall cause no delay to other Divisions engaged upon this project or to the Owner.
- B. Plumbing Contractor shall arrange for all cutting necessary for the proper installation of its work, providing all sleeves and chases necessary. Cutting shall not be done in such a manner to impair the strength of the structure. Any damage resulting from work shall be repaired by the Contractor at his expense to the satisfaction of the Engineer.
- C. Progressively, daily at the completion of each day's work, and at completion of the job, the Contractor shall thoroughly clean all of his work, removing all debris, stain and marks resulting from his work.
- D. **IAQ Management plan will be in effect for Cal Green requirements. Adhesives and mastic must comply with low VOC requirements and documentation (MSDS, etc.) shall be provided with submittals.**

3.3 EXCAVATION AND BACKFILL

- A. Excavation: Trenches are to be excavated to grade and depth established by drawings. Unless otherwise noted, minimum earth cover above top of pipe shall be 24", not including base and paving in paved areas. Width of trenches at top of pipe shall be a minimum of 16" plus the outside diameter of the pipe. Provide all shoring required by site conditions. Barrel of pipe shall have uniform support on trench bottom, hand excavate additional depth at bells, hubs, and fittings. Where over-excavation occurs, provide compacted selected backfill to pipe bottom. Where ground water is encountered, remove to keep excavation dry, using well points and pumps as required.
- B. Backfill:
 - 1. Around Pipe and to One Foot Above Pipe: Material shall be river run sand or native granular free flowing material, free of clay lumps, silt or vegetable matter and shall have 100% passing through the No. 4 sieve and a maximum of 3% passing through the No. 200 sieve. Place carefully around and on top of pipe, taking care not to disturb piping. Consolidate with vibrator.

2. One Foot Above Pipe to Grade: Material to be sandy or silty loam, free of lumps, laid in 6" layers, uniformly mixed, to proper moisture and compacted to required density. If backfill is determined to be suitable and required compaction is demonstrated by laboratory test, water compaction in 6" layers may be used, subject to approval by the Engineer.
 3. Remove all water sensitive settlement from trench backfill regardless of location and compaction requirements.
- C. Compaction: Compact to a density of 95% within building and 90% outside building. Demonstrate proper compaction by testing at one-half of the trench depth. Perform three tests per 100' of trench.

3.4 OPENINGS, CUTTING AND PATCHING

- A. The locations and dimensions for openings through walls, floors, ceilings, foundations, footings, etc. required to accomplish the work under this Specification Division shall be provided under this Division. The actual openings and the required cutting and patching shall be provided. Coring through existing concrete or masonry walls, floors, ceilings, foundations, footings, etc., and saw cutting of concrete floors or asphaltic concrete required to accomplish the work under this Specification Division shall be provided under this Division. Patching of these surfaces shall also be provided. Cutting and coring shall not impair the strength of the structure. Any damage resulting from this work shall be repaired at the Contractor's expense to the satisfaction of the Engineer.

3.5 MANUFACTURER'S RECOMMENDATIONS

- A. All material, equipment, devices, etc., shall be installed in accordance with the recommendations of the manufacturer of a particular item. The Contractor shall be responsible for all installations contrary to the manufacturer's recommendations. The Contractor shall make all necessary changes and revisions to achieve such compliance. Manufacturer's installation instructions shall be delivered to and maintained at the job site through the construction of the project.

3.6 QUIETNESS

- A. Piping and equipment shall be arranged and supported so that vibration is a minimum and is not carried to the building structure or spaces.

3.7 DAMAGES BY LEAKS

- A. The Contractor shall be responsible for damages to other work caused by leaks in the temporary or permanent piping systems prior to completion of work and during the period of the guarantee, and for damages to other work caused by disconnected pipes or fittings, and the overflow of equipment prior to completion of the work.

3.8 CLEANING

- A. Progressively and at completion of the job, the Contractor shall thoroughly clean all of his work, removing all debris, stain and marks resulting from his work.

END OF SECTION 22 00 00

SECTION 22 00 01

PLUMBING

PART 1 GENERAL

1.1 GENERAL CONDITIONS

- A. The foregoing Section 22 00 00, General Plumbing Provisions shall form a part of this specification.

1.2 SCOPE

- A. Included: Perform all work necessary and required to complete construction as indicated. Such work includes the furnishings of all labor, materials, and services necessary for a complete, lawful, and operating plumbing system with all equipment as shown or noted on the drawings or as specified herein. The work includes, but is not necessarily limited to, the following:
 - 1. Sanitary sewer system.
 - 2. Domestic water system.
 - 3. Plumbing fixtures.
 - 4. Plumbing equipment.
- B. Work Specified Elsewhere:
 - 1. Line voltage power wiring (60 volts or greater), motor starters in motor control centers, and disconnect switches are included in the Electrical Division, unless otherwise noted.
 - 2. Access doors.
 - 3. Concrete and reinforcing steel.
 - 4. 23 00 01, Heating, Ventilating and Air Conditioning.

1.3 CODES AND STANDARDS

- A. All pipe, pipe or plumbing fittings or fixture, solder, or flux shall be lead free that provides water for human consumption per California Assembly Bill 1953 (AB1953).
- B. See Section 22 00 00 for additional requirements.

1.4 SUBMITTALS

- A. Provide product data for all materials per Division 01.

PART 2 MATERIALS

2.1 PIPING MATERIALS

- A. Sanitary Sewer:
 - 1. Soil, Waste and Vent Piping:
 - a. Inside Building and Within Five Feet of Building Walls: Standard weight coated cast iron pipe and fittings. Plain end with neoprene gasket and stainless steel retaining sleeve, CISPI 301, ASTM A888 hubless cast-iron, or hub end with rubber gasket, ASTM A74, ASTM C564. Size 2" and smaller above grade may be standard weight galvanized steel, ASTM A53, with coated cast iron recessed drainage fittings, ANSI B16.12. All cast iron pipe and couplings shall be American made and

tested, no imported pipe or coupling are acceptable. Use heavy-duty (4-Band) couplings for all soil and waste piping. Use standard (2-Band) couplings for all vent piping. Tyler Pipe, AB & I Foundry or Charlotte Pipe. Couplings shall be Tyler, Anaco or Husky.

OR

- b. Inside Building and Within Five Feet of Building Walls: PVC-DWV sewer pipe with solvent weld, ASTM D2665. Schedule 40 wall thickness. Traps, sink outlets, cleanouts, etc., shall be same material. Traps shall have union connections.
 - 1) Piping over food prep centers, food serving facilities, food storage areas and other critical areas shall be kept to a minimum and shall not be exposed.
- c. Outside Building:

FOR STATE JOBS, DELETE PLASTIC PIPE FROM DRAINAGE SECTION PER AMENDMENT TO UPC, 701.1.

- 1) For domestic waste only: Polyvinyl chloride gravity sewer pipe with bell and rubber Z-gasket, ASTM D3034, SDR 35. Carlon, J.M.
 - 2) PVC-DWV sewer pipe with solvent weld, ASTM D2665. Schedule 40 wall thickness. Traps, sink outlets, cleanouts, etc., shall be same material. Traps shall have union connections.
 - 3) Where cover is less than 15", pipe shall be cast iron, same as for inside of building.
 - 2. Cleanouts: Floor cleanouts: Smith 4020 with nickel bronze top in finished areas; Smith 4220 in utility areas. Wall cleanouts: Smith 4530 with stainless steel cover and screw. Comparable models of Josam, Wade, Zurn or equal.
 - 3. Cleanout Box: Precast reinforced concrete. Cast iron lid marked for service. Christy or equal; F22 in foot traffic area; G5 in roadways.
- B. Water, Vacuum, Air and Gas:
 - 1. Hot and Cold Water, Vacuum & Air Piping:
 - a. Inside Building: Type L hard temper seamless copper, ASTM B88. Wrought copper fittings ANSI B16.22. Vacuum pipe shall have long sweeping elbow fittings. 95/5 tin-silver soldered joints. Brazesafe, Silcan or equal brazing material.
 - b. Outside Building Below Grade: Same as Inside Building with protective coating on ferrous pipe or Schedule 40 PVC pipe thru 2", Class 315 2" thru 4".
- C. Condensate Drain Piping: Same as cold water piping.
- D. Valves and Specialties:
 - 1. Valves:
 - a. General: Manufacturer's model numbers are listed to complete description. Milwaukee, Kitz, Apollo, Nibco, Stockham or equal. All valves shall be full size of upstream piping. **Ball valves shall be substituted for gate valves 2" and smaller. Butterfly valves shall be substituted for gate valves 2-1/2" and larger. C_v factors for ball valves shall not be less than equal size gate valves.**
 - b. Gate Valve: 2" and smaller: All bronze, rising stem, union bonnet, wedge disk, 200 psi WOG. Milwaukee No. 1152. The material of the valve stem shall be limited to a maximum of six (6) percent zinc content. 2-1/2" and larger: Iron body, bronze mounted. Non-rising stem. Wedge disk. 200 psi WOG. Flanged or AWWA hub as applicable. Open/ closed indicator. Milwaukee No. F2882. Underground valves shall have square operating nut.
 - c. Check Valve: 2" and smaller: All bronze swing check, regrinding. 200 psi WOG. Milwaukee No. 509, 1509 or equal. 2-1/2" and larger: Non-slam type, 125 psi iron body wafer type with renewable seats and stainless steel spring. Milwaukee 1400 series or equal.

- d. Plug Valve: Eccentric bronze plug. Nickel chromium alloy iron body. Bronze bushings. Buna-N O-rings. UL approved for gas distribution. 175 psi WOG. DeZurick Series 400 or equal.
- e. Ball Valves: Two or three piece construction, forged bronze body, chrome plated brass ball, threaded ends, teflon seats, PTFE or reinforced teflon stem seals, lever handle. Underground valves shall have "T" handle. Provide one operating "T" extension handle for all underground valves. Milwaukee BA100/150, BA300/350, Nibco or equal.
- f. Valve Box: Precast reinforced concrete. Cast iron lid marked for service. Christy or equal; F22 in foot traffic areas; G5 in roadways.
- g. Butterfly Valve: Iron Body, Aluminum bronze disk (connection to shaft shall not be by pins, screws, or bolts). Ductile body PPS coated with EPPM coated ductile disc. O-ring seals. Resilient removable seat. 416 stainless steel two piece shaft. 6" and smaller valves shall have multi-position lever handle. Underground valves shall have square operating nut. Provide one operating "T" handle for underground valves. Provide 2" extension neck at insulated pipes. Milwaukee "C" series, Kitz or equal.
- 2. Miscellaneous Specialties:
 - a. Temperature and Pressure Relief Valve: ASME rated fully automatic, reseating combination temperature and pressure relief valve sized in accordance with energy input. Sensing element immersed within upper 6" of tank. Watts.
 - b. Union: 2" and Smaller: AAR malleable iron, bronze to iron ground seat. 300 psi.
 - c. Dielectric Coupling: Insulating coupling rated for 250 psig. EPCO or equal.
 - d. Shock Absorbers: Sioux Chief "Hydra-Rester", Zurn "Shoktrol", PPP "SC Series" or equal.
- E. Miscellaneous Piping Items:
 - 1. Pipe Support:
 - a. Pipe Hanger: Adjustable split ring, swivel hanger and rod. Black malleable iron. Size and maximum load per manufacturer's recommendation. Felt lined, B-Line B3690F, Unistrut or equal.
 - b. Construction Channel: 12 gage 1-5/8" x 1-5/8" steel channel. Single or multiple section. Self-locking nuts and fittings. B-Line, Unistrut, Superstrut or equal.
 - 2. Pipe Sleeves: 24 gage galvanized steel. Adjust-to-Crete #10 with #99 thimble for floors. #100 for walls.
 - 3. Flashing: Vent flashing and flashing for piping through roof shall be prefabricated 24 gauge galvanized steel roof jacks with 8" square flange around pipe sealed with weatherproofing mastic.
 - 4. All wall mount access panels shall have cylinder key lock. Ceiling access panels can be screwdriver latch.

2.2 PIPING INSULATION MATERIALS

- A. General: All piping insulation materials shall have fire and smoke hazard ratings as tested under ASTM E-84 and UL 723 not exceeding a flame spread of 25 and smoke developed of 50.
- B. Pipe Insulation: Elastomeric type, ASTM C534, with a thermal conductivity of 0.27 at 75°F when measured in accordance with ASTM C177 or ASTM C518.
 - 1. Wall thickness: 3/4 in.
 - 2. Adhesive: Conform to Manufacturer's recommendations.

- C. Pre-molded Fiberglass: Heavy density sectional pre-molded fiberglass with vapor barrier laminated all-service jacket and pressure sealing vapor barrier lap. Thermal conductivity shall not exceed 0.25 Btu-in/hr-sq. ft-degrees F, at a mean temperature of 50 degrees F. Perm rating 0.02, ASTM E96. Puncture rating 50 Beach units, ASTM D781. Provide 3" (min.) wide tape of same material as lap for butt joints. For hot water piping, thickness shall be 1" for pipe sizes less than 2", 1-1/2" thickness for pipe sizes 2" and larger. CSG Insulation Corp., Manville, Owens-Corning or equal.
- D. Fiberglass Blanket: Unfaced. Thermal conductivity shall not exceed 0.25 Btu-in/hr sq. ft-degrees F, at a mean temperature of 50 degrees F. 1-1/2" thickness. Manville, Owens-Corning or equal.
- E. PVC Jacket (for exposed pipes and fittings): Pre-molded polyvinyl chloride (PVC) jackets. Size to match application. Provide PVC vapor barrier, pressure-sealing tape by same manufacturer. Zeston or equal.

2.3 FIXTURES

- A. General: This Division shall rough-in for and install all plumbing fixtures shown on drawings. All trim not concealed shall be brass with polished chromium plate finish unless otherwise noted. All enameled fixtures shall be acid resisting. Standard color is white unless otherwise noted.
- B. Schedule: Refer to Plumbing Fixture Schedule on the drawings for list of fixtures. Manufacturer's model numbers are listed to complete description. Water consumption quantities listed on schedule are maximum. Equivalent models of American Standard, Crane, Haws, Kohler, Eljer, Zurn or equal. For drainage fixtures, equivalent models of Josam, Smith, Wade, Zurn or equal.
- C. Stops and P-traps: All fixtures shall be provided with stops and p-traps as applicable.
 - 1. Stops: All hot and cold water supplies shall be 1/2" angle stops with IPS inlets and compression outlets, stuffing box, screwdriver lock shield, and 1/2" flexible brass tubing riser. Speedway. Wall mounted trim shall have concealed loose key wall stop. Chicago 1771 or equal.
 - 2. P-traps: Brass, ground joint. 17 gage. American Standard, California Tubuler or equal.
 - a. Trap primers shall be provided with ball valve and cylinder key-lock access panel for all floor drains and floor sinks. PPP, Inc. or equal.

2.4 EQUIPMENT

- A. General Requirements:
 - 1. General: These equipment specifications are to supplement the drawings. Refer to schedules on drawings for the specific equipment to be provided. Capacities shall be in accordance with the schedules shown on the drawings. Capacities are to be considered minimum.
 - 2. Dimensions: Equipment must conform to space requirements and limitations as indicated on the drawings and as required for operation and maintenance. Equipment will not be accepted that does not readily conform to space conditions.
 - 3. Ratings: Electrical equipment shall be in accordance with NEMA Standards and UL listed where applicable standards have been established.
 - 4. Basis of Design: Manufacturers and model numbers listed in schedules as the basis of design are intended to represent the standard of quality and the features desired.

5. Piping: Each item or assembly of items shall be furnished completely piped for connection to services. Control valves and devices shall be provided. Equipment requiring domestic water for non-potable use shall be provided with backflow preventer acceptable for intended use by local governing authorities.
 6. Electrical:
 - b. General: Each item or assembly of items shall be furnished completely wired to individual terminal blocks for connection to single branch electrical circuit. All electrical accessories and controls required by equipment shall be furnished. Provide terminal blocks for controls not included in equipment package. Manual and magnetic starters shall have ambient compensating running over-current protection in all ungrounded conductors. Magnetic starters shall be manual reset. Controllers and other devices shall be in NEMA 3 or 12 enclosures as applicable.
 - c. Wiring: Conductors, conduit, and wiring shall be in accordance with Electrical Specifications. Individual items within assembly shall be separately protected with dead front, fused disconnect, fuse block, or circuit breaker for each ungrounded conductor, all accessible on operating side of equipment. Switches, contacts, and other devices shall be in ungrounded conductors.
 - d. Control Voltage: Equipment connected to greater than 240 volts shall be provided with 120 volt transformer if separate source is not indicated on plans. 240 volt control is acceptable if confined within control panel.
 - e. Submittals: Included in shop drawings shall be internal wiring diagrams and manufacturer's recommended external wiring.
- B. Electric Drinking Fountain: Wall hung, Dual height with Bottle Filler. Provide steel mounting brackets. Stainless steel basin. Removable grid drain. Chrome plated brass bubbler with automatic flow regulator and self-closing valve. Nonferrous evaporator. Hermetic compressor with automatic reset overload protection. Air cooled condenser. Adjustable thermostat. UL listed. ARI certified. Oasis, Sunroc.
- C. Water Heater, Electric: Glass lined tank. 150 psi working pressure. Fully insulated. Automatic temperature control. High limit control. Provide ASME rated temperature and pressure relief valve sized in accordance with energy input, dielectric couplings and drain cock. UL listed and CEC approved. Extended warranty for a period of 3 years minimum. State, A.O. Smith, National, Rheem or equal.
1. System Valves:
 - a. Constant system pressure shall be maintained by a pilot operated diaphragm type combination pressure regulating and non-slam check valve on each pump. Main valve and cover to be cast iron with a fused epoxy coating and stainless steel stem and cover bolts. Construction shall be suitable for the maximum working pressure of the system.
 2. Control Panel:
 - a. Each system shall include a UL listed enclosed industrial control panel in a NEMA 3/3R enclosure factory mounted and wired on the steel skid. The panel shall be furnished with Main Disconnect with External Handle and Fusing with through the door handle(s), magnetic starters with (3) leg overload protection, pump run lights, H-O-A selector switches, 115 volt fused control transformer, necessary relays and timers and pump start, stop and sequence controls.
 3. Control Panel Options:
 - a. In addition, the control panel shall be furnished with the following features:
 - 1) Low Suction Pressure Shutdown Circuit with Auto Reset and Light.
 - 2) Automatic Alternation.
 - 3) System Temperature Probe and Purge.
 - 4) Key Lockable Enclosure.

4. Factory Test:
 - a. After factory assembly, the packaged pumping system shall be hydrostatically tested as well as undergo a complete electric and hydraulic test from 0 to 100% design flow at the factory. All controls, pump sequencing devices, alarms and instrumentation shall be tested and calibrated for proper operation during factory testing.
 5. Warranty:
 - a. The booster system shall be warranted in writing against defects in materials or workmanship under normal use and service for a period of one year after date of original operation but not more than 18 months from date of shipment from the Company's factory when installed and used in accordance with good standard practice.
 6. Start-Up Service:
 - a. The service of a factory trained representative shall be made available on the jobsite for start-up and instructing operating personnel. Notify the Engineer 2 days prior to the start-up.
- D. Circulation Pump: Bronze pump with stainless steel or non-metallic impeller. Shaft shall be stainless steel or ceramic with carbon bearings with EPDM O-ring and gaskets. Replaceable cartridge type circulators shall have stainless steel cartridge. Connections shall be sweat, threaded, or flanged. Taco, Bell & Gossett, Grundfos, Armstrong or equal.

PART 3 EXECUTION

3.1 PIPING INSTALLATION

- A. General:
1. Piping Layout: Piping shall be concealed in walls, above ceilings, or below grade unless otherwise noted. Exposed piping shall run parallel to room surfaces; location to be approved by Owner's Representative. No structural member shall be cut, notched, bored, or otherwise altered unless specifically allowed by structural drawings and/or specifications. Where such cutting is required, reinforcement shall be provided as specified or detailed. All piping shall be installed in a manner to ensure unrestricted flow, eliminate air pockets, prevent any unusual noise, and permit complete drainage of the system. All piping shall be installed to permit expansion and contraction without strain on piping or equipment. Expansion joints shall be installed as required. Vertical lines shall be installed to allow for building settlement without damage to piping. All exposed piping to be primed and painted, see painting section.
 2. Joints:
 - a. Threaded: Pipe shall be cut square and reamed to full size. Threads shall be in accordance with ANSI B2.1. Joint compound or tape suitable for conveyed fluid shall be applied to male thread only. Joints shall be made with three threads exposed.
 - b. Welded or Brazed: Filler rod shall be of the same suitable alloy as pipe. Welding or brazing shall be performed in accordance with requirements of recognized published standards of practice and by licensed or otherwise certified contractors. Welder or Brazer shall be a person who specialized in welding or brazing of pipes and holds a recognized certificate of competency from a recognized testing laboratory, based on the requirements of the ASME Boiler and Pressure Vessels Code, Section 9.
 - c. Other: Joints other than threaded or welded shall be installed in accordance with manufacturer's recommendations.
 - d. Open Ends: Open ends of piping shall be capped during progress of work to preclude foreign matter.

- e. Electrical Equipment: Joints shall be avoided, where possible, over electrical equipment.
 - f. Copper pipe 1-1/2" or less may be soldered. Above 1-1/2" and all below grade shall be brazed.
3. Fittings:
- a. Standard Fittings: All joints and changes in direction shall be made with standard fittings. Close nipples shall not be used.
 - b. Reducers: Pipe size reduction shall be made with bell reducer fittings. Bushings shall not be used.
 - c. Unions: A union shall be installed on the leaving side of each valve, at equipment connections, and elsewhere as necessary for assembly or disassembly of piping.
 - d. Valves: All valves shall be full line size. At equipment connections, valves shall be full size of upstream piping.
4. Pipe Support:
- a. General: Hangers shall be placed to support piping without strain on joints or fittings. Maximum spacing between supports shall be as specified below. Actual spacing requirements will depend on structural system. Refer to drawings for additional requirements and attachment to structure. Vertical piping shall be supported at floor and ceiling. Support pipe within 12" of all changes in direction. Support individual pipes with pipe hanger. All pressure piping, drainage piping above grade and metallic piping of dissimilar metal from hangers shall have isolating shield, or felted hangers.
 - 1) Screwed Pipe:

Pipe Size Between Supports*	Max. Spacing
(in)	(ft)
1/2	6
3/4	8
1	8
1-1/4 & larger	10

* Based on straight lengths of pipe with couplings only. Provide additional supports for equipment, valves, or other fittings.

 - 2) Copper Tubing: Copper tubing shall be supported at approximately six (6) foot intervals for piping one and one-half (1-1/2) inches and smaller in diameter and ten (10) foot intervals for piping two (2) inches and larger in diameter.
 - 3) Gravity Drainpipe: Piping shall be supported at each length of pipe or fitting, but in no case at greater spacing than indicated above for pressure pipe.
 - b. Trapeze: Trapeze hangers of construction channel and pipe clamps may be used. Submit design to Engineer for approval.
5. Excavation and Backfill: Minimum cover on all piping shall be as follows unless otherwise noted:
- a. Up to 2-1/2" pipe - 24" cover.
 - b. 3" and larger pipe - 30".
6. Miscellaneous:
- a. Escutcheons: Provide chromium plated escutcheons where piping penetrates walls, ceilings, or floors in finished areas.
 - b. Pipe Sleeves: All piping passing through concrete shall be provided with pipe sleeves. Allow 1" clearance between sleeve and pipe or pipe insulation.
 - c. Dielectric Couplings: Dielectric couplings shall be installed wherever piping of dissimilar metals are joined.
 - d. Shock Absorbers: Install per manufacturers recommendations.

- B. Sanitary Sewer Piping:
1. General: Where inverts are not indicated, sanitary sewer piping shall be installed at 1/4" per foot pitch. Piping 4" and larger may be installed at 1/8" per foot pitch where structural or other limitations prevent installation at a greater pitch.
 2. Cleanouts: Install cleanouts at ends of lines, at changes of direction greater than 45 degrees, and at not greater than 100 foot intervals. Locate interior cleanouts in accessible locations and bring flush to finished surface. Cleanouts at urinals shall be installed above urinal.
 3. Vents: Vents shall terminate not less than 6" above the roof nor less than 12" from any vertical surface nor within 10 feet of any outside air intake. Install horizontal vent lines at 1/4" per foot pitch. Offset vents 2 feet minimum from gutters, parapets, ridges, and roof flashing.
 4. Acid Waste & Vent: Push together joints tightly, then mark with permanent marker before fusing joints. After fusing joints with piping manufacturer's tools then cut off fusing tabs on pipe. Tailpiece and traps shall be threaded union fittings only.

3.2 PIPING INSULATION INSTALLATION

- A. Domestic Tempered Water Supply:
1. General: All domestic tempered water supply piping, except for exposed connections to fixtures, shall be insulated. Do not insulate unions or valves less than 2", unless exposed to weather.
 2. Install elastomeric pipe insulation by slipping over end of pipe. Where not feasible, slit insulation longitudinally, snap over piping and seal with adhesive. Insulate fittings with larger diameter sleeves or insulation, lapping pipe insulation a minimum of 2 in.
 3. Butt sections of insulation tightly together and seal with adhesive to provide a continuous vapor and thermal barrier.
 4. Pipe: Apply pre-molded fiberglass sections to pipe using integral pressure sealing lap adhesive in accordance with manufacturer's recommendations. Stagger longitudinal joints. Seal butt joints with factory supplied sealing tape.
 5. Fittings and Valves:
 - a. Wrap fitting with pre-cut fiberglass blanket to thickness matching adjoining insulation. Cover blanket with PVC jacket in accordance with manufacturer's recommendations. Seal all joints with factory supplied pressure sealing vapor barrier tape with 2" (min.) overlap on both sides of joint. Insulate valves to stem.
 - b. For miscellaneous fittings for which PVC jackets are not available or where proximity of fittings precludes a neat-appearing installation, the contractor may cover the fiberglass blanket with stretchable glass fabric and at least two coats of vapor barrier coating. All exposed ends of insulation shall be adequately sealed.
- B. ADA Compliant Fixtures:
1. At sinks/ lavatories which are to be ADA Compliant, the p-trap and angle stop assemblies shall be insulated with Trap Wrap Protective Kit 500R by Brocar, Truebro Handi Lav-Guard #102W or #105W or equal. Abrasion resistant exterior cover shall be smooth and have 1/8" wall minimum over cushioned foam insert. Fasteners shall remain substantially out of sight.
- OR**
- C. ADA Compliant Fixtures:
1. At lavatories which are to be ADA Compliant the P-Trap and angle stop assemblies & water heater shall be covered with Truebro Lav-Shield, or equivalent. Abrasion resistant exterior cover shall be smooth. Fasteners shall be tamper resistant.

3.3 FIXTURE INSTALLATION

- A. Fixture Height: Shall be standard height except those specified as ADA Compliant. Such fixtures shall be mounted in accordance with CBC, Section 11B, Division 6 and drawing details.
- B. Wall Hung Fixtures: Shall be provided with proper backing and hanger plates secured to wall. Fixtures mounted on carriers shall bear against stop nuts, clear of wall surface. Caulk fixtures against walls with white G.E. "Sanitary SCS1700" silicone sealant. Caulking shall be smooth and flush with fixture surface (not concave).
- C. Floor Drains or Floor Sinks: Shall be placed parallel to room surfaces, set level, flush with floor, and adjusted at proper height to drain and easily accessible for inspection and cleaning. Cover openings during construction to keep all foreign matter out of drain line.
- D. Other Connections: Rough-in and connection for trim or fixtures supplied by others shall be included in this specification section.
- E. Floor Mounted Fixtures: Shall be provided with proper support plates. Caulk fixtures against floors with white G.E. "Sanitary SCS1700" silicone sealant. Caulking shall be smooth and flush with fixture surface (not concave).

3.4 EQUIPMENT INSTALLATION

- A. General: It shall be the responsibility of the equipment installer to ensure that no work done under other specification sections shall in any way block, or otherwise hinder the equipment.
- B. Connections to Equipment: Where size reductions are required for connections to equipment, they shall be made immediately adjacent to the equipment and, if possible, inside the equipment cabinet.
- C. Diesel Fuel Tank: Install per manufacturer recommendations.

3.5 TESTS AND ADJUSTMENTS

- A. General: Unless otherwise directed, tests shall be witnessed by the Owner's Representative. Work to be concealed shall not be enclosed until prescribed tests are made. Should any work be enclosed before such tests, the Contractor shall, at his expense, uncover, test, and repair his work, and that of other contractors, to original conditions. Leaks and defects shown by tests shall be repaired and entire work retested. Tests may be made in sections. However, all connections between sections previously tested and new section shall be included in the new test. New sections shall be isolated from existing sections for testing purposes. There shall be no drop in pressure during test except that due to ambient temperature changes. All components of system not rated for test pressure shall be isolated from system before test is made. Test the new sections or branches of piping only.
- B. Gravity System:
 - 1. Sanitary Sewer: All ends of the new sections of sewer system shall be capped and lines filled with water to the top of the highest vent, 10 feet above grade minimum. This test shall be made before any fixtures are installed. Test shall be maintained until all joints have been inspected, but no less than 2 hours.
 - 2. Condensate Piping: Maintain 15 psig water pressure for a duration of 4 hours.

- C. Pressure Systems:
 - 1. General: There shall be no drop in pressure during test except that due to ambient temperature changes. All components of system not rated for test pressure shall be isolated from system before test is made. Test the new sections or branches of piping only.
 - 2. Domestic Tempered, Cold Piping: Maintain 60 psig water pressure for a minimum duration of 2 hours.
- D. Accessible Lavatories:
 - 1. Faucet controls and operating mechanisms shall be installed and tested to comply per CBC Section 11B-606.4.

3.6 DISINFECTION

- A. Disinfect all domestic hot and cold water piping systems in accordance with California Plumbing Code Sections 609.9.1 through 609.9.4. The method to be followed shall be that prescribed by the Health Authority or, in case no method is prescribed by it, the following:
 - 1. The pipe system shall be flushed with clean, potable water until potable water appears at the points of outlet.
 - 2. The system or parts thereof shall be filled with a water-chlorine solution containing not less than 50 parts per million of chlorine, and the system or part thereof shall be valved-off and allowed to stand for 24 hours; or the system or part thereof shall be filled with a water-chlorine solution containing not less than 200 parts per million of chlorine and allowed to stand for 3 hours.
 - 3. Following the allowed standing time, the system shall be flushed with clean, potable water until the chlorine residual in the water coming from the system does not exceed the chlorine residual in the flushing water.
 - 4. The procedure shall be repeated where it is shown by bacteriological examination made by an approved agency that contamination persists in the system.
- B. Disinfection process shall be performed by certified testing agency or in cooperation with health department having jurisdiction and witnessed by a representative of the Architect. During procedure, signs shall be posted at each water outlet stating, "Chlorination - Do Not Drink". After disinfection, water samples shall be collected by certified testing agency or by health department for bacteriological analysis. Certificate of Bacteriological Purity shall be obtained and delivered to the Owner through the Owner's Representative.

END OF SECTION 22 00 01

SECTION 23 00 00

GENERAL MECHANICAL PROVISIONS

PART 1 GENERAL

1.1 GENERAL CONDITIONS

- A. The foregoing General and Special Conditions shall form a part of this Division with the same force and effect as though repeated herein. The provisions of this Section shall apply to all the Sections of Division 23.

1.2 CODES AND REGULATIONS

- A. All work and materials shall be in full accordance with current rules and regulations of applicable codes and all California Amendments. Nothing in these drawings or specifications is to be construed to permit work not conforming to these codes. Should the drawings or specifications call for material or methods of construction of a higher quality or standard than required by these codes, the specifications shall govern. Applicable codes and regulations are:
1. California Code of Regulations – CCR:
 - a. Title 8, Industrial Relations.
 - b. Title 24, Building Standards.
 2. California Building Code – CBC.
 3. California Mechanical Code – CMC.
 4. California Plumbing Code – CPC.
 5. California Fire Code – CFC.
 6. California Green Building Code.
 7. Air Diffusion Council – ADC.
 8. American Gas Association – AGA.
 9. Air Moving and Conditioning Association – AMCA.
 10. American National Standards Institute – ANSI.
 11. Air Conditioning and Refrigeration Institute – ARI.
 12. American Society of Heating, Refrigerating and Air Conditioning Engineers – ASHRAE.
 13. American Society of Mechanical Engineers – ASME.
 14. American Society for Testing and Materials – ASTM.
 15. American Water Works Association – AWWA.
 16. California Electrical Code – CEC.
 17. National Electrical Manufacturers Association – NEMA.
 18. National Fire Protection Association – NFPA.
 19. Sheet Metal and Air Conditioning Contractors National Association – SMACNA.
 20. Underwriters' Laboratory – UL.
 21. Occupational Safety and Health Act - OSHA.
 22. ASCE 7-16, Chapter 13.

1.3 PERMITS AND FEES

- A. The Contractor shall take out all permits and arrange for all tests in connection with his work as required by local ordinances. All charges are to be included in the work. Permits for equipment connected to a particular system are to be considered as a part of the work included under each system; for example, permits for electric motor connection are part of electrical work, permits for domestic water or gas connections are part of plumbing work. All charges for service connections, meters, etc. by utility companies or districts shall be included in the work.

1.4 COORDINATION OF WORK

- A. Layout of materials, equipment and systems is generally diagrammatic unless specifically dimensioned. The actual locations of all materials, piping, ductwork, equipment, supports, etc. shall be carefully planned, prior to installation of any work, to avoid all interferences with each other, or with structural, electrical, or architectural elements. Verify the proper voltage and phase of all equipment with the electrical plans. All conflicts shall be called to the attention of the Engineer prior to the installation of any work or the ordering of any equipment.

1.5 GUARANTEE

- A. Guarantee shall be in accordance with the General Conditions. These specifications may extend the period of the guarantee for certain items. Where such extensions are called for, or where items are normally provided with guarantee periods in excess of that called for in the General Conditions, the Certificate of Guarantee shall be furnished to the Owner through the Engineer.

1.6 EXAMINATION OF SITE

- A. The Contractor shall examine the site, compare it with plans and specifications, and shall have satisfied himself as to the conditions under which the work is to be performed. No allowance shall subsequently be made in his behalf for any extra expense to which he may be put due to failure or neglect on his part to make such an examination.

1.7 SUBMITTALS

- A. Submit shop drawings in accordance with Division 01.
- B. Shop Drawings: Within 30 days of contract award, the Contractor shall submit six copies of shop drawings for all materials, equipment, etc. proposed for use on this project. Material and equipment shall not be ordered or installed until written review is processed by the Engineer. Any item omitted from the submittal shall be provided as specified without substitution. All shop drawings must comply with the following:
 - 1. Shop drawings are required for all material and equipment items and shall include manufacturer's name and catalog numbers, dimensions, capacities, performance curves, and all other characteristics and accessories as listed in the specifications or on the drawings. Descriptive literature shall be current factory brochures and submittal sheets. Capacities shall be certified by the factory.
 - 2. All shop drawings shall be submitted at one time in a neat and orderly fashion in a suitable binder with title sheet including Project, Engineer, and Contractor; Table of Contents; and indexed tabs dividing each group of materials or item of equipment. All items shall be marked with the specification paragraph number for which they are proposed. All equipment shall also be identified by the mark number as indicated on the drawings.
 - 3. All capacities, characteristics, and accessories called for in the specifications or on the drawings shall be highlighted, circled, or underlined on the shop drawings. Calculations and other detailed data indicating how the item was selected shall be included for items that are not scheduled. Data must be complete enough to permit detailed comparison of every significant characteristic which is specified, scheduled, or detailed.

- C. Substitutions: Manufacturers and model numbers listed in the specifications or on the drawings represent the standard of quality and the features desired. Unless otherwise noted, alternate manufacturers may be submitted for review by the Engineer. Calculations and other detailed data indicating how the item was selected shall be included. The Contractor shall assume full responsibility that substituted items or procedures will meet the specifications and job requirements and shall be responsible for the cost of redesign and modifications to the work caused by these items.
- D. Review: Submittals will be reviewed for general conformance with the design concept, but this review does not guarantee quantity shown, nor does it supersede the responsibility of the Contractor to provide all materials, equipment, and installation in accordance with the drawings and specifications. The Contractor shall agree that shop drawing submittals processed by the Engineer are not Change Orders; that the purpose of shop drawing submittals by the Contractor is to demonstrate to the Engineer that the Contractor understands the design concept; that he demonstrates his understanding by indicating which equipment and material he intends to furnish and install and by detailing the fabrication and installation methods he intends to use. The Contractor shall agree that if deviations, discrepancies or conflicts between shop drawings and design drawings and specifications are discovered either prior to or after shop drawing submittals are processed by the Engineer, the design drawings and specifications shall control and shall be followed.

1.8 OPERATION AND MAINTENANCE INSTRUCTIONS

- A. Submit one electronic pdf copy for review and after approved submit three hard copies of the Operation and Maintenance Instructions and Wiring Diagrams for all equipment and parts lists for all equipment, etc. shall be submitted to the Engineer. All instructions shall be clearly identified by marking them with the same designation as the equipment item to which they apply (e.g. AC-1). All wiring diagrams shall agree with revised shop drawings and indicate the exact field installation. All instructions shall be submitted at the same time and shall be bound in a suitable binder with tabs dividing each type of equipment (e.g. Fans, Motors, etc.). Each binder shall be labeled indicating "Operating and Maintenance Instructions, Project Title, Contractor, Date" and shall have a Table of Contents listing all items included. **(These submittals shall be submitted with regular submittals at start of job so Commissioning Contractor can start on the commissioning check list for Title 24 Requirements)**
- B. Verbal: The Contractor shall verbally instruct the Owner's maintenance staff in the operation and maintenance of all equipment and systems. The controls contractor shall present that portion of the instruction that applies to the control system. The Engineer's office shall be notified 96 hours prior to this meeting.
- C. Posted: The Contractor shall prepare operation instructions for all systems which shall be typewritten, reviewed by the Engineer, and mounted under glass adjacent to the appropriate temperature control panel. These instructions shall include applicable temperature control diagrams.
- D. Acknowledgment: The Contractor shall prepare a letter indicating that all operation and maintenance instructions (printed, verbal and posted) have been given to the Owner, to the Owner's satisfaction. This letter shall be acknowledged (signed) by the Owner and submitted to the Engineer.

1.9 RECORD DRAWINGS

- A. The Contractor shall maintain a set of prints for the project as a record of all construction changes made. As the Work progresses, the Contractor shall maintain a record of all deviations in the Work from that indicated on the drawings. Final location of all underground work shall be recorded by depth from finished grade and by offset distance from permanent surface structures, i.e. buildings, curbs and walks. In addition, the water, gas, under-floor ducts, etc. within the building shall be recorded by offset distances from building walls. The original drawings will be made available to the Contractor from which he shall have a set of reproducible drawings made. The Contractor shall then transfer the changes, notations, etc. from the marked-up prints to the reproducible drawings. The record drawings (marked-up prints and reproducibles) shall be submitted to the Engineer for review (as an alternative, the marked-up prints may be photocopied full size on reproducible stock).

PART 2 PRODUCTS

2.1 SEISMIC RESTRAINTS

- A. All mechanical systems (all equipment, piping, etc.) shall be provided with seismic restraints in accordance with details on the drawings.

2.2 SYSTEM IDENTIFICATION

- A. Above Grade Piping: Provide markers on piping which is either exposed or concealed in accessible spaces. For piping systems, other than drain and vent lines, indicate the fluid conveyed or its abbreviation, either by preprinted markers or stenciled marking, and include arrows to show the direction of flow. Comply with ANSI A13.1 for colors. Locate markers at ends of lines, near major branches and other interruptions including equipment in the line, where lines pass through floor, walls or ceilings or otherwise pass into inaccessible spaces, and at 50' maximum intervals along exposed portion of lines. Marking of short branches and repetitive branches for equipment connections is not required.
- B. Equipment: All equipment shall be identified with a plastic laminated, engraved nameplate which bears the unit mark number as indicated on the drawings (e.g. AC-1). Provide 1/2" high lettering, white on black background. Nameplates shall be permanently secured to the unit.
- C. Valves: Provide valve tags on all valves of each piping system, excluding check valves, valves within equipment, shut-off valves at equipment and other repetitive terminal units. Provide brass tags or plastic laminate tags. Prepare and submit a tagged valve schedule, listing each valve by tag number, location, and piping service. Mount in glazed frame where directed.
- D. Controls: Label all panels, thermostats and by-pass timers with plastic laminated, engraved nameplate which bears the unit mark number as indicated on the drawings (e.g. AC-1). Provide 1/4" high lettering, white on black background. Nameplates shall be permanently secured to the unit.

2.3 EQUIPMENT SUPPORT FRAMES

- A. Unless specifically noted otherwise, it shall be the responsibility of Mechanical Contractor to furnish and install all support frames for its equipment.

PART 3 EXECUTION

3.1 SCHEDULING OF WORK

- A. All work shall be scheduled subject to the approval of the Engineer and Owner. No work shall interfere with the operation of the existing facilities on or adjacent to the site.

3.2 CONDUCT OF WORK

- A. The Contractor shall have at all times, as conditions permit, a sufficient force of workmen and quantity of materials to install the work contracted for as rapidly as possible consistent with good work and shall cause no delay to other Divisions engaged upon this project or to the Owner.
- B. Mechanical Contractor shall arrange for all cutting necessary for the proper installation of its work, providing all sleeves and chases necessary. Cutting shall not be done in such a manner to impair the strength of the structure. Any damage resulting from work shall be repaired by the Contractor at his expense to the satisfaction of the Engineer.
- C. Progressively, daily at the completion of each day's work, and at completion of the job, the Contractor shall thoroughly clean all of his work, removing all debris, stain and marks resulting from his work.
- D. **IAQ Management plan will be in effect for Cal Green Certification, including the sealing of duct ends before and during rough-in, specific requirements for the use of HVAC equipment during construction (if used at all), building flush-out, etc. Adhesives and mastic must comply with low VOC requirements and documentation (MSDS, etc.) shall be provided with submittals.**

3.3 EXCAVATION AND BACKFILL

- A. Excavation: Trenches are to be excavated to grade and depth established by drawings. Unless otherwise noted, minimum earth cover above top of pipe shall be 24", not including base and paving in paved areas. Width of trenches at top of pipe shall be a minimum of 16" plus the outside diameter of the pipe. Provide all shoring required by site conditions. Barrel of pipe shall have uniform support on trench bottom, hand excavate additional depth at bells, hubs, and fittings. Where over-excavation occurs, provide compacted selected backfill to pipe bottom. Where ground water is encountered, remove to keep excavation dry, using well points and pumps as required.
- B. Backfill:
 - 1. Around Pipe and to One Foot Above Pipe: Material shall be river run sand or native granular free flowing material, free of clay lumps, silt or vegetable matter and shall have 100% passing through the No. 4 sieve and a maximum of 3% passing through the No. 200 sieve. Place carefully around and on top of pipe, taking care not to disturb piping. Consolidate with vibrator.
 - 2. One Foot Above Pipe to Grade: Material to be sandy or silty loam, free of lumps, laid in 6" layers, uniformly mixed, to proper moisture and compacted to required density. If backfill is determined to be suitable and required compaction is demonstrated by laboratory test, water compaction in 6" layers may be used, subject to approval by the Engineer.
 - 3. Remove all water sensitive settlement from trench backfill regardless of location and compaction requirements.

- C. Compaction: Compact to a density of 95% within building and 90% outside building. Demonstrate proper compaction by testing at one-half of the trench depth. Perform three tests per 100' of trench.

3.4 OPENINGS, CUTTING AND PATCHING

- A. The locations and dimensions for openings through walls, floors, ceilings, foundations, footings, etc. required to accomplish the work under this Specification Division shall be provided under this Division. The actual openings and the required cutting and patching shall be provided. Coring through existing concrete or masonry walls, floors, ceilings, foundations, footings, etc., and saw cutting of concrete floors or asphaltic concrete required to accomplish the work under this Specification Division shall be provided under this Division. Patching of these surfaces shall also be provided. Cutting and coring shall not impair the strength of the structure. Any damage resulting from this work shall be repaired at the Contractor's expense to the satisfaction of the Engineer.

3.5 MANUFACTURER'S RECOMMENDATIONS

- A. All material, equipment, devices, etc., shall be installed in accordance with the recommendations of the manufacturer of a particular item. The Contractor shall be responsible for all installations contrary to the manufacturer's recommendations. The Contractor shall make all necessary changes and revisions to achieve such compliance. Manufacturer's installation instructions shall be delivered to and maintained at the job site through the construction of the project.

3.6 QUIETNESS

- A. Piping, ductwork, and equipment shall be arranged and supported so that vibration is a minimum and is not carried to the building structure or spaces.

3.7 DAMAGES BY LEAKS

- A. The Contractor shall be responsible for damages to other work caused by leaks in the temporary or permanent piping systems prior to completion of work and during the period of the guarantee, and for damages to other work caused by disconnected pipes or fittings, and the overflow of equipment prior to completion of the work.

3.8 CLEANING

- A. Progressively and at completion of the job, the Contractor shall thoroughly clean all of his work, removing all debris, stain and marks resulting from his work.

END OF SECTION 23 00 00

SECTION 23 00 01

HEATING, VENTILATING AND AIR CONDITIONING

PART 1 GENERAL

1.1 GENERAL CONDITIONS

- A. The foregoing Section 23 00 00, General Mechanical Provisions, shall form a part of this specification.

1.2 SCOPE

- A. Included: Perform all work necessary and required to complete construction as indicated. Such work includes the furnishing of all labor, materials, and services necessary for a complete, lawful, and operating air conditioning, heating, ventilating system with all equipment as shown or noted on the drawings or as specified herein. The work includes, but is not necessarily limited to, the following:
 - 1. Heating, ventilating and air conditioning equipment.
 - 2. Air distribution system (Ductwork, Air Terminals, etc.).
 - 3. Piping systems.
 - 4. System insulation.
- B. Work Specified Elsewhere:
 - 1. Line voltage power wiring (60 volts or greater), motor starters in motor control centers and disconnect switches are included in the Electrical Section.
 - 2. Connection of gas and condensate drains to equipment.
 - 3. Access doors.
 - 4. Controls, control wiring, and conduit for control wiring.

PART 2 MATERIALS

2.1 DUCTWORK MATERIALS

- A. General: All ductwork materials shall have fire and smoke hazard ratings as tested under ASTM E-84 and UL-723 not exceeding a flame spread of 25 and smoke developed of 50. All ductwork shall be per Chapter 6 of the CMC.
- B. Low Velocity Metal Ductwork: Metal ductwork shall be galvanized sheet steel, ASTM A653.
- C. Low Velocity Flexible Ductwork: Insulated flexible ductwork. Continuous internal liner bonded to galvanized steel wire helix. One pound per cubic foot glass fiber insulation, R-8. Thermal conductivity shall not exceed 0.13 Btu./ hr. sq. ft.-degrees F at a mean temperature of 75°F. Seamless vapor barrier jacket. Each length shall have a factory installed metal sleeve at each end. Duct shall be capable of continuous operation at 1.5" of water static pressure and 4000 ft./ min. air velocity. Maximum length 5 ft., single piece at runouts to air terminals. Genflex, Lamborn or equal.
- D. Spiral Duct: Ductwork shall be galvanized steel with uni-seal spiral seamlock and uni-seal fittings, ASTM A653. United McGill Corp. All exposed spiral duct shall be painted, color selected by Owner.
- E. Round Duct on Roof: Ductwork shall be double wall insulated galvanized steel with solid welded seam longitudinal seam-K27. United McGill Corp.

- F. Fiberglass Ductwork: Fiberglass continuous strands impregnated with polyester corrosion resistant resins and filament wound under exacting conditions. Duct shall effectively resist corrosive effects of most acids, alkalis, and organic solvents. Spunstrand or approved equal.
- G. Bonding Adhesive: Durodyne WBG, Scotchgrip Adhesive 4230, United McGill Uni-Tack.
- H. Duct Mastic: Minnesota Mining and Manufacturing Duct Sealer 800, Tuff-Bond No. 12, Glencoe Seal-Flex, United Duct Sealer.
- I. Fiber Tape: Mineral impregnated fiber tape and plastic activator - adhesive, Hardcast, Inc., United McGill Uni-Cast or equal.
- J. Duct Joints:
 - 1. As an option to joints and seams designated by SMACNA or shown on Drawings, the following systems may be used:
 - a. Ducts with sides 24 inches to 48 inches, transverse duct joint system by Ductmate Jr., Nexus or equal (SMACNA "E" Type connection).
 - b. Ducts 48 inches and larger, Ductmate Regular, Nexus or equal (SMACNA "J" Type connection).

2.2 AIR TERMINALS AND DUCT FITTINGS

- A. Grilles: (Grilles, Registers and Diffusers)
 - 1. Information on Drawings: Refer to the Air Distribution Schedule on the drawings for the list of grilles. Manufacturer's model numbers are listed to complete the description. Equivalent models of Anemostat, J & J, Krueger, Barber-Colman, Price, Environmental Air Products, Titus or equal. Refer to the floor plans for neck size, CFM, air diffusion pattern, and fire damper, if required.
 - 2. Performance: If, according to the certified data of the manufacturer of the proposed units, the sizes indicated on the drawings will not perform satisfactorily, the units shall be reselected by the Contractor for the proper diffusion, spread, drop, and throw.
 - 3. Frame Accessories: All supply, return, and exhaust grilles shall be provided with cushion heads and attachments to structure, unless otherwise noted. All surface mounted grilles shall have a perimeter gasket and flanged edge. All grilles shall have frames suitable for mounting in the surfaces designated by the architectural drawing, coordinate prior to ordering.
 - 4. Finish: All ceilings and wall grilles shall have a paintable white finish unless otherwise noted. Interior components shall be flat black.
 - 5. Gyms: Provide 12 Ga. wire safety cables for all overhead grilles in Gym.
- B. Turning Vanes: Double wall, hollow metal, air-foil shape. Spacing in accordance with manufacturer's recommendations. Aero Dyne, HEP, or equal.
- C. Flexible Connection: UL listed neoprene coated 30-ounce fiberglass cloth. 3" metal, 6" fabric, 3" metal. Ventglas or equal.
- D. Fire/ Smoke Damper: Multi-blade construction in accordance with CBC & CMC. UL 555 and UL 555S labels. Blades shall have metal-to-metal seals and not rely on actuator torque to maintain leakage rating. Prefco, Air Balance, Ruskin, Greenheck, or equal power open/ spring close operator or equivalent.

Must specify duct smoke detector - coordinate with electrical.

- E. Displacement Ventilation Diffusers: The perforated face diffusers shall be constructed with equalization baffles behind the operative diffuser faces for uniform, low velocity, distribution of supply air. Both the equalization baffles and faces shall be securely retained in the diffuser frames with no visible fasteners on the front or side panels. The diffuser frames shall be constructed of high strength aluminum extrusion. The operative faces shall be constructed of painted high-gauge steel. The paint shall be powder coated polyester, color selected by Architect. The diffuser shall be provided with concealed mounting brackets. Diffuser manufacturer shall provide sound and pressure drop data derived from tests in accordance with ASHRAE Standard 70-1991. Provide and install 22 gauge solid steel face duct cover with extruded aluminum frame from top of diffuser to ceiling for all exposed diffuser/ duct installations, see plans.
- F. Fire Damper: Dynamic rated fire dampers, U.L. 555 label. Prefco, Air Balance, Ruskin, Greenheck or equal.
- G. Louvers: Refer to the Air Distribution Schedule on the drawings. Manufacturer's model numbers are listed to complete the description. Equivalent models of Ruskin, Greenheck, Dayton or approved equal. Contractor shall fabricate and provide 16 GA. galvanized perforated panel (50% Free Area) over exterior of all louvers and have field painted to match exterior wall. Refer to the floor plans for all sizes.

2.3 DUCTWORK INSULATION MATERIALS

- A. General: All ductwork insulation materials shall have fire and smoke hazard ratings as tested under ASTM E-84 and UL 723 not exceeding a flame spread of 25 and smoke developed of 50.
- B. Acoustic Lining: Glass fiber. One side coated to prevent fiber erosion up to 6000 ft./ min. Average noise reduction coefficient of 0.90. 0.13 Btu/ hr. – sq. ft. – degrees F conductivity at a mean temperature of 75 degrees F, R-8. CSG Insulation Corp., Schuller, Owens-Corning, Knauf or equal. Duct dimensions shown on drawings for lined duct are clear (net) opening inside of lining.
- C. Fiber Glass Blanket: Foil faced, 0.13 Btu/ hr. – sq. ft. – degrees F conductivity at a mean temperature of 75 degrees F, R-8. CSG Insulation Corp., Schuller, Owens-Corning, Knauf or equal.
- D. Bonding Adhesive: Benjamin Foster 85-15 or equal.

2.4 PIPING MATERIALS

- A. Refrigerant Piping:
 - 1. Piping: Type L hard temper seamless copper, ASTM B88. Wrought copper fittings ANSI B16.22. 95/ 5 tin-silver brazed joints. Provide schedule 40 PVC sleeve pipe for all below grade refrigerant piping. All piping shall be sized per equipment manufacturer requirements.
 - 2. Valves and Specialties:
 - a. Line Valves: Bronze body, ball type, TFE locked in seals. Back seated valve stem. Contromatics C-11.
 - b. Filter-Drier: Replaceable core. Capacity in accordance with ARI Standard 710. Sporlan "Catch-All".
 - c. Moisture Indicator-Sight Glass: Double port. Henry, Sporlan.
 - d. Vibration Isolating Connection: Seamless flexible bronze tubing, braid covered. Suitable for system pressure. American, Flexonics.

- B. Refrigerant Piping (Ductless Split System Multi-Zone):
 - 1. Type ACR soft temper seamless copper, ASTM B280. Cast copper alloy fittings for flared copper tubes, ASME B16.26. Follow the Society of Automotive Engineers SAE J533 Standard-Flares for tubing. All piping shall be sized per equipment manufacturer requirements.
 - 2. Valves and Specialties:
 - a. Line Valves: Bronze body, ball type, TFE locked in seals. Back seated valve stem. Contromatics C-11.
 - b. Filter-Drier: Replaceable core. Capacity in accordance with ARI Standard 710. Sporlan "Catch-All".
 - c. Moisture Indicator-Sight Glass: Double port. Henry, Sporlan.
 - d. Vibration Isolating Connection: Seamless flexible bronze tubing, braid covered. Suitable for system pressure. American, Flexonics.
- C. Miscellaneous Piping Items:
 - 1. Pipe Support:
 - a. Pipe Hanger: Adjustable split ring, swivel hanger and rod. Black malleable iron. Size and maximum loads per manufacturer's recommendations. Felt lined, B-Line B3690F, Unistrut, Superstrut.
 - b. Construction Channel: 12 gage 1-5/8" x 1-5/8" steel channel. Single or multiple sections. Self-locking nuts and fittings. B-Line, Unistrut, Superstrut.
 - 2. Pipe Sleeves: 24 gage galvanized steel. Adjus-to-Crete #10 with #99 thimble for floors. #100 for walls.
 - 3. Flashing: Flashing for piping through roof shall be prefabricated 24 gage galvanized steel roof jacks with 8" square flange around pipe. Seal with weatherproofing mastic.

2.5 PIPING INSULATION MATERIALS

- A. General: All piping insulation materials shall have fire and smoke hazard ratings as tested under ASTM E-84 and UL 723 not exceeding a flame spread of 25 and smoke developed of 50.
- B. Pre-Molded Fiberglass: Heavy density sectional pre-molded fiberglass with vapor barrier laminated all-service jacket and pressure sealing vapor barrier lap. Thermal conductivity shall not exceed 0.25 Btu-in/ hr.-sq. ft-degrees F. at a mean temperature of 50°F. Perm rating 0.02, ASTM E96. Puncture rating 50 Beach units, ASTM D781. Provide 3" (min.) wide tape of same material as lap for butt joints. For chilled and hot water piping, thickness shall be 1" for pipe sizes less than 2", 1-1/2" thickness for pipe sizes 2" and larger. CSG Insulation Corp., Manville, and Owens-Corning.
- C. Fiber Glass Blanket: Unfaced. Thermal conductivity shall not exceed 0.25 Btu-in/ hr. sq. ft-degrees F. at a mean temperature of 50°F. 1-1/2" thickness. Manville, Owens-Corning.
- D. PVC Jacket (for fittings and valves): Pre-molded polyvinyl chloride (PVC) jackets. Size to match application. Provide PVC vapor barrier, pressure-sealing tape by same manufacturer. Zeston.
- E. Aluminum Jacketing: Aluminum pipe and fitting jacketing, 0.016" thickness for straight pipe, 0.024" thickness for fittings. Integral moisture barrier. Provide pre-fabricated aluminum strapping and seals by same manufacturer. Childers, Pabco.

- F. Refrigerant Piping: Rubber based elastomeric preformed pipe insulation. Thermal conductivity shall not exceed 0.25 Btu-in/ hr.-sf-°F. at mean temperature of 75°F., 3/4" thickness. Provide aluminum pipe and fitting jacketing. 0.016" thickness for straight pipe, 0.024" thickness for fittings with integral moisture barrier, pre-fabricated strapping and seals for piping exposed to weather, Childers, Pabco or equal.
1. Insulation shall be provided on both refrigerant lines for ductless split systems.

2.6 EQUIPMENT

- A. General Requirements:
1. Capacity: Capacities shall be in accordance with schedules shown on drawings. Capacities are to be considered minimum.
 2. Dimensions: Equipment must conform to space requirements and limitations as indicated on drawings and as required for operation and maintenance. Where Architectural screening is indicated, equipment shall not extend above or beyond screening. Equipment will not be accepted that does not readily conform to space conditions. Prepare and submit layout drawings for all proposed equipment (different than scheduled units) showing actual job conditions, required clearances for proper operation, maintenance, etc.
 3. Ratings:
 - a. Gas: Gas burning equipment shall be furnished with 100% safety gas shut-off, intermittent pilot ignition, and be CSA (US) certified, except that boilers shall be CSA (US) certified or UL listed.
 - b. Electrical: Electrical equipment shall be in accordance with NEMA Standards and UL or ETL listed where applicable standards have been established.
 4. Piping: Each item or assembly of items shall be furnished completely piped for connection to services. Control valves and devices shall be provided. Equipment requiring domestic water for non-potable use shall be provided with backflow preventer acceptable for intended use by local governing authorities.
 5. Electrical:
 - a. General: Each item or assembly of items shall be furnished completely wired to individual terminal blocks for connection to single branch electrical circuit. All electrical accessories and controls required by equipment shall be furnished. Provide terminal blocks for controls and interlocks not included in equipment package. Manual and magnetic starters shall have ambient compensating running overcurrent protection in all ungrounded conductors. Magnetic starters shall be manual reset, shall have H-O-A switches and auxiliary contacts. Controllers and other devices shall be in NEMA 1 or 3R enclosures as applicable.
 - b. Wiring: Conductors, conduit, and wiring shall be in accordance with Electrical Specifications. Individual items within assembly shall be separately protected with dead front, fused disconnect, fuse block, or circuit breaker for each ungrounded conductor, all accessible on operating side of equipment. Switches, contacts, and other devices shall be in ungrounded conductors.
 - c. Motors: Shall be rated, constructed, and applied in accordance with NEMA and ANSI Standards without using service factor. Single-phase motor shall be of type to suit application. Three-phase motors shall be open drip proof, NEMA B design on pumps and fans, NEMA C on reciprocating equipment, sealed ball bearing, three-phase induction unless otherwise noted. Design shall limit starting inrush current and running current to values shown on drawings. Motors 1 horsepower and larger shall be the premium efficiency type, tested according to IEEE Standard 112, Method B. Motors exposed to weather shall be TEFC. Motors in a fan air stream shall be TEFC or TEO. Vertical motors outdoors shall be ODP or TEFC and shall have rain caps.
 - d. Starters: Motor starters shall be furnished for all equipment except where starter is in a motor control center as designated on the electrical drawings. Deliver starter to Electrical Contractor for installation and wiring.

- e. Control Voltage: Equipment connected to greater than 240 volts shall be provided with 120 volt control circuit from integral protected transformer if separate source is not indicated on plans. 240 volt control is acceptable if confined within control panel.
 - f. Submittals: Included in shop drawings shall be internal wiring diagrams and manufacturer's recommend external wiring.
6. Fan Selection:
- a. Fan Curves: Performance curves shall be submitted for all units of 3000 CFM or greater. Operating point for forward curved fans shall be from point of maximum efficiency towards increased CFM limited by horsepower scheduled. Operating point for backward inclined fans shall be selected near point of maximum efficiency. Curves shall plot CFM verses static pressure with constant brake horsepower, RPM, and efficiency lines.
 - b. Static Pressure: Unless otherwise noted, pressure scheduled as external static pressure (ESP) includes all ductwork and accessory losses external to the unit housing. Unless otherwise noted, pressure scheduled as total static pressure includes all ductwork, filter, coil, cabinet, damper, and other accessory losses. Unless otherwise noted, pressure scheduled as duct static pressure includes all supply and return ductwork and accessory losses external to the unit housing and plenum (as applicable). The allowance for filter losses is 0.3" WC, unless otherwise noted. Submit itemized static pressure losses for all components.
7. Filters:
- a. General: Tested and rated in accordance with ASHRAE Standard 52.2 and Title 24, C.C.R. Furnish and install one complete change of all filters after air balance in completed and prior to acceptance. Provide pressure differential gage across all filter banks.
 - b. Filter Media: 2" media. MERV-13. Clean filter resistance 0.25" water at 500 fpm. Throw-away frame. Class 2. Camfil Farr AP or equal.
 - c. Pressure Differential Gage: Diaphragm actuated. 4" dial. Zero adjustment. Accuracy +/- 2% of full scale. Range as required. Provide static pressure sensors, tubing, and mounting brackets. Dwyer Series 2000. Mark gage to indicate filter replacement pressure, coordinate point with filter and equipment manufacturers.
8. Mixing Dampers: Opposed blade, 16-gage. Six-inch maximum blade width, 48" maximum length. Nylon or oil impregnated bronze bearings. One-half inch diameter pin shaft. 16-gage channel frame. One percent maximum leakage at 4" WC in accordance with AMCA 500 for outside air dampers. Actuating rod out of air stream. Arrow.
9. Sound Ratings: Shall be in accordance with ASHRAE 36-72. Sound ratings shall not exceed scheduled values.
10. Drives: Unless noted as direct connected, drives shall be V-belt, rated at 150% of motor horsepower. Multiple drive belts shall be matched set. Drive sheaves shall be dynamically balanced, adjustable, range +/- 10%, selected at mid-range. Adjustable relative movement shall be lockable to shaft. Belts shall be aligned within 1-1/2 degrees at all times. Open drives shall be provided with OSHA approved open mesh belt guards. Belt guards exposed to weather shall be weatherproof enclosure with louvered face for adequate ventilation. Driving motor shall be mounted on adjustable rails. T.B. Woods, Browning. Submit RPM range of driven machine with drive selection.

B. Split System Air Conditioning:

1. Condensing Unit:

- a. General: Self-contained unit designated for outdoor installation. Factory assembled and tested. Provide all starters and relays required for operation. 24 volt control circuit from integral transformer. Weatherproof cabinet, galvanized steel with enamel finish. Drain pan. ARI certified. Basis of design: Samsung, Daikin, Carrier, York, Trane, and Mitsubishi.

- b. Refrigeration: Sealed Hermetic compressor with internal vibration isolating mount. Crank case heater, high/ low pressure switch, anti-recycle timer. Air-cooled condenser with propeller fan. Non-ferrous finned coil. Low ambient control to 25°F, unless otherwise noted.
 - c. Guarantee: Provide 5 year extended warranty on the condenser coil and compressor.
 - 2. Indoor Unit: Multi-speed direct drive blower on vibration mountings, filters, capacity as scheduled on plans. Basis of design: Samsung. Daikin, Carrier, York, and Mitsubishi..
 - 3. Coil Section: Encased coil. Casing shall be galvanized steel finished with baked enamel and shall be insulated. Direct expansion evaporation coils suitable for use with upflow furnace complete with distribution piping, expansion valve, drain pan, and drain connection. Basis of design: Samsung. Daikin, Carrier, York, and Mitsubishi.
- C. Ductless Split System Air Conditioning (Multi-Zone):
- 1. Heat Pump Condensing Unit:
 - a. The outdoor unit will have up to 3 air cooled heat exchange coils constructed from copper tubing with aluminum fins. The coils will be capable of being divided into a maximum of 3 sections to enable the outdoor unit capacity to match the capacity required by the indoor units and to allow individual defrosting take place when required.
 - b. The outdoor unit will have one inverter controlled hermetic twin rotary compressor and up to two high efficiency scroll constant speed compressors depending on selected unit type. The system shall use a control sequence to ensure that indoor loads are matched to compressor capacity control.
 - c. The refrigeration process of the outdoor unit will be maintained by pressure and temperature sensors controlling solenoid valves, check valves, and bypass valves. The heating or cooling mode of the outdoor unit will be controlled using a combination of 2 & 3 way valve's which will reverse the cycle of the refrigerant to change the mode of the outdoor unit.
 - d. The variable capacity, heat pump air conditioning system shall be variable refrigerant flow split system. The system shall consist of multiple evaporators using PID control and inverter driven outdoor unit. The unit shall consist of direct expansion (DX), air-cooled heat pump air conditioning system, variable speed driven compressor multi-zone split system. The outdoor unit may connect and indoor evaporative capacity of 80-130% to that of the outdoor condensing unit capacity. Each indoor unit shall be capable of operating separately with individual temperature control.
 - e. The outdoor unit shall be interconnected to indoor unit types specified in this section. The indoor units shall be connected to the outdoor units utilizing the specialized piping joints and headers provided by the equipment manufacturer.
 - f. General: The outdoor unit is designed specifically for use with manufacturer's components:
 - 1) Refrigerant: R410A.
 - 2) The outdoor unit shall be factory assembled and pre-wired with all necessary electronic and refrigerant controls. The refrigeration circuit of the condensing unit shall consist of a compressor, motors, fans, condenser coil, electronic expansion valve, solenoid valves, 4 way valve, distribution headers, capillaries, filters, shut off valves, oil separators, service ports, liquid receivers and accumulators, refrigerant separation tube assemblies, and branch boxes.
 - 3) Both liquid and suction lines shall be individually insulated between the outdoor and indoor units.
 - 4) The outdoor unit shall be wired and piped with outdoor unit access from left, right, rear or bottom.
 - 5) The connection ratio of indoor units to outdoor unit shall be 80% to 130%.

- 6) The sound pressure dB(A) at rated conditions shall be a value of 56 decibels at 3 feet from the front of the single condensing unit. The outdoor unit shall be capable of operating at further reduced noise in 'Quiet Mode' (52-59 dB).
 - 7) The system shall automatically restart operation after a power failure and shall not cause any settings to be lost, thus eliminating the need for re-programming.
 - 8) The outdoor unit shall be modular in design and should allow for side-by-side installation with minimum spacing.
 - 9) The following safety devices shall be included on the condensing unit: High pressure switch, control circuit fuses, crankcase heaters, fusible plug, high pressure switch, overload relay, inverter overload protector, thermal protectors for compressor and fan motors, over current protection for the inverter and anti-recycling timers. To ensure the liquid refrigerant does not flash when supplying to the various fan coil units, the circuit shall be provided with a sub-cooling feature. Oil recovery cycle shall be automatic, occurring 1 hour after system start up, every 6 hours of system operation or as required to maintain oil levels at the system condensing unit.
 - 10) The outdoor unit shall operate in heating mode to -4 degrees F dry bulb ambient temperature without additional ambient controls.
- g. Unit Cabinet: The outdoor unit model shall be completely weatherproof and corrosion resistant. The outdoor unit will be constructed from steel plate and treated with acrylic paint silky shade (1Y 8.5/ 0.5)
- h. Fan:
- 1) The condensing unit shall consist of propeller type, direct-drive fan motors that have multiple speed operation via a DC inverter.
 - 2) The fans shall be a vertical or horizontal discharge configuration.
 - 3) The fan motors shall have inherent protection and permanently lubricated bearings and be mounted.
 - 4) The fan shall be provided with a fan guard to prevent contact with moving parts.
- i. Condenser Coil: The condenser coil shall be manufactured from copper tubes expanded into aluminum fins to form a mechanical bond.
- j. Compressor:
- 1) The rotary compressor shall be variable speed control capable of changing the speed to follow the variations in total cooling load as determined by the suction gas pressure as measured in the condensing unit.
 - 2) The inverter driven compressor in each condensing unit shall be of highly efficiency DC, hermetically sealed, rotary type compressor.
 - 3) The capacity control range shall be a minimum of 20% to 100% of total capacity.
 - 4) Each compressor shall be equipped with a crankcase heater, high pressure safety switch, and internal thermal overload protector.
 - 5) Oil separators shall be standard with the equipment together with an oil balancing circuit.
 - 6) The compressor shall be mounted to avoid the transmission of vibration.
- k. Electrical:
- 1) The power supply to the outdoor unit shall be 208/ 230 volts, 1 phase, 60 hertz with a voltage range of 187 volts to 253 volts.
 - 2) The system controls shall communicate overpower wiring from outdoor to indoor units, thus simplifying the wiring operation.

- 1) Each branch box may be powered from separate 15A dedicated breaker or from single 15A dedicated breaker using a daisy chain to connect to secondary branch boxes.
 - 2) Follow manufacturer requirements for all refrigerant piping minimum and maximum lengths.
2. Indoor Air Handling Units:
 - a. It shall be possible for the total connected capacity of the indoor units to be between 80% and 130% of the capacity of the outdoor unit.
 - b. Each indoor unit will have a heat exchanger which shall be constructed from copper tubing with aluminum fins. The flow of refrigerant through the heat exchanger will be controlled by an electronic proportional expansion valve. This valve will be controlled by two pipe thermistors, a return air and discharge air thermistor and shall be capable of controlling the variable capacity of the indoor unit between 25% and 100%.
 - c. Each indoor unit shall have an operating voltage of 208-230V/ 1 phase/ 60Hz. The indoor unit shall supply demand capacity information to the outdoor unit via its control algorithm.
3. 4-Way Ceiling Cassette Indoor Unit:
 - a. The indoor unit shall be a ceiling cassette fan coil unit for installation into the ceiling cavity equipped with an air panel grille to be connected to indoor unit as scheduled and specified in this section. The indoor unit shall have a four-way air distribution type, ivory white, impact resistant, and washable decoration panel. The supply air shall be distributed via motorized louvers which can be horizontally and vertically adjusted from 0 degree to 90 degree angle.
 - b. Acoustic Performance: The indoor units sound pressure shall range from 27 dB(A) to 33 dB(A) at low speed measured at 5 feet below the unit.
 - c. Construction:
 - 1) The indoor unit shall be completely factory assembled and tested. The unit shall include factory wiring, piping, electronic proportional expansion valve, control circuit board, fan motor thermal protector, flare connections, condensate drain pan, condensate drain pump, self-diagnostics, auto-restart function, 3 minute fused time delay, and test run switch.
 - 2) The 4-way supply airflow shall be field modifiable to 3-way and 2-way airflow to accommodate various installation configurations including corner installations.
 - 3) Return air shall be through the concentric panel, which shall include a filter.
 - 4) The indoor units shall be equipped with a condensate pan and condensate pump. The condensate pump shall provide up to 25" of lift.
 - 5) The indoor units shall be equipped with a return air thermistor.
 - 6) The indoor unit shall be separately powered with 208-230V/ 1-phase/ 60Hz.
 - 7) The voltage range shall be 253 volts maximum and 187 volts minimum.
 - d. Unit Cabinet:
 - 1) The cabinet shall be space saving and shall be located into the ceiling.
 - 2) The airflow of the unit shall have the ability to shut down one or two sides allowing for simpler corner installation.
 - 3) Provide fresh air intake kit where used and indicated on the drawings. A branch duct knockout shall exist for branch ducting supply air.
 - 4) The cabinet shall be constructed with sound absorbing foamed polystyrene and polyethylene insulation.
 - e. Fan:
 - 1) The fan shall be direct-drive turbo fan type with statically and dynamically balanced impeller with high and low fan speeds available.

- 2) The indoor unit shall operate with a power supply of 208/ 230 volts, 1 phase, 60 hertz. The allowable voltage range shall be 187 to 253 volts.
- 3) The airflow rate shall be adjustable and have high, medium, and low fan settings.
- 4) The fan motor shall be thermally protected.
- f. Filter: The return air shall be filtered by means of a washable long-life filter with mildew proof resin.
- g. Coil:
 - 1) Coils shall be of the direct expansion type constructed from copper tubes expanded into aluminum fins to form a mechanical bond.
 - 2) The coil shall be of a waffle louver fin and high heat exchange, rifled bore tube design to ensure highly efficient performance.
 - 3) The refrigerant connections shall be flare connections and the condensate shall be 1-1/4 inch outside diameter PVC.
 - 4) A condensate pan shall be located under the coil.
 - 5) A condensate pump with a 25 inch lift shall be located below the coil in the condensate pan with a built in high level safety alarm to shut down the unit.
 - 6) A thermistor shall be located on the liquid and gas line.
4. Wall Mount Indoor Unit:
 - a. The indoor unit shall be an exposed wall fan coil unit. The indoor unit shall have a front bottom air distribution system, ivory white, impact resistant, and washable decoration panel. The supply air shall be distributed via motorized louvers which can be horizontally and vertically adjusted from 0 degree to 90 degree angle.
 - b. Acoustic Performance: The indoor units sound pressure shall range from 27 dB(A) to 33 dB(A) at low speed measured at 5 feet below the unit.
 - c. Construction:
 - 1) The indoor unit shall be completely factory assembled and tested. The unit shall include factory wiring, piping, electronic proportional expansion valve, control circuit board, fan motor thermal protector, flare connections, condensate drain pan, condensate drain pump, self-diagnostics, auto-restart function, 3 minute fused time delay, and test run switch.
 - 2) Return air shall be through the front panel, which shall include a filter.
 - 3) The indoor units shall be equipped with a condensate pan and condensate pump. The condensate pump shall provide up to 25" of lift.
 - 4) The indoor units shall be equipped with a return air thermistor.
 - 5) The indoor unit shall be separately powered with 208-230V/ 1-phase/ 60Hz.
 - 6) The voltage range shall be 253 volts maximum and 187 volts minimum.
 - d. Unit Cabinet:
 - 1) The cabinet shall be constructed with sound absorbing foamed polystyrene and polyethylene insulation.
 - e. Fan:
 - 1) The fan shall be direct-drive turbo fan type with statically and dynamically balanced impeller with high and low fan speeds available.
 - 2) The indoor unit shall operate with a power supply of 208/ 230 volts, 1 phase, 60 hertz. The allowable voltage range shall be 187 to 253 volts.
 - 3) The airflow rate shall be adjustable and have high, medium, and low fan settings.
 - 4) The fan motor shall be thermally protected.
 - f. Filter: The return air shall be filtered by means of a washable long-life filter with mildew proof resin.
 - g. Coil:
 - 1) Coils shall be of the direct expansion type constructed from copper tubes expanded into aluminum fins to form a mechanical bond.
 - 2) The coil shall be of a waffle louver fin and high heat exchange, rifled bore tube design to ensure highly efficient performance.

- 3) The refrigerant connections shall be flare connections and the condensate shall be 1-1/4 inch outside diameter PVC.
 - 4) A condensate pan shall be located under the coil.
 - 5) A condensate pump with a 25 inch lift shall be located below the coil in the condensate pan with a built in high level safety alarm to shut down the unit.
 - 6) A thermistor shall be located on the liquid and gas line.
5. Controls:
 - a. The unit shall have controls provided with the unit by the manufacturer to perform input functions necessary to operate the system.
 - b. Computerized PID control shall be used to maintain room temperature within 1°F of setpoint.
 - c. The unit shall be equipped with a programmed drying mechanism that dehumidifies while inhibiting changes in room temperature.
 6. Controllers:
 - a. Physical Characteristics: The control system shall be a neutral color plastic material with a Liquid Crystal Display (LCD).
 - b. Electrical Characteristics:
 - 1) General: Form each circuit board to the controls, the electrical voltage shall be 16 volts DC.
 - 2) Wiring: Control wiring shall be installed in a daisy chain configuration from indoor unit to indoor unit then to the outdoor unit. Control wiring shall run from the indoor unit terminal block to the specific controller for that unit.
 - 3) Wiring Size: The wire shall be a shielded, size AWG18-2.
 7. Individual Zone Controller – Wired Remote Controller:
 - a. The wired remote controller shall be able to control 1 group (maximum of 8 fan coil units) and shall be able to function as follows:
 - 1) The controller shall have a self-diagnosis function that constantly monitors the system for malfunctions.
 - 2) The controller shall be able to immediately display fault location and condition.
 - 3) An LCD digital display shall allow the temperature to be set in 2°F units.
 - 4) The controller shall be equipped with a thermostat sensor in the remote controller making possible more comfortable room temperature control.
 - b. The wired remote controller shall have the following features:
 - 1) Operation: Start/ Stop, Operation Mode, Temperature Setting 60F-90F, Set Point Range, Fan Speed, Airflow Direction.
 - 2) Monitoring: Status, malfunction flashing, malfunction content, filter sign, operation mode, temperature setting, permit/ prohibit selection, fan speed, airflow direction.
 - 3) Scheduling: ON/ OFF Timer.
 - 4) Control Management: Field Setting Mode, Group Setting, Auto Re-Start.
 8. System Remote Controller:
 - a. The controller shall control up to 8 units and shall be able to be used in conjunction with all room controller types. Collective and individual group commands are available with permit/ prohibit individual remote controller function. The system controller shall use the following connections for power and remote monitoring:
 - 1) Power supply (60Hz, 208-230 VAC).
 - 2) Inter-unit control wiring (Low voltage).
 - 3) Auxiliary.
 - 4) Ground for inter-unit control wiring.
 - 5) Input for turning on air conditioners concurrently.
 - 6) Input for turning OFF air conditioners concurrently.
 - 7) Common input for turning air conditioners ON or OFF.
 - 8) On operation state indicator output.
 - 9) Alarm indicator output.
 - 10) Common indicator output.

9. Acceptable manufacturers are Fujitsu, Daikin, Mitsubishi or equal.
 10. Warranty:
 - a. The units shall be covered by the manufacturer's limited warranty for a period of five (5) years from date of installation.
 - b. The unit's compressor shall be covered by the manufacturer's limited warranty for a period of seven (7) years from date of installation.
- D. Heat Pump, Split System:
1. Outdoor Unit:
 - a. General: Self-contained unit designed for outdoor installation. Factory assembled and tested. Provide all starters and relays required for operation. 24 volt control circuit from integral transformer. Weatherproof cabinet, galvanized steel with enamel finish. Drain pan. ARI certified. BDP, Carrier, Trane, York, and Lennox.
 - b. Refrigeration: Sealed Hermetic compressor with internal vibration isolating mount. Reversing valve, hard start components crankcase heater, high/ low pressure switch, anti-recycle timer. Air-cooled condenser with propeller fan. Non-ferrous finned coil. Low ambient control to 25 degrees, unless otherwise noted. Provide base mounting rails.
 - c. Guarantee: provide 5 year extended warranty on the condenser coil and compressor.
 2. Fan Coil:
 - a. General: Multi-speed direct drive blower on vibration mountings, filters, capacity as scheduled on plans. Casing shall be galvanized steel finished with baked enamel and shall be insulated. Direct expansion evaporation coils complete with distribution piping, expansion valve, drain pan, and drain connection. Supplemental electric heater. Carrier, Trane, York, Lennox.
 - b. Thermostat: Thermostats shall comply with Title 24 Energy Conservation Standards. Thermostat shall provide automatic changeover from heating to cooling with continuous fan operation. Provide 2 stage heating and "OFF-HEAT-AUTO-COOL" and "AUTO-ON" switches.
- E. Exhaust Fans:
1. General: All exhaust fans shall be tested and rated in accordance with AMCA Standard 210. Fans exposed to the weather shall have ventilated weatherproof housing over motor and drive assembly.
 2. Ceiling Fan: Ceiling mounted direct drive centrifugal exhaust fan with exhaust grille. Motor mounted in rubber-in-shear isolators. Motor and fan removable through grille. Acoustically lined housing. Backdraft damper. UL listed. Penn, Cook, ACME, Greenheck or equal.
 3. Kitchen Hood Fan: Multivane centrifugal fan. Ball bearings. Vibration isolation mount. All aluminum construction with steel or aluminum wheel, and aluminum curb base. Weatherproof disconnect switch. Upblast type UL listed for removal of smoke and grease laden vapors (YZHW, 762), for kitchen hood service. Cook, Greenheck, Penn, ACME or equal.
 4. Residential Ceiling Fan: Ceiling mounted direct drive whisper quiet fan with DC motor that is variable speed and operates at a constant flow with varying static pressures. Energy Star rated and certified by the Home Ventilating Institute (HVI). Sound rating shall not exceed 1.0 sone as required by Title-24. Galvanized steel body, 4" diameter duct connection, built-in backdraft damper, expandable mounting bracket up to 24" and polypropylene ceiling grille with torsion springs. All controls shall be as scheduled on drawings. Factory warranty shall be 6 years limited on motor and 3 years limited on other parts. Panasonic, Air King, Broan or equal.

5. Smoke Control Fan: Heavy gauge aluminum propeller fan. Duplex split pillow block ball bearings. All galvanized steel construction with a die formed flange, aluminum butterfly dampers, water trough for rain drainage, and curb base. Weatherproof disconnect switch. Fan shall be rated for 500°F air at 4 hours continuous. Upblast type UL listed for removal of smoke vapors. Greenheck or approved equal.
6. Fume Hood Fan: Multi-vane centrifugal fan. Ball bearings. Vibration isolation mount. All aluminum construction with steel or aluminum wheel, and aluminum curb base with built-in stack. Weatherproof disconnect switch. CFD and by-pass damper included. Upblast type UL listed for removal of chemical vapors, for fume hood service. Greenheck or approved equal.
7. Roof Fan: Multivane centrifugal fan. Ball bearings. Vibration isolation mount. All aluminum curb base. Weatherproof disconnect switch. Down blast type UL listed. Cook, Greenheck, Penn, ACME or equal.
8. In-Line Fan: Attic mounted direct drive centrifugal exhaust fan. Motor shall be open drip proof with permanently lubricated sealed bearings and built-in thermal overload protection and disconnect plug. Acoustic lined housing. Backdraft damper. Provide 24"x24" access panel with cylinder key lock when above hard ceiling. UL listed. Penn, Cook, ACME, Greenheck or equal.

PART 3 EXECUTION

3.1 DUCTWORK INSTALLATION:

- A. General:
 1. Standards: Unless otherwise noted, all ductwork shall be constructed and installed in accordance with current SMACNA "HVAC Duct Construction Standards." Ductwork and accessories shall be installed in a manner to prevent vibration and rattling.
 2. Seismic Bracing: All ducts shall be braced and supported per details on the drawings.
 3. Duct Access Doors: Provide access doors as required to adjust equipment and dampers.
 4. Flexible Connections: Connections of ductwork to all equipment shall be with 6" (min.) flexible connection. Install with ample slack and uniform gap after deflection of vibration isolators. There shall be no metal to metal contact across flexible connection. Protect outdoor connections with weatherproof metal shroud on top and sides, no metal-to-metal contact. Provide at all seismic joints.
 5. Open ends of ductwork shall be covered during construction to keep inside clean.
- B. Low Velocity-Low Pressure (up to 2000 ft./ min.; up to 2.0 in. water):
 1. Sheet Metal Ductwork:
 - a. Ells: Ells with less than standard radius and square ells shall be fitted with turning vanes.
 - b. Tees: Tees shall be straight tap-in with extractor or 45 degree takeoff, as shown on drawings.
 - c. Duct Joints: Seal duct joints airtight with fibre tape and adhesive per manufacturer's printed instructions. Ducts in weather shall be sealed air and watertight with duct mastic before closing and taping.
 - 1) Where Ductmate type of joints are used the manufacturer's, designated procedure shall be followed. Ductmate joints on roof shall have continuous cleat on top duct flange to prevent water from collecting on gasket.
 - d. Dampers: Install volume control damper and damper regulator in all branch ducts whether specifically shown on drawings or not.
 - e. Duct dimensions shown on drawings for lined ducts are clear net openings inside of lining.

- f. Top of ducts exposed to weather shall be cross broken and sloped slightly to each side to allow rainwater to run off. Ducts that do not drain off top will be rejected and need to be replaced at contractors' expense.
2. Flexible Glass Fiber Ductwork: Hangers shall be 2" wide metal straps spaced to prevent sagging, 3 feet spacing maximum. Insert 6" wide fiberglass pad between duct and hanging strap. All joints and fittings shall be sheet metal and shall be installed with metal bands or 3 (min.) self-tapping screws and fiber tape. Maximum length of flexible duct shall be 5 ft., single piece minimum length shall be 3 ft. Minimum turn radius shall be in accordance with SMACNA Standards (turn radius to duct centerline not less than 1.5 times the duct diameter).
3. Fiberglass Ductwork: Install per manufacturer's instructions.

3.2 AIR TERMINALS AND DUCT FITTINGS INSTALLATION

- A. General: Unless otherwise noted, all air terminals and duct fittings shall be installed in accordance with current SMACNA "HVAC Duct Construction Standards", details on drawings and manufacturer's instructions. Terminals and fittings shall be installed in a manner to prevent vibration and rattling.
- B. Fire Damper: Fire dampers shall be installed in accordance with their State Fire Marshal approval and the manufacturer's recommendations.
- C. Gym: Attach safety cable to inside of duct and to grille neck with #10 sheet metal screws.

3.3 DUCTWORK INSULATION INSTALLATION

- A. General: All supply and return sheet metal ductwork shall be insulated.
- B. Concealed Ductwork: Wrap ductwork with fiberglass blanket lapped 2" minimum. Secure with foil tape at all joints for a complete vapor barrier.
- C. Acoustic Lining: All ductwork in equipment rooms, where exposed to weather, and elsewhere as indicated on drawings, shall have acoustic lining (except downstream of final filters). Increase each sheet metal dimension to accommodate lining and maintain clear inside duct dimensions shown on drawings. Apply lining with bonding adhesive in accordance with manufacturer's recommendations and also secure with mechanical fasteners in accordance with SMACNA Standards. Seal exposed edges of lining with bonding adhesive.

3.4 PIPING INSTALLATION

- A. General:
 1. Piping Layout: Piping shall be concealed in walls, above the ceilings, or below grade unless otherwise noted. Exposed piping shall run parallel to room surfaces; location to be approved by Architect. No structural member shall be cut, notched, bored or otherwise, unless specifically allowed by structural drawings and/ or specifications. Where such cutting is required, reinforcement shall be provided as specified or detailed. All piping shall be installed in a manner to ensure unrestricted flow, eliminate air pockets, prevent any unusual noise, and permit complete drainage of the system. All piping shall be installed to permit expansion and contraction without strain on piping or equipment. Expansion joints and/ or flexible connectors shall be installed as required. Vertical lines shall be installed to allow for building settlement without damage to piping. Lines shall be adequately braced against vertical and lateral movement.

2. Seismic bracing: All piping shall be braced and supported per SMACNA "Guidelines for Seismic Restraints of Mechanical Systems and Plumbing Piping Systems" and OSHPD pre-approval no. 0010.
3. Joints:
 - a. Threaded: Pipe shall be cut square and reamed to full size. Threads shall be full cut, true, and tapered. Joint compound or tape suitable for conveyed fluid shall be applied to male thread only.
 - b. Open Ends: Open ends of piping shall be capped during progress of work to preclude foreign matter.
 - c. Electrical Equipment: Joints shall be avoided, where possible, over electrical equipment.
4. Fittings:
 - a. Standard Fittings: All joints and changes in direction shall be made with standard fittings. Close nipples shall not be used.
 - b. Reducers: Pipe size reduction shall be made with bell reducer fittings. Bushings shall not be used.
 - c. Unions: A union shall be installed on one side of each valve, at two sides of automatic valves, at equipment connections, and elsewhere as necessary for assembly or disassembly of piping.
 - d. Valves: All valves shall be full line size. At equipment connections, valves shall be full size of upstream piping.
 - e. Flow Switch: The flow switch shall be located in a horizontal section of pipe where there is a straight horizontal run of at least 5 pipe diameters on each side of switch. The flow switch must be installed in the upright position.
5. Pipe Support:
 - a. General: Hangers shall be placed to support piping without strain on joints or fittings. Maximum spacing between supports shall be as specified below. Actual spacing requirements will depend on structural system. Refer to drawings for additional requirements and attachment to structure. Vertical piping shall be supported at floor and ceiling. Support pipe within 12" of all changes in direction. No perforated straphanger shall be used in any work.

Pipe Size (in).	Max. Spacing Between Supports*
1/2 to 1-1/2	6
2 to 2-1/2	10
3 & 4	12
6 - 12	14

*Based on straight lengths of pipe with couplings only. Provide additional supports for equipment, valves, or other fittings.

 - b. Non-insulated Piping: Support individual pipes with pipe hanger and isolation shield.
 - c. Trapeze: Trapeze hangers of construction channel and pipe clamps may be used. Submit design to Architect for approval.
6. Miscellaneous:
 - a. Escutcheons: Provide chromium-plated escutcheons where piping penetrates walls, ceilings, or floors in finished areas.
 - b. Dielectric Coupling: Dielectric coupling shall be installed wherever piping of dissimilar metals are joined.

- B. Refrigerant Piping: Pipe shall be cut square. Joint surfaces shall be thoroughly cleaned, fitted, and erected before brazing. Install specified accessories. After installation, evacuate to 29 inches of mercury (ambient temperature during evacuation shall not be less than 70°F). After evacuation, fill with dry nitrogen to 250 psi and maintain for two-hour period without additional charge. After nitrogen test, purge with refrigerant charged through dryer and maintain holding charge in system and equipment.

3.5 PIPING INSULATION INSTALLATION

- A. Chilled and Hot Water Supply and Return:
1. General: All chilled and hot water supply and return piping and hot water equipment shall be insulated. Do not insulate unions or valves less than 2".
 2. Pipe: Apply pre-molded fiberglass sections to pipe using integral pressure sealing lap adhesive in accordance with manufacturer's recommendations. Stagger longitudinal joints. Seal butt joints with factory supplied pressure-sealing tape.
 3. Fittings and Valves:
 - a. Wrap fittings with pre-cut fiberglass blanket to thickness matching adjoining insulation. Cover blanket with PVC jacket in accordance with manufacturer's recommendations. Seal all joints with factory supplied pressure sealing vapor barrier tape with a 1-1/2" (min.) overlap on both sides of joint. For outdoor piping, apply 1/8" tack-coat of Childers CP-10 mastic weather-proofing to clean, dry insulation. While still tacky, add a spiral wrap of 4" wide 10-20 fiberglass mesh, overlapped 50%. When dry, add final coat of mastic weatherproofing.
 - b. For miscellaneous fittings for which PVC jackets are not available or where proximity of fittings precludes a neat-appearing installation, the contractor may cover the fiber glass blanket with stretchable glass fabric and at least two coats of vapor barrier coating.
 4. Vapor Barrier Continuity: All exposed ends of insulation and all gaps or voids in vapor barrier shall be sealed with stretchable glass fabric and at least two coats of vapor barrier coating. Build up all horizontal areas to prevent water accumulation.
 5. Pipe Supports: Seal all joints at pipe supports with vapor barrier tape.
 6. Piping Exposed to Weather:
 - a. All piping and fittings exposed to weather shall have, in addition to the above described insulation, an aluminum jacketing installed in accordance with manufacturer's recommendations. Secure in place with factory supplied straps. Install all joints to minimize water entry. All joints shall be sealed with outdoor silicone sealant.
 - b. For miscellaneous fittings for which aluminum jackets are not available or where proximity of fittings precludes a neat-appearing installation, the contractor may cover the insulation with stretchable glass fabric and at least two coats of outdoor mastic.
- B. Refrigerant Piping: Cover suction piping with foamed plastic insulation. Longitudinal and end seams shall be thoroughly cemented with adhesive in accordance with manufacturer's recommendations. Cover all fittings, unions, valves, and connections. **Piping exposed to weather shall be covered with aluminum jacket protective finish.**

3.6 EQUIPMENT INSTALLATION

- A. General: It shall be the responsibility of the contractor to ensure that no work done under other specification sections shall in any way block, or otherwise hinder access panels or diminish the effectiveness of equipment vibration isolation.
- B. Connections to Equipment: Where size reductions are required for connections to equipment, they shall be made immediately adjacent to the equipment and, if possible, inside the equipment cabinet. Connections made to equipment mounted on vibration isolators shall be with flexible connectors, installed adjacent to equipment.
- C. Start Up: Engage manufacturer or factory-authorized service representative to perform start up supervision. Manufacturer shall provide on-site start up and commissioning assistance through job completion. Complete installation and start up checks according to manufacturer's written instructions.

- D. Pumps: Install pumps with a minimum of 8 diameters of straight pipe at the pump suction or provide suction diffuser.
- E. Boiler: Installation shall be in accordance with California Administrative Code, Title 8, Industrial Relations. Permit for system operation shall be obtained and permanently posted at installation. Make no connections to any piping, which connects to safety control components.

3.7 TEMPERATURE CONTROL SYSTEM

- A. Thermostats shall have the capability of terminating all heating at a temperature of no more than 70 degrees F or terminating all cooling at a temperature of no less than 78 degrees F, and to provide a temperature range of up to 10 degrees F between full heating and full cooling. Thermostats shall be 7 day programmable, Carrier, Robertshaw or equal with sub-base capable of battery backup or capacitor to retain program in the event of a power outage. All control wiring, regardless of voltage, shall be installed in conduit.

3.8 TESTS AND ADJUSTMENTS

- A. General: Unless otherwise directed, tests shall be witnessed by a representative of the Architect. Work to be concealed shall not be enclosed until prescribed tests are made. Should any work be enclosed before such tests, the Contractor shall, at his expense, uncover, test, and repair his work and that of other contractors to original conditions. Leaks and defects shown by tests shall be repaired and entire work retested.
- B. Piping Tests:
 - 1. General: Tests may be made in sections, however, all connections between sections previously tested and new section must be included in the new test. There shall be not drop in pressure during test except that due to ambient temperature changes. All components of system not rated for test pressure shall be isolated from system before test is made.
 - 2. Water Piping: Maintain 100 psig water pressure for a duration of 4 hours.
 - 3. Refrigerant Piping: Refer to paragraph 3.4C.
 - 4. Steam Piping: With all existing header discharge valves closed, and steam return valves to boiler closed, maintain 125 psi hydrostatic pressure for duration of two hours. There shall be no drop in pressure except that due to ambient temperature changes.

3.9 SYSTEM ENERGY BALANCE

- A. Scope: Provide the services of a qualified independent test and balance agency certified by the Associated Air Balance Council (AABC) or The National Environmental Balancing Bureau (NEBB) to test, adjust and balance, retest, and record performance of the system to obtain design quantities as specified. Balancing contractor must also be TABB certified and have a C-20 license.
- B. Qualifications: Prior to commencing work, the agency shall be approved by the Owner's Representative.
- C. Instruments: All instruments shall be accurately calibrated; calibration histories shall be available for examination. Application of instrumentation shall be in accordance with AABC standards.

- D. Procedure: General: Balanced quantities shall be plus 5%, minus 5% of design quantities. All name-plate data, manufacturer, model, and serial numbers shall be recorded for each item tested. All outside air flow listed in minimum.
- E. Extended Warranty: The test and balance agency shall include an extended warranty of 90 days after completion of test and balance work, during which time the Owner's Representative at his discretion may request a recheck or resetting of any item or items in test report. The agency shall provide technicians to assist the Owner's Representative in making any tests he may require during this period of time.
- F. Air Balance Procedure (For Each Air Handling System):
1. All air filters shall be clean when air balance is performed.
 2. Provide a sketch of the equipment showing exactly where all pressure readings were taken.
 3. Adjust blower RPM to design requirements.
 4. Record motor full load amperes.
 5. Make pitot tube traverse of main supply and return ducts and obtain design CFM at fans.
 6. Record system static pressures, inlet, and discharge.
 7. Record filter quantity, size(s) and pressure drop across filter(s) at each filter bank.
 8. Adjust system for design CFM recirculated air.
 9. Adjust system for design CFM outside air minimum settings.
 10. Record entering air temperatures. (DB heating, DB and WB cooling.)
 11. Record leaving air temperatures. (DB heating, DB and WB cooling.)
 12. Adjust all main supply and return air ducts to design CFM.
 13. Adjust all zones to design CFM, supply, and return.
 14. Adjust all diffusers, grilles, and registers to plus 10%, minus 0% of design requirements.
 15. Adjust CFM at all exhaust fans, make-up units, etc. (high and low speed, where applicable). Record applicable data from items 1 through 11 above.
 16. Each grille, diffuser and register shall be identified as to location.
 17. Verify proper diffusion pattern for all ceiling grilles and that all sidewall grilles are set for 5 degrees downward deflection unless otherwise noted. Make a notation of any that are not set properly.
 18. Size, type and manufacturer of diffusers, grilles, registers, and all tested items shall be identified and listed. Manufacturer's ratings shall be used to make required calculations on all items.
 19. Readings and tests of diffusers, grilles, and registers shall include required FPM velocity and test resultant velocity, required CFM and test resultant CFM after adjustments.
 20. In cooperation with the control manufacturer's representative, set adjustments of automatically operated dampers to operate as specified. Testing agency shall check all controls for proper calibrations and list all controls requiring adjustment by control installers.
 21. All diffusers, grilles and registers shall be adjusted for required air patterns and to minimize drafts.
 22. As a part of the work of this contract, THE AIR CONDITIONING CONTRACTOR shall make any changes in pulleys, belts, dampers, or the addition of dampers cleaning of insect screens and replacement of filters required for correct balance as recommended by air balance agency, at no additional cost to Owner.
 23. Set, test, and adjust packaged heating/ cooling unit economizer operation in cooperation with controls contractor. Record minimum and maximum outside and exhaust airflows.

- G. Acoustic Performance Testing: Provide acoustic performance testing in accordance with the requirements of EQ3.0 of the "California Criteria for High Performance Schools, Best Practices Manual, 2009 Edition".
1. Maximum Background Noise Level: Unoccupied classrooms must have a maximum background noise level of no more than 45 dBA LAeq. The standard anticipates two primary noise sources, steady HVAC equipment noise and the usually unsteady exterior environmental noise. Where the measured ambient noises due to sources other than HVAC are within 5 dB of the measured overall noise (HVAC and exterior intrusive noise) a measurement of at least 1/2 hour duration shall be made in at least two classrooms in each building in the worst case (noisiest) locations on the school site during normal school days and hours.
 - a. To evaluate the significance of intrusive exterior noise, a 30-minute Equivalent Sound Level (LAeq30, in general conformance with ANSI S12.60-2002, Annex E3) measurement shall be made in the classroom that is subjectively assessed to represent the worst case exposure to exterior noise, with the HVAC system not in operation. This Leq30 measurement shall be repeated with the HVAC in operation. If the second "HVAC-on" sound level is more than 5 dB greater than the initial "HVAC-off" measurement, exterior noise intrusion shall be deemed "not significant".
 - b. Where intrusive exterior noise has been deemed "not significant" short-term (15 second) A-weighted sound level measurements shall be made in each classroom with the HVAC systems in operation. Where exterior intrusive noise has been deemed "significant" (per the evaluation method noted above), LAeq30 sound level measurements shall be made in each classroom with the HVAC system in operation. In either case, where classrooms are served by variable-air-volume systems, the systems shall be operated at maximum nominal flow (typically by means of varying the thermostat set point).
 - c. Where exposure to exterior noise varies significantly between groups of classrooms (e.g. one side of a classroom wing adjacent to a street, the other side facing away), separate evaluations of exterior noise significance can be conducted to limit the need for LAeq30 measurements.

END OF SECTION 23 00 01

SECTION 26 05 00

COMMON WORK RESULTS FOR ELECTRICAL

CONDITIONS OF THE CONTRACT AND DIVISION 01, as applicable, apply to this Section.

PART 1 GENERAL

1.1 SUMMARY

- A. Provide all work for electrical systems required in the project to be properly installed, tested, and performing their intended function.

1.2 QUALITY ASSURANCE

- A. Perform all work in accordance with the latest edition of the California Electrical Code.
- B. All electrical materials and distribution, and utilization equipment shall be UL Listed.
- C. All equipment and materials shall be new and unused and of United States Domestic manufacture unless approved otherwise by engineer or owner.
- D. Eliminate any abnormal sources of noise that are considered by the architect not to be an inherent part of the electrical systems as designed.

1.3 COORDINATION WITH OTHER TRADES

- A. Coordinate the work of this division with all other divisions to ensure that all components of the electrical system will be installed at the proper time and fit the available space.
- B. Locate and size all openings in work of other trades required for the proper installation of the electrical system components.
- C. Make all electrical connections to all equipment furnished by this division and any other division.
- D. Make all electrical connections from all 120 volt and greater dampers and switches to associated exhaust fan(s) furnished by any other division.

1.4 DRAWINGS

- A. The drawings are schematic in nature but show the various components of the systems approximately to scale and attempt to indicate how they are to be integrated with other parts of the building. Determine exact locations by review of equipment manufacturer's data, by job site measurements, by checking the requirements of other trades, and by reviewing all Contract Documents. The size of the electrical equipment indicated on the Drawings may be based on the dimensions of a particular manufacturer. While other listed manufacturers will be acceptable, it is the responsibility of the Contractor to determine if the equipment that Contractor proposes to furnish will fit in the space. The drawings are not intended to show exact locations of conduit and wire, or to indicate all wire terminators, connectors, conduit fittings, boxes or supports, but rather to indicate distribution, circuitry, and control.

- B. The Electrical Drawings are necessarily diagrammatic in character and cannot show every connection in detail or conduit in its exact location. These details are subject to the requirements of ordinances and also structural and architectural conditions. The Contractor shall carefully investigate structural and finish conditions and shall coordinate the separate trades in order to avoid interference between the various phases of work. Work shall be laid out so that it will be concealed in furred chases and suspended ceilings, etc., in finished portions of the building, unless specifically noted to be exposed. Work shall be installed to avoid crippling of structural members. All exposed work shall be installed parallel or perpendicular to the lines of the building unless otherwise noted.
- C. When the mechanical and electrical Drawings do not give exact details as to the elevation of pipe, conduit, and ducts, physically arrange the systems to fit in the space available at the elevations intended with the proper grades for the functioning of the system involved. Exposed conduit is generally intended to be installed true and square to the building construction and located as high as possible against the structure in a neat and workmanlike manner. The Drawings do not show all required offsets and their location details. Work shall be concealed in all finished areas.

1.5 SUBMITTALS

- A. Specification Review:
 - 1. Include a paragraph-by-paragraph written specification review for each product listed requiring a submittal. Denote any proposed deviations from specifications.

1.6 EXISTING CONDITIONS

- A. Do all work required to maintain electrical services to the Owner occupied portions of the building during construction.
- B. No connection to existing services or utilities shall be made without Owner's knowledge and permission. All such connections shall be planned and scheduled to minimize the length of service interruption required. Request for shutdown shall be made to Owner at least two (2) weeks in advance and shall be accompanied by detailed written schedule of activities during shutdown and list of materials required for connection and renewal of service. It shall be understood that all such service interruptions shall be made at the Owner's convenience, not the Contractor's. No increase in contract amount will be allowed for reasons of premium time, inefficiency of operations or other considerations not calculated in original bid.
- C. All items removed shall be stored on-site. Schedule a review of the items with the Owner. Remove from site all items the Owner does not choose to keep. Deliver Owner designated items to Owner's storage facility.

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Accept materials on site in original factory packaging, labeled with manufacturer's identification.
- B. Protect from weather and construction traffic, dirt, water, chemical, and mechanical damage, by storing in original packaging.
- C. Do not deliver items to project before time of installation. Limit shipment of bulk and multiple-use materials to quantities needed for immediate installation.

PART 2 EXECUTION

2.1 EXISTING WORK

- A. Disconnect electrical systems in walls, floors, and ceilings scheduled for removal.
- B. Provide temporary wiring and connections to maintain existing systems in service during construction.
- C. When performing work on energized equipment or circuits, use personnel experienced and trained in similar operations.
- D. Remove, relocate, and extend existing installations to accommodate new construction.
- E. Repair adjacent construction and finishes damaged during demolition and extension work.

2.2 OWNER INSTRUCTION

- A. Provide on-site Owner training for all new equipment.
- B. Use Operation and Maintenance manuals and actual equipment installed as basis for instruction.
- C. At conclusion of on-site training program have Owner personnel sign written certification they have completed training and understand equipment operation. Include copy of training certificates in final Operation and Maintenance manual submission.
- D. Supply record drawings to the district in PDF and the latest version of AutoCAD.

END OF SECTION 26 05 00

SECTION 26 05 19

LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES

PART 1 GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section includes:
 - 1. Wires and cables rated for 600 volts or less.
 - 2. Connectors, splices, and terminations rated for 600 volts or less.
 - 3. Lugs and pads rated for 600 volts or less.
- B. System Description:
 - 1. Provide wires, cables, connectors, lugs, strain reliefs, racking insulators for a complete and operational electrical system.
- C. Reference Standards:
 - 1. California Electrical Code (CEC). California Code of Regulations, Title 24, Part 3.
 - 2. National Electrical Manufacturers Association (NEMA):
 - a. WC 70 Power Cables Rated 2,000 V or Less for the Distribution of Electrical Energy.
 - 3. National Electrical Testing Association (NETA):
 - a. ATS Acceptance Testing Specifications for Electrical Power Distribution Equipment and Systems.
 - 4. Underwriters Laboratories, Inc. (UL):
 - a. 83 UL Standard for Safety Thermoplastic-Insulated Wires and Cables.
 - b. 486 Standard for Wire Connectors.
 - 5. American Society for Testing and Materials (ASTM):
 - a. B1 Standard Specification for Hard-Drawn Copper Wire.
 - b. B3 Standard Specification for Soft or Annealed Copper Wire.
 - c. B8 Standard Specification for Concentric-Lay-Stranded Copper Conductors, Hard, Medium-Hard, or Soft.

1.3 SUBMITTALS

- A. Provide product data for the following equipment:
 - 1. Wires.
 - 2. Cables.
 - 3. Connectors.
 - 4. Lugs.
 - 5. Splice Kits.
- B. Provide the insulation cable testing report in the project closeout documentation, refer to Closeout Requirements in the General Conditions portion of this specification.

1.4 QUALITY ASSURANCE

- A. Regulatory Requirements:
 - 1. Confirm to requirements of the CEC, latest adopted version.
 - 2. Furnish products listed by UL or other testing firm acceptable to AHJ.

PART 2 PRODUCTS

2.1 MANUFACTURERS

- A. Wires and Cables:
 - 1. Southwire Company
 - 2. Encore Wire Corporation
 - 3. Cerro Wire and Cable Co.
 - 4. General Cable Corp.; a brand of Prysmian Group
 - 5. Okonite Co.
 - 6. Alan Wire
 - 7. LS Cable and System USA
 - 8. American Wire and Cable
- B. Connectors:
 - 1. FCI Burndy Corp.
 - 2. Cooper Crouse Hinds.
 - 3. O.Z./ Gedney Co.
 - 4. Thomas & Betts Co.
 - 5. 3-M Co.
 - 6. Ideal Industries Co.
 - 7. Polaris Electrical Connectors
 - 8. ILSCO
- C. Wire connectors shall be minimum 75 degree centigrade rated and properly sized for the number of conductors being connected, terminated, spliced etc. All above grade connectors shall be solderless lug or plastic wire nut type, screw on, pressure cable type (wire nut or spring nut type), 600 Volt, 105-degree C, with skirt to cover all portions of stripped wires. Connector shall be U.L. rated for number and size of conductors being joined together as a splice.
- D. Splices:
 - 1. Branch Circuit Splices: Ideal, Scotch-Lock, 3M, or approved.
 - 2. Feeder Splices: Compression barrel splice with two layers Scotch 23 and four layers of Scotch 33+ as vapor barrier.
 - 3. Screw Terminal Lugs.
 - 4. Kearney Split Bolt.

2.2 WIRES AND CABLES FOR LINE VOLTAGE SYSTEM AND CONTROLS.

- A. Wire and Cable Shall Be:
 - 1. Copper, 600 volt rated throughout. Conductors 12AWG to 10AWG, solid or stranded. Conductors 8AWG and larger, stranded.
 - 2. Phase color to be consistent at all feeder terminations; A-B-C, top to bottom, left to right, front to back. Phasing tape shall be permitted on sizes #6 and larger.

- B. Each phase wire shall be uniquely color-coded as indicated below:
1. 120/ 240 Volts
Phase A – Black
Phase B – Red
Neutral – White
Ground – Green
 2. 120/ 208 Volts
Phase A – Black
Phase B – Red
Phase C – Blue
Neutral – White
Ground – Green
 3. 277/ 480 Volts
Phase A – Brown
Phase B – Orange
Phase C – Yellow
Neutral – White or Natural Gray
Ground – Green
 4. Isolated Grounds: Green with Yellow Stripes
- C. All conductors shall be copper unless otherwise noted. Minimum size for individual conductors shall be #12 AWG unless otherwise noted. Sizes #8 AWG and larger shall be stranded conductor. Individual conductors shall be insulated with type, XHHW, THW, THHN/ THWN 600- volt insulation unless otherwise noted. Control, signal, communication conductors shall be as dictated by the vendor of that equipment or as specified here-in. Proper insulation type shall be used for the proper environmental application (i.e., waterproof, wet location, plenum, temperature rated). If a condition exists where the application is uncertain, contact the Engineer for direction. Contractor is responsible to follow specific cabling requirements described in other sections of this specification relative to various communications and controls systems as well as the respective riser diagrams shown on plans. If a discrepancy occurs, communicate such discrepancy to the Architect and Engineer immediately for resolution.
- D. Insulation types THWN, THHN or XHHW. Minimum insulation rating of 90C for branch circuits.
- E. Refer to signal and communications specification sections for cable requirements.

2.3 CONNECTORS

- A. Copper Pads: Drilled and tapped for multiple conductor terminals.
- B. Lugs: Indent/ compression type for use with stranded branch circuit or control conductors.
- C. Solid Conductor Branch Circuits: Spring connectors, wire nuts, for conductors 12 through 8AWG.

2.4 LUGS AND PADS

- A. Ampacity: Cross-sectional area of pad for multiple conductor terminations to match ampere rating of panelboard bus or equipment line terminals.

PART 3 EXECUTION

3.1 INSTALLATION

- A. Installation: Conductors shall not be installed until after conduit systems are permanently in place. Use an approved non-hardening type wire pulling lubricant if lubricant is to be used. Maintain all conduits and wire pulls free from foreign material. If due to field conditions, more than a total of 300 degrees of bend are required; a pull box shall be furnished and installed for ease of installation. Said pull boxes must be sized and rated for the appropriate application and must remain easily accessible upon completion of the project (approval of the location shall be obtained from the Architect prior to installation). Show these pullboxes on the field record drawings. Conductors installed in underground raceways on site shall be duct sealed and taped where they exit the raceway to prevent the entrance of foreign material and moisture after the conductors are installed. Proper drainage shall be provided for underground pull and splice boxes.
- B. Insulation: Use proper insulation types where temperature and environment are a factor.
- C. Labeling: All conductors in panels, switchboards, terminal cabinets, vaults, pull boxes, and junction boxes shall be labeled with tape number markers indicating circuit number and identifying system. All labeling shall be permanent. See Section 26 05 53: Identification of Electrical Systems.
- D. All conductors, wiring, cable where installed below floor, slab or underground shall be considered wet locations, and shall be rated accordingly. Non-waterproof cabling is not allowed in any below grade or wet application.
- E. Cables routed together in cable tray shall be stacked, organized and tie wrapped together in a neat and workman like manner. Random cable routing is not acceptable.
- F. Cable and conductors routed through pull boxes and vaults shall be properly supported. Bend radius of cable or conductor shall not be less than six times the overall cable diameter.
- G. Wires and Cables:
 - 1. Conductor Installation:
 - a. Install conductors in raceways having adequate, code size cross-sectional area for wires indicated.
 - b. Install conductors with care to avoid damage to insulation.
 - c. Do not apply greater tension on conductors than recommended by manufacturer during installation.
 - d. Use of pulling compounds is permitted. Clean residue from exposed conductors and raceway entrances after conductor installation.
 - 2. Conductor Size and Quantity:
 - a. Install no conductors smaller than 12AWG unless otherwise shown (e.g. – Fire alarm and communications systems, as defined in their respective specifications sections and/ or drawings).
 - b. Provide all required conductors for a fully operable system.
 - 3. Provide dedicated neutrals (one neutral conductor for each phase conductor). Exceptions may only be granted with Electrical Engineer approval.
 - 4. Conductors in Cabinets:
 - a. Cable and train all wires in panels and cabinets for power and control neatly and uniformly. Use plastic ties in panels and cabinets.
 - b. Tie and bundle feeder conductors in wireways of panelboards.
 - c. Hold conductors away from sharp metal edges.

3.2 FIELD QUALITY CONTROL

- A. Field inspection and test shall be performed under provisions of NETA ATS section 7.3 (2) - Low Voltage Cables, 600-Volt Maximum as follows:
1. Visual and Mechanical Inspection:
 - a. Compare cable data with drawings and specifications.
 - b. Inspect exposed sections of cable for physical damage and correct connection in accordance with single-line diagram.
 - c. Inspect all bolted electrical connections for high resistance using one of the following methods:
 - 1) Use of low-resistance ohm-meter in accordance with NETA section 7.3.2.2 (Electrical Tests).
 - 2) Verify tightness of accessible bolted electrical connections by calibrated torque-wrench method in accordance with manufacturer's published data from NETA ATS Table 10.12.
 - d. Inspect compression-applied connectors for correct cable match and indentation.
 - e. Verify cable color coding with applicable specifications and CEC.
 2. Electrical Tests
 - a. Perform insulation-resistance test on each conductor with respect to ground and adjacent conductors. Applied potential shall be 500 volts dc for 300 volt rated cable and 1000 volts dc for 600 volt rated cable. Test duration shall be one minute.
 - b. Perform resistance measurements through all bolted connections with low-resistance ohmmeter, if applicable, in accordance with Section 7.3.2.1 (Visual and Mechanical Inspection).
 - c. Perform continuity test to insure correct cable connection.
 - d. Correct malfunctions and/ or deficiencies immediately as detected at no additional cost to the District, including additional verification testing.
 - e. Subsequent to final wire and cable terminations, energize all circuitry and demonstrate functional adequacy in accordance with system requirements.
 3. Test Values
 - a. Compare bolted connection resistance to values of similar connections.
 - b. Bolt-torque levels should be in accordance with NETA ATS Table 10.12 unless otherwise specified by the manufacturer.
 - c. Micro-ohm or milli-volt drop values shall not exceed the high levels of the normal range as indicated in the manufacturer's published data. If manufacturer's data is not available, investigate any values which deviate from similar connections by more than 50 percent of the lowest value.
 - d. Minimum insulation-resistance values should not be less than 50 meg-ohms.
 - e. Investigate deviations between adjacent phases.

END OF SECTION 26 05 19

SECTION 26 05 26

GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS

PART 1 GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. This Section Includes:
 - 1. Grounding and bonding requirements of electrical installations for personnel safety and to provide a low impedance path for possible ground fault currents as described in CEC Article 250.
 - 2. "Grounding electrode system" refers to all electrodes required by CEC, as well as including made, supplementary, lightning protection system and telecommunications system grounding electrodes.
 - 3. The terms "connect" and "bond" are used interchangeably in this specification and have the same meaning.
- B. Related Sections:
 - 1. Section 26 05 00: Common Work Results for Electrical.
 - 2. Section 26 05 19: Low-Voltage Electrical Power Conductors and Cables.
- C. Reference Standards:
 - 1. California Electrical Code (CEC). California Code of Regulations, Title 24, Part 3.
 - 2. Institute of Electrical and Electronics Engineers (IEEE):
 - a. 81 IEEE Guide for Measuring Earth Resistivity, Ground Impedance, and Earth Surface Potentials of a Grounding System.
 - b. 142 Recommended Practice for Grounding of Industrial and Commercial Power Systems.
 - c. 1100 Recommended Practice for Powering and Grounding Electronic Equipment
 - 3. National Electrical Testing Association (NETA):
 - a. ATS Acceptance Testing Specifications for Electrical Power Distribution Equipment and Systems
 - 4. Underwriters Laboratories, Inc. (UL):
 - a. 83 UL Standard for Safety Thermoplastic-Insulated Wires and Cables.
 - b. 467 Grounding and Bonding Equipment.
 - 5. American Society for Testing and Materials (ASTM):
 - a. B1 Standard Specification for Hard-Drawn Copper Wire.
 - b. B3 Standard Specification for Soft or Annealed Copper Wire.
 - c. B8 Standard Specification for Concentric-Lay-Stranded Copper Conductors, Hard, Medium-Hard, or Soft.

PART 2 PRODUCTS

2.1 GROUNDING AND BONDING CONDUCTORS

- A. Equipment grounding conductors shall be UL 83 insulated stranded copper, except that sizes No. 10 AWG and smaller shall be solid copper. Insulation color shall be continuous green for all equipment grounding conductors, except that wire sizes No. 4 AWG and larger shall be permitted to be identified per CEC.
- B. Bonding conductors shall be ASTM B8 bare stranded copper, except that sizes No. 10 AWG and smaller shall be ASTM B1 solid bare copper wire.
- C. Conductor sizes shall not be less than what is shown on the drawings and not less than required by the CEC, whichever is greater.

2.2 SPLICES AND TERMINATION COMPONENTS

- A. Components shall meet or exceed UL 467 and be clearly marked with the manufacturer, catalog number, and permitted conductor size(s).

2.3 GROUNDING ELECTRODES

- A. Ground Rods: Copper; 3/4 inch by 10 feet (19 mm by 3 m).
- B. Ground Plates: 1/4 inch (6 mm) thick, hot-dip galvanized.
- C. Test Wells: Ground rod driven through drilled hole in bottom of handhole. Handholes shall be at least 12 inches (300 mm) deep, with cover.
 - 1. Install at least one test well for each service unless otherwise indicated. Install the ground rod electrically closest to service entrance. Set top of test well flush with finished grade or floor.

PART 3 EXECUTION

3.1 GENERAL

- A. Ground in accordance with the CEC, as shown on drawings, and as hereinafterspecified.
- B. System Grounding:
 - 1. Secondary service neutrals: Ground at the supply side of the secondary disconnecting means and at the related transformers.
 - 2. Separately derived systems (transformers downstream from the service entrance): Ground the secondary neutral.
- C. Equipment Grounding: Metallic structures (including ductwork and building steel), enclosures, fire sprinklers, plumbing piping, raceways, junction boxes, outlet boxes, cabinets, machine frames, and other conductive items in close proximity with electrical circuits shall be bonded and grounded.

3.2 INACCESSIBLE GROUNDING CONNECTIONS

- A. Make grounding connections which are buried or otherwise normally inaccessible (except connections for which periodic testing access is required) by exothermicweld.

3.3 SECONDARY EQUIPMENT AND CIRCUITS

- A. Main Bonding Jumper: Bond the secondary service neutral to the ground bus in the service equipment.
- B. Metallic Piping, Building Steel, and Supplemental Electrode(s):
 - 1. Provide a grounding electrode conductor sized per CEC between the service equipment ground bus and all metallic water and gas pipe systems, building steel, and supplemental or made electrodes. Jumper insulating joints in the metallic piping. All connections to electrodes shall be made with fittings that conform to UL 467.
 - 2. Provide a supplemental ground electrode and bond to the grounding electrode system.
- C. Service Disconnect: Provide a ground bar bolted to the enclosure with lugs for connecting the various grounding conductors.
- D. Switchgear, Switchboards, and Motor Control Centers:
 - 1. Connect the various feeder equipment grounding conductors to the ground bus in the enclosure with suitable pressure connectors.
 - 2. For service entrance equipment, connect the grounding electrode conductor to the ground bus.
 - 3. Connect metallic conduits, which terminate without mechanical connection to the housing, by grounding bushings and grounding conductor to the equipment ground bus.
- E. Transformers:
 - 1. Exterior: Exterior transformers supplying interior service equipment shall have the neutral grounded at the transformer secondary. Provide a grounding electrode at the transformer.
 - 2. Separately derived systems (transformers downstream from service equipment): Ground the secondary neutral at the transformer. Provide a grounding electrode conductor from bar at the service equipment.
- F. Conduit Systems:
 - 1. Ground all metallic conduit systems. All metallic conduit systems shall contain an equipment grounding conductor sized per CEC.
 - 2. Nonmetallic conduit systems shall contain an equipment grounding conductor, except that non-metallic feeder conduits which carry a grounded conductor from exterior transformers to interior or building-mounted service entrance equipment need not contain an equipment grounding conductor.
 - 3. Metal conduit containing only a grounding conductor, and which is provided for mechanical protection of the conductor, shall be bonded to that conductor at the entrance and exit from the conduit.
- G. Feeders and Branch Circuits: Install equipment grounding conductors with all feeders, power, and lighting branch circuits.
- H. Boxes, Cabinets, Enclosures, and Panelboards:
 - 1. Bond the equipment grounding conductor to each pullbox, junction box, outlet box, device box, cabinets, and other enclosures through which the conductor passes.
 - 2. Provide lugs in each box and enclosure for equipment grounding conductor termination.
 - 3. Provide ground bars in panelboards, bolted to the housing, with sufficient lugs to terminate the equipment grounding conductors.

- I. Motors and Starters: Provide lugs in motor terminal box and starter housing or motor control center compartment to terminate equipment grounding conductors.
- J. Receptacles shall not be grounded through their mounting screws. Ground with a jumper from the receptacle green ground terminal to the device box ground screw and the branch circuit equipment grounding conductor.
- K. Ground lighting fixtures to the equipment grounding conductor of the wiring system when the green ground is provided; otherwise, ground the fixtures through the conduit systems. Fixtures connected with flexible conduit shall have a green ground wire included with the power wires from the fixture through the flexible conduit to the first outlet box.
- L. Fixed electrical appliances and equipment shall be provided with a ground lug for termination of the equipment grounding conductor.

3.4 CONDUCTIVE PIPING

- A. Bond all conductive piping systems, interior and exterior, to the building to the grounding electrode system. Bonding connections shall be made as close as practical to the equipment ground bus.

3.5 TELECOMMUNICATIONS SYSTEM

- A. Bond telecommunications system grounding equipment to the electrical grounding electrode system. Refer to communications backbone cabling specification section.

3.6 GROUND RESISTANCE

- A. Grounding system resistance to ground shall not exceed 15 ohms. Make necessary modifications or additions to the grounding electrode system for compliance without additional cost to the Owner. Final tests shall assure that this requirement is met, and test results shall be submitted to the Owner with final close out documents.
- B. Resistance of the grounding electrode system shall be measured using a four-terminal fall-of-potential method as defined in IEEE Standard 81. Ground resistance measurements shall be made before the electrical distribution system is energized and shall be made in normally dry conditions not less than 48 hours after the last rainfall. Resistance measurements of separate grounding electrode systems shall be made before the systems are bonded together below grade. The combined resistance of separate systems may be used to meet the required resistance, but the specified number of electrodes must still be provided.
- C. Below-grade connections shall be visually inspected by the Inspector of Record (IOR) prior to backfilling. The Contractor shall notify the IOR 24 hours before the connections are ready for inspection.
- D. Furnish a copy of tests to Owner at completion of project.

END OF SECTION 26 05 26

SECTION 26 05 29

HANGERS AND SUPPORTS FOR ELECTRICAL SYSTEMS

CONDITIONS OF THE CONTRACT AND DIVISION 01, as applicable, apply to this Section.

PART 1 GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Conduit supports.
 - 2. Formed steel channel.
 - 3. Spring steel clips.
 - 4. Sleeves.
 - 5. Mechanical sleeve seals.
 - 6. Firestopping relating to electrical work.
 - 7. Firestopping accessories.
 - 8. Equipment bases and supports.

1.2 REFERENCES

- A. Underwriters Laboratories Inc.:
 - 1. UL 263 - Fire Tests of Building Construction and Materials.
 - 2. UL 723 - Tests for Surface Burning Characteristics of Building Materials.
 - 3. UL 1479 - Fire Tests of Through-Penetration Firestops.
 - 4. UL - Fire Resistance Directory.

1.3 DEFINITIONS

- A. Firestopping (Through-Penetration Protection System): Sealing or stuffing material or assembly placed in spaces between and penetrations through building materials to arrest movement of fire, smoke, heat, and hot gases through fire rated construction.

1.4 PERFORMANCE REQUIREMENTS

- A. Firestopping: Conform to Building Code and UL for fire resistance ratings and surface burning characteristics.

1.5 SUBMITTALS

- A. Product Data:
 - 1. Hangers and Supports: Submit manufacturers catalog data including load capacity.

1.6 QUALITY ASSURANCE

- A. Perform Work in accordance with the Building Code.

PART 2 PRODUCTS

2.1 CONDUIT SUPPORTS

- A. Manufacturers:
 - 1. Allied Tube & Conduit Corp.
 - 2. Electroline Manufacturing Company.
 - 3. O-Z Gedney Co.
 - 4. Appleton.
- B. Hanger Rods: Threaded high tensile strength galvanized carbon steel with free running threads.
- C. Beam Clamps: Malleable Iron, with tapered hole in base and back to accept either bolt or hanger rod. Set screw: hardened steel.
- D. Conduit clamps for trapeze hangers: Galvanized steel, notched to fit trapeze with single bolt to tighten.
- E. Conduit clamps - general purpose: One hole malleable iron for surface mounted conduits.
- F. Cable Ties: High strength nylon temperature rated to 185 degrees F. Self-locking. With Stainless tooth.

2.2 FORMED STEEL CHANNEL

- A. Manufacturers:
 - 1. Allied Tube & Conduit Corp.
 - 2. B-Line Systems.
 - 3. Midland Ross Corporation, Electrical Products Division.
 - 4. Unistrut Corp.
- B. Product Description: Galvanized 12 gage thick steel. With holes 1-1/2 inches on center.

2.3 SLEEVES

- A. Sleeves for raceway Through Non-fire Rated Floors: 18 gage galvanized steel.
- B. Sleeves for raceway Through Non-fire Rated Beams, Walls, Footings, and Potentially Wet Floors: Steel pipe or 18 gage galvanized steel.
- C. Sleeves for raceway Through Fire Rated and Fire Resistive Floors and Walls, and Fire Proofing: Prefabricated fire rated sleeves including seals, UL Listed.
- D. Fire-stopping Insulation: Glass fiber type, non-combustible.

2.4 SPRING STEEL CLIPS

- A. Product Description: Mounting clamp, and screw.

2.5 MECHANICAL SLEEVE SEALS

- A. Manufacturers:
 - 1. Thunderline Link-Seal, Inc.
 - 2. NMP Corporation.

- B. Product Description: Modular mechanical type, consisting of interlocking synthetic rubber links shaped to continuously fill annular space between object and sleeve, connected with bolts and pressure plates causing rubber sealing elements to expand when tightened, providing watertight seal and electrical insulation.

2.6 FIRESTOPPING

- A. Manufacturers:
 - 1. Dow Corning Corp.
 - 2. Fire Trak Corp.
 - 3. Hilti Corp.
 - 4. International Protective Coating Corp.
 - 5. 3M fire Protection Products.
 - 6. Specified Technology, Inc.
- B. Product Description: Different types of products by multiple manufacturers are acceptable as required to meet specified system description and performance requirements; provide only one type for each similar application.
 - 1. Silicone Firestopping Elastomeric Firestopping: Multiple component silicone elastomeric compound and compatible silicone sealant.
 - 2. Foam Firestopping Compounds: Multiple component foam compound.
 - 3. Formulated Firestopping Compound of Incombustible Fibers: Formulated compound mixed with incombustible non-asbestos fibers.
 - 4. Fiber Stuffing and Sealant Firestopping: Composite of mineral or ceramic fiber stuffing insulation with silicone elastomer for smoke stopping.
 - 5. Mechanical Firestopping Device with Fillers: Mechanical device with incombustible fillers and silicone elastomer, covered with sheet stainless steel jacket, joined with collars, penetration sealed with flanged stops.
 - 6. Intumescent Firestopping: Intumescent putty compound which expands on exposure to surface heat gain.
 - 7. Firestop Pillows: Formed mineral fiber pillows.

2.7 FIRESTOPPING ACCESSORIES

- A. Installation Accessories: Provide clips, collars, fasteners, temporary stops or dams, and other devices required to position and retain materials in place.
- B. General:
 - 1. Furnish UL Listed products.
 - 2. Select products with rating not less than rating of wall or floor being penetrated.
- C. Non-Rated Surfaces:
 - 1. Stamped steel, chrome plated, hinged, split ring escutcheons or floor plates or ceiling plates for covering openings in occupied areas where conduit is exposed.
 - 2. For exterior wall openings below grade, furnish modular mechanical type seal consisting of interlocking synthetic rubber links shaped to continuously fill annular space between conduit and cored opening or water-stop type wall sleeve.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Verify openings are ready to receive sleeves.
- B. Verify openings are ready to receive firestopping.

3.2 INSTALLATION - HANGERS AND SUPPORTS

- A. Anchors and Fasteners:
 - 1. Concrete Structural Elements: Provide precast inserts, expansion anchors, powder actuated anchors or preset inserts as required.
 - 2. Steel Structural Elements: Provide beam clamps, spring steel clips, steel ramset fasteners or welded fasteners as required.
 - 3. Concrete Surfaces: Provide self-drilling anchors and expansion anchors as required.
 - 4. Hollow Masonry, Plaster, and Gypsum Board Partitions: Provide toggle bolts or hollow wall fasteners as required.
 - 5. Solid Masonry Walls: Provide expansion anchors or preset inserts as required.
 - 6. Sheet Metal: Provide sheet metal screws.
 - 7. Wood Elements: Provide wood screws.
- B. Inserts:
 - 1. Install inserts for placement in concrete forms.
 - 2. Install inserts for suspending hangers from reinforced concrete slabs and sides of reinforced concrete beams.
 - 3. Provide hooked rod to concrete reinforcement section for inserts carrying pipe over four (4) inches.
 - 4. Where concrete slabs form finished ceiling, locate inserts flush with slab surface.
 - 5. Where inserts are omitted, drill through concrete slab from below and provide through-bolt with recessed square steel plate and nut recessed into and grouted flush with slab.
- C. Install conduit and raceway support and spacing in accordance with CEC.
- D. Do not fasten supports to suspended ceiling support system, pipes, ducts, mechanical equipment, or conduit.
- E. Install multiple conduit runs on common hangers.
- F. Supports:
 - 1. Fabricate supports from structural steel or formed steel channel. Install hexagon head bolts to present neat appearance with adequate strength and rigidity. Install spring lock washers under nuts.
 - 2. Install surface mounted cabinets and panelboards with minimum of four anchors.
 - 3. In wet and damp locations install steel channel supports to stand cabinets and panelboards one (1) inch off wall.
 - 4. Support vertical conduit at every floor.

3.3 INSTALLATION - FIRESTOPPING

- A. Install material at fire rated construction perimeters and openings containing penetrating sleeves, piping, ductwork, conduit, and other items, requiring firestopping.
- B. Apply primer where recommended by manufacturer for type of firestopping material and substrate involved, and as required for compliance with required fire ratings.
- C. Apply firestopping material in sufficient thickness to achieve required fire and smoke rating.
- D. Compress fibered material to maximum 40 percent of its uncompressed size.
- E. Place intumescent coating in sufficient coats to achieve rating required.
- F. Remove dam material after firestopping material has cured.

- G. Fire Rated Surface:
 - 1. Seal opening at all rated floors and walls as follows:
 - a. Install sleeve through opening and extending beyond minimum of one (1) inch on both sides of building element.
 - b. Size sleeve allowing minimum of one (1) inch void between sleeve and building element.
 - c. Pack void with backing material.
 - d. Seal ends of sleeve with UL Listed fire resistive silicone compound to meet fire rating of structure penetrated.
 - 2. Where cable tray, bus, or conduit, penetrates fire rated surface, install firestopping product in accordance with manufacturer's instructions.
- H. Non-Rated Surfaces:
 - 1. Seal opening through non-fire rated floors and walls as follows:
 - a. Install sleeve through opening and extending beyond minimum of one (1) inch on both sides of building element.
 - b. Size sleeve allowing minimum of one (1) inch void between sleeve and building element.
 - c. Install type of firestopping material recommended by manufacturer.
 - 2. Install escutcheons where conduit, penetrates non-fire rated surfaces in occupied spaces. Occupied spaces include rooms with finished ceilings and where penetration occurs below finished ceiling.
 - 3. Exterior wall openings below grade: Assemble rubber links of mechanical seal to size of conduit and tighten in place, in accordance with manufacturer's instructions.

3.4 INSTALLATION - SLEEVES

- A. Exterior watertight entries: Provide mechanical sleeve seals.
- B. Interior conduit penetrations not required to be watertight: Sleeve and fill with silicon foam.
- C. Set sleeves in position in forms. Provide reinforcing around sleeves.
- D. Size sleeves large enough to allow for movement due to expansion and contraction. Provide for continuous insulation wrapping.
- E. Extend sleeves through floors and walls one (1) inch above finished floor level. Caulk sleeves.

END OF SECTION 26 05 29

SECTION 26 05 33

RACEWAY AND BOXES FOR ELECTRICAL SYSTEMS

PART 1 GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section Includes:
1. Conduit and fittings.
 2. Outlet boxes.
 3. Weatherproof outlet boxes.
 4. Junction and pull boxes.
 5. Floor boxes.
 6. Cabinets, termination cabinets.
 7. Gutters.

1.3 SUBMITTALS

- A. Provide Product Data for the Following Equipment:
1. Conduit and fittings.
 2. Outlet boxes.
 3. Weatherproof outlet boxes.
 4. Junction and pull boxes.
 5. Floor boxes.
 6. Cabinets, termination cabinets.
 7. Gutters.
 8. Putty pads.
 9. Raceways
- B. Submit detailed conduit routing plan, for review and approval, prior to installation as follows:
1. Exposed and/ or concealed in building walls for conduits larger than 2-inch outside diameter.
 2. All underground conduits (3/4-inch and larger) in duct bank; concealed in floor slabs, equipment pads and concrete slabs.

1.4 SUBMITTALS

- A. Minimum acceptable conduit sizes are summarized in the following table:

	Minimum Size
Underground, site wiring	1"
Underground • Building Wiring Aboveground • Equipment or panel feeders • Telecommunications	3/4"
Aboveground • Lighting or branch circuit wiring • Fire alarm	1/2"

	Minimum Size
• Security	
Other	3/4"

1.5 QUALITY ASSURANCE

- A. Regulatory Requirements:
1. Conform to requirements of the CEC, latest adopted version.
 2. Furnish products listed by UL or other independent and nationally recognized testing firm.

1.6 DELIVERY, STORAGE AND HANDLING

- A. Protect conduit from corrosion and entrance of debris by storing above grade. Provide appropriate covering.
- B. Protect PVC and PVC-coated metallic conduit from sunlight.
- C. Protection of and cleanliness of pathways and raceways must be assured during the construction process in order to eliminate the possibility of debris entering the conduit, duct, pathway resulting in decreased wire capacity and potential damage to installed conductors and cables.

PART 2 PRODUCTS

2.1 MATERIALS

- A. Polyvinyl Chloride (PVC) coated galvanized rigid steel conduit and intermediate metal conduit shall be in accordance with NEMA RN 1. Coating shall be applied under controlled factory conditions. Prior to coating, conduit shall meet requirements of ANSI C80.1 and UL 6 or ANSI C80.6 and UL 1242 as appropriate. PVC coated conduits shall have ultra-violet (UV) inhibitor in the coating material.
- B. Intermediate Metal Conduit (IMC). Raceway shall be hot dipped galvanized mild steel in accordance with ANSI C80.6 and UL 1242 and shall bear the UL label. Conduit shall have same characteristics of rigid steel except for thinner wall.
- C. Galvanized Rigid Steel Conduit (GRSC or RGS), couplings and elbows shall be hot dip galvanized, rigid mild steel in accordance with ANSI C80.1 and UL 6. The conduit interior and exterior surfaces shall have a continuous zinc coating with a transparent overcoat of enamel, lacquer, or zinc chromate. Conduit shall be formed with continuous welded seams with a uniform wall thickness, in minimum 10-foot lengths, with threaded ends.
- D. Electrical Metallic Tubing (EMT). Electrical metallic tubing, including elbows and bends, shall be zinc coated, mild steel in accordance with the requirements of ANSI C80.3 and UL 797. The interior and exterior surfaces of the tubing shall have a continuous zinc coating. Conduit shall be formed with a continuous welded seam, with a uniform wall thickness, in minimum 10-foot lengths.
- E. Non-Metallic Conduit shall be as follows:
1. Schedule 40: Conduit shall be 90 degree Celsius, polyvinyl chloride in conformance with NEMA TC-2 and UL 651 requirements.
 2. Spacers used in duct bank installations shall be high impact plastic, interlocking bases, and intermediate type spacers. Place spacers between 6 and 10 feet apart.

- F. Flexible Metal Conduit shall be galvanized steel meeting the requirements of UL 1. Flexible aluminum conduit is not permitted.
- G. Liquid-Tight Flexible Metal Conduit shall be plastic jacketed, galvanized steel, "Sealtite" Type EF for general service areas or Type HC for high temperature when used under raised floor or in air plenums. Conduit shall be UL listed.
- H. Manufacturers:
 - 1. Outlet Boxes: Bowers, Raco, Orbit, Steel City or equal.
 - 2. Weatherproof Outlet Boxes: Bell, Red Dot, Carlon or equal.
 - 3. Floor Boxes: Wiremold/ Walker, Hubbell, Steel City, or equal.
 - 4. Junction and Pull Boxes: Circle AW, Hoffman, Wireguard or equal.
 - 5. Box Extension Adapter: Bell, Red Dot, Carlon or equal.
 - 6. Conduit Fittings: O-Z Gedney, Thomas & Betts, Raco, Crouse Hinds, or equal.
 - 7. Putty pads: 3M, Hilti, or equal.
 - 8. Heavy wall rigid non-metallic conduit, Carlon, Certainteed, R&G Sloane or equal.
 - 9. Extra heavy wall non-metallic conduit, Carlon, Certainteed, R&G Sloane or equal.
 - 10. Flexible Metal Conduit (FMC), Alfex, American Flexible Conduit or equal.
 - 11. Liquid tight flexible metal conduit, Anacanda (type UA), Electri-flex Liqueatite or equal.
 - 12. Floor Boxes, Single Gang, Walker/ Wiremold 880 CS Series or approved equal.
 - 13. Floor Boxes, Multiple Gang, Walker/ Wiremold RFB Series or Walker Omnibox multi-service floor box with carpet plates, and/ or water resistant device covers.
 - 14. Masonry Boxes, outlets in concrete, Raco Series 690 or equal.
- I. Listed products for termination, coupling, extending, benching supports of raceways shall be used.

2.2 OUTLET BOXES

- A. NEMA 1 gutter, junction and pull boxes shall be fabricated from code gage steel finished in grey enamel with screw cover fronts and concentric knockouts in all sides.
- B. NEMA 3R gutter, junction and pull boxes shall be fabricated from code gage galvanized steel with screw cover fronts and concentric knockouts in the bottom only. Any penetrations to the side, top or back shall be weatherproofed in an approved manner such as "MYERS" gasketed type hub or equal.
- C. Steel outlet boxes and plaster rings shall be galvanized rigid assemblies, either one piece pressed or factory welded construction containing the size and number of knockouts required. Steel outlet boxes shall be manufactured, sized and installed in accordance with CECArticle 314. Device Outlet: Installation of one or two devices at common location, minimum 4" square, minimum 1-1/2" deep. Single or 2 gang flush device plaster ring. Raco or equal.
- D. Luminaire Outlet: minimum 4" square with correct plaster ring depth, minimum 1-1/2" deep with 3/8" luminaire stud if required. Provide proper depth plaster ring on bracket outlets and on ceiling outlets.
- E. Construction: Provide galvanized steel interior outlet wiring boxes, of the type, shape and size, including depth of box, to suit each respective location and installation; constructed with stamped knockouts in back and sides, and with threaded holes with screws for securing box covers or wiring devices. Boxes shall be properly secured to the structure such that they are flush with the finish surface. Boxes shall be made structurally secure by means of the proper fastening devices.

- F. Accessories: Provide outlet box accessories as required for each installation, including mounting brackets, wallboard hangers, extension rings, plaster rings, luminaire studs, cable clamps and metal straps for supporting outlet boxes, compatible with outlet boxes being used and meeting requirements of individual wiring situations.

2.3 JUNCTION AND PULL BOXES

- A. Construction: Provide galvanized sheet steel junction and pull boxes, with screw-on covers; of the type shape and size, to suit each respective location and installation; with welded seams and equipped with steel nuts, bolts, screws and washers.
- B. Location:
 - 1. Install junction boxes above accessible ceilings for drops into walls for receptacle outlets from overhead.
 - 2. Install junction boxes and pull boxes as required to facilitate the installation of conductors and limiting the accumulated angular sum of bends between boxes, cabinets and appliances to 300 degrees.
 - 3. Locations: Junction boxes shall be located only where necessary and only in equipment rooms, closets, and accessible attic and underfloor spaces. A horizontal distance of 24" shall separate outlet boxes on opposite sides of occupancy separation walls, fire-rated walls or partitions.
 - 4. Labeling: Junction box covers shall be marked with indelible ink indicated the circuit numbers passing through the box.

2.4 CONDUIT FITTINGS

- A. Requirements: Provide corrosion-resistant punched-steel box knockout closures, conduit locknuts and plastic conduit bushings of the type and size to suit each respective use and installation.
- B. Steel boxes may allow for field knock-out modifications, but shall in all other ways conform to code requirements.

2.5 FLOOR BOXES - SINGLE GANG

- A. Construction: Deep cast iron fully adjustable before and after concrete pour with all required components for complete activation. Verify required components for application of service fittings, covers, monuments, and the like, attached to floor boxes.
- B. Activations:
 - 1. Flush: Provide brass duplex or single signal cover, hinged with set screw lock. Carpet or tile finish ring.
 - 2. Monuments: Provide stainless steel monuments with power receptacle or data grommet as noted.
 - 3. Coordinate specific application of systems as noted on Drawings.

2.6 FLOOR BOXES - MULTIPLE GANG

- A. Construction: Deep cast iron, fully adjustable before and after pour. Equal to Walker/ Wiremold RFB Series or Walker Omnibox multi-service floor box with carpet plates, and/ or water resistant device covers. Verify color. Partition for different power or signal applications. Provide required power receptacle devices and signal grommets or receptacles as noted. Flange type shall be compatible with floor covering for either carpet or vinyl as required and shall be brass type not polycarbonate.

- B. Floor mounted boxes shall be water tight and cast iron when installed in grade level concrete slab floor, fully adjustable with interior and exterior leveling screws. Receptacle flange shall be brass with a duplex lift lid. Flange type shall be compatible with floor type. Before installation, coordinate exact location with Architect.

2.7 PUTTY PADS

- A. Intumescent moldable firestop putty designed to protect electrical outlet boxes.
- B. Provide putty pads of proper type around outlet boxes and/ or as detailed on plan to meet sound transmission restrictions and fire ratings of walls

2.8 PULLBOXES AND HANDHOLES

- A. Construction: High densities precast reinforced concrete box, extension, base, and cover. Furnish box with end and side knockouts and non-settling shoulders. Cover shall have hold-down bolts and two lifting eyes.
- B. Size: As indicated on the Drawings.
- C. Cover markings: Covers shall read "ELECTRICAL", "COMMUNICATIONS", or "SIGNAL" as appropriate.
- D. Rated covers: Use cast iron lid with H20 traffic rating when subject to vehicular traffic.

PART 3 EXECUTION

3.1 INSTALLATION

- A. Conduit systems listed below are for use in installations where they are permitted to be used by CEC and/ or other occupancy restrictions. The below installation methods do not intend to suggest that these materials be installed in conflict with any applicable code. Special attention to applications shall be made in building types such as wet location, hazardous locations, assembly occupancy and multi-story, but not limited to these. Requirements which are more restrictive than the CEC may be called for by the drawings and/ or these specifications. These requirements must be adhered to. The Electrical Contractor shall be responsible to use the proper conduit system for the application. Exposed conduit is not allowed below ceilings or above slab of floor, without prior approval from Electrical Engineer. All conduits shall be concealed except in electrical and telecommunication rooms or where shown to be surface mounted. Exposed conduit (where allowed) shall be run square and plumb with building lines in an approved manner. Support roof mount conduits, where allowed, with minimum 12" wide approved rooftop supports (B-Line Durablok or approved equal) unless otherwise detailed in roof requirements or as specified in roofing specification. Strap conduits to blocks with proper sized conduit straps. Spacing of support shall be a minimum as provided for in the CEC. All exposed conduit mounted below 8' above finished grade shall be strapped at a minimum of 5' spacing.

- B. Non-Metallic Rigid Conduit shall be used in concrete slabs, below concrete slabs on grade, or underground outside of a building slab or foundation. Maintain minimum depth requirements and cover with appropriate fill material. Conduit shall be heavy wall Schedule 40 or 80, rigid PVC only. Rigid utility P&C duct shall not be used in any application. Properly sized grounding conductors shall be installed per CEC article 250, in all non-metallic conduit branch circuit and feeder runs. PVC conduit shall be formed or field bent only with the use of properly approved bending tools such as to not decrease the internal bore of the conduit. All conduits shall be cut square and reamed of burrs. Approved and compatible glue shall be used on all PVC fittings to attain watertight joints.
- C. Galvanized Rigid Steel (GRS) conduit shall be used where exposed less than 8'-0" above finished grade to 18" below finished grade and where subject to physical damage. Conduits shall be cut square and reamed to remove burrs and sharp edges. Strap conduit below 8' above grade at 5' intervals. Unless otherwise noted, threadless setscrew and threadless weathertight fittings may be used in lieu of threaded fittings. All threaded ends entering a junction box of any type shall require one locknut on the inside and one on the outside of the enclosure and be provided with a plastic bushing or grounding bushing where necessary for proper grounding. Where exposed to moisture, a watertight hub or other approved method shall be required. All conduits shall be stubbed up straight and uniform into junction boxes, panels, cabinets, etc., and shall be (GRS) properly supported and strapped. All GRS conduit located below grade, shall be tape wrapped.
- D. Electrical Metallic Tubing (EMT) shall be used as allowed by code and as permitted by this specification. It shall not be in contact with soil or the concrete slab on the ground floor of any structure. Connectors and couplings shall be steel insulated set screw type where installed in indoor dry locations not subject to moisture. Where the potential for moisture is present, compression type weathertight fittings are required. One hole conduit straps are permitted from 1/2" to 1" and two hole conduit straps are required for size 1-1/4" and larger. EMT shall not be allowed in areas subject to severe physical damage. Install copper ground wire sized per CEC 250-122 in all EMT conduits.
- E. Flexible conduit may be used where concealed in building construction or above dropped ceilings, but shall meet the following criteria: No individual circuit path from distribution panel to last device shall exceed a cumulative length of 6' of flexible conduit from start to end. Flexible conduit shall not exceed a total directional change of 270 bending degrees in any one run between conduit terminations. Squeeze type or Jake type steel flex fittings of a grounding type are required. Flexible conduit must be supported in accordance with CEC. Where exposed to the weather, moisture, or spray down flexible conduit shall be of the liquidtight type. Fittings shall be manufactured for use with liquidtight flexible conduit. All motor connections shall be made with liquidtight flex. Flexible conduit may not be used where exposed except for last 2' of equipment connection and unless otherwise noted or approved. A copper ground wire sized per CEC 250-122 shall be installed in all flexible conduit runs. Flexible conduit may not be used exposed. Weatherproof liquid tight conduit shall not be used at roof level for equipment connections with lengths exceeding 24" nor shall it be used to circumvent a rigid conduit system in a horizontal direction. Connect recessed lighting fixtures to conduit runs with a maximum of 6' of flexible metal conduit extending from junction box to fixture.
- F. Underground conduits and transition to above grade/ slab shall be as follows:
1. PVC elbows 2" and smaller are allowed, or if top of elbow is minimum 18" BFG or below top of slab, otherwise GRS elbows are required.
 2. GRS risers are required from elbow below grade to equipment (device, outlet, panel, cabinet, etc.) above grade.
 3. GRS elbows/risers to be PVC coated or 10 MIL tape wrapped (1/2" lapped) to 3" above finish grade or top of slab.

- G. Conduit Supports: Conduit runs may be supported by one-hole and two-hole straps or supports as manufactured by Unistrut, Minerallac, Caddy or equals. Supports may be fastened by means of anchors, shields, beam clamps, toggle bolts, or other approved methods appropriate for the application and size of conduit. Pipe nailers (J-hooks) may only be used for 1" conduit and smaller and only in wood frame construction. Conduit support methods are subject to review by the engineer and authority having jurisdiction for adequacy. Installations deemed inadequate shall be corrected by the contractor at no cost to the Owner.
- H. Bends and offsets shall be made with approved tools for the type of conduit being utilized. Bends shall be made without kinking or destroying the smooth bore of the conduit. Parallel conduits shall be run straight and true with bends uniform and symmetrical. Minimum radii shall be per CEC 344-24.
- I. Conduit Stub-outs below grade shall be capped with plastic cap, and identified by placing a pull box marked with correctly identified utility such as "Elec", "Tel", etc. Dimension for exact location on field record drawings. Provide lids for proper field application (i.e. traffic, incidental, pedestrian).
- J. Conduit Seals - Where below grade conduits enter structure through slab or retaining wall of building or basement, seal the inside of each conduit as follows:
1. Provide damming material around conductors 3" into conduit. Polywater or equal.
 2. Fill 3" of conduit with 3M #2123 sealing compound.
 3. Wrap conductors where they exit the conduit with 3M #2229 "Scotch Seal" mastic tape. Lap tape to approximate diameter of the raceway and wrap outside of conduit opening with (minimum) one turn.
 4. Use conduit sealing bushings type CSB (O-Z/ Gedney) or equal.
 5. Empty conduits shall be sealed with standard non-hardening duct seal compound and then capped to prevent entrance of moisture and gases and to meet fire resistance requirements.
 6. Provide cable drip loop minimum 12" high.
- K. Marker tape: Place marker tape at 12" below finish grade along and above buried conduits. Label tape "CAUTION: ELECTRICAL LINES BELOW" or similar wording.
- L. Electrical and communications systems raceways routed underground shall not occupy the same trench as plumbing utilities such as sewer, water, storm drain, gas or other wet or dry gaseous utility system. A minimum of 12" of undisturbed earth is required. Where utilities must cross in closer proximity to each other due to physical constraints, 6" minimum crossing distances are allowed.
- M. Conduits, routed below footings, slabs, grade beams, columns, and other structural elements shall be installed in strict compliance with structural details and criteria shown on structural plans. Clearances below structural elements and sleeves through structural elements must be carefully planned to avoid conflict and must be approved by the structural engineer if conflict arises.
- N. All conduit or raceways passing through fire rated walls, floors, or ceilings shall be installed with a listed penetration method which protects the opening to the same rating as the assembly and is non hardening.
- O. Location: Locate boxes and conduit bodies so as to ensure accessibility of electrical wiring.
- P. Anchoring: Secure boxes rigidly to the substrate upon which they are being mounted, or solidly embed boxes in concrete or masonry.

- Q. Special Application: Provide weatherproof outlets for locations exposed to weather or moisture.
- R. Knockout Closures: Provide knockout closures to cap unused knockout holes where blanks have been removed.
- S. Mount outlet boxes, unless otherwise required by ADA and CBC, or noted on drawings, the following distances above the finished floor:
1. Receptacles, Telephone, TV & Data outlets. (measured to bottom of outlet box): +15".
 2. Outlet above counter (measured to top of outlet box): +46".
 3. Control (light) Switches. (measured to top of outlet box): +48".
 4. Fire Alarm Manual Pull Stations, T-stats. (measured to top of outlet box): +48".
 5. Fire Alarm Visuals: the lower of +80" to bottom of lens, or 6" below ceiling.
 6. Other Outlets: As indicated in other sections of specifications or as detailed on drawings.
- T. Coordinate all electrical device locations with the architectural floor plan and interior and exterior elevations to prevent mounting devices within elements that they may conflict such as cabinetry, mirrors, planters, etc.
- U. Size outlet and junction boxes to minimum wire fill space requirements. Upsize box as required to allow ease of wire installation and device installation.
- V. Outlet and junction boxes in fire rated walls shall be gauged and spaced so as not to exceed the maximum penetration allowed by the assembly without compromising the fire rating. If a conflict arises relative to a specific condition, the contractor shall follow the requirements of the fire authority and ask for guidance from the design team. At no time should a larger box be installed prior to resolution of conflict.

END OF SECTION 26 05 33

SECTION 26 05 53

IDENTIFICATION OF ELECTRICAL SYSTEMS

PART 1 GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. This Section Includes:
 - 1. Nameplates and warning signs where specified herein and as shown on contract documents including the following:
 - a. Nameplates and warning signs permanently installed on all electrical equipment and devices including, but not limited to, the following items:
 - 1) Enclosures for transformers, switchboards, motor control, panels, pullboxes, cabinets, motors, generators, transfer switches.
 - 2) Enclosures for all separately enclosed devices including, but not limited to, disconnect switches, circuit breakers, contactors, time switches, control stations and relays, fire alarm panels and lighting control panel.
 - 3) Wall switches not within sight of outlet controlled.
 - 4) Special systems such as, but not limited to, telephone, fire alarm, warning, and signal systems. Identification shall be at each equipment rack, terminal cabinet, control panel, annunciator and pullbox.
 - 5) Devices mounted within and part of equipment including circuit breakers, switches, control devices, control transformers, relays, indication devices and instruments.
 - 2. Conductor and Cable Identification.
- B. Related Sections:
 - 1. Section 26 05 00: Common Work Results for Electrical.
 - 2. Section 26 05 19: Low-Voltage Electrical Power Conductors and Cables.
 - 3. Section 26 20 00 Electrical Distribution Equipment.
- C. Reference Standards:
 - 1. California Electrical Code (CEC). California Code of Regulations, Title 24, Part 3.
 - 2. National Fire Protection Agency (NFPA):
 - a. 70E Standard for Electrical Safety in the Workplace.
 - 3. American National Standards Institute (ANSI):
 - a. A13.1 Pipe Markers.
 - b. Z535 Standards for Safety Signs and Labels.
 - 4. Underwriters Laboratories, Inc. (UL):
 - a. 969 Standard for Marking and Labeling Systems.
 - 5. Code of Federal Regulations, Title 29, Part 1910:
 - a. 144 Safety color code for marking physical hazards.
 - b. 145 Specifications for accident prevention signs and tags.

PART 2 PRODUCTS

2.1 EQUIPMENT LABEL DESIGNATIONS

- A. Equipment labels indicating equipment designations both emergency and normal. Designation per drawings or to be supplied with shop drawings approval.
- B. Panelboard labels showing panel designation, voltage, phase, and source.
- C. Distribution panels, transformers, safety switches, transfer equipment, etc. Labels shall be per ANSI Z535.4 guidelines.

2.2 MATERIALS

- A. For Labels: Three layer laminated plastic or micarta with engraved white letters over black background.
- B. For Emergency Equipment: Use engraved white letters over red background.
- C. For Warning Signs: Minimum 18 gauge steel with red lettering on white porcelain enamel finish.
- D. Arc flash labels shall be provided as required by CEC Article 70E.
- E. Conductor tape number markers: TayMac MX4280 Series non-fading permanent adhesive.

PART 3 EXECUTION

3.1 MOUNTING

- A. Equipment labels shall be mounted by self-tapping, threaded screws, and bolts, or by rivets. Adhesive types are not acceptable unless specifically noted in this section.
- B. Conductor tape markers shall be consistently placed for ready conductor identification.

3.2 HEIGHTS ON LABELS

- A. Panelboards, Switchboards and Motor Control Centers and Special Systems Enclosures: 1/4" identify equipment designation; 1/8" identify voltage rating and source.
- B. Individual Circuit Breakers, Switches, and Motor Starters in Panelboards, Switchboards, and Motor Control Centers: 3/16" identify circuit and load served, including location of equipment.
- C. Enclosed Circuit Breakers, Enclosed Switches, and Motor Starters: 3/16" identify load served.
- D. Transformers: 3/16" identify equipment designation; 1/8" identify primary and secondary voltages, primary source, and secondary load. Include location of primary source or secondary load if remote from transformer.

3.3 WARNING SIGNS

- A. Warning signs shall be permanently mounted with cadmium plated steel screws or nickel-plated brass bolts.
- B. Warning signs to read "DANGER - HIGH VOLTAGE", with letters 1-1/2" high, 3/16" stroke minimum.
- C. Provide warning sign on all doors or immediately next to door for equipment rooms, enclosures or closets containing equipment energized above 150 volts to ground as per CEC, and/ or as directed by the Architect. For interior finish spaces and interior doors, signage shall be coordinated and approved with the Architect in advance of installation.

END OF SECTION 26 05 53

SECTION 26 09 43.13

DIGITAL-NETWORK LIGHTING CONTROLS

PART 1 GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. System Software Interfaces.
 - 2. System Backbone and Integration Equipment.
 - 3. Wired Networked Devices.
- B. Related Requirements:
 - 1. Section 26 27 26 "Wiring Devices" for wired switches and dimmers and other Project requirements applicable to Work specified in this Section.

1.2 DEFINITIONS

- A. Data Bus: A wired interface used to communicate with connected devices.
- B. Device: A collective term for connected devices, including fluorescent ballasts, LED drivers, incandescent luminaires, manual switches, switching relays, sensors, and similar.
- C. Global: Communication between devices in otherwise separate spaces using a bridging device or system controller.
- D. Group: A set of devices that communicate together.
- E. Monitoring: Acquisition, processing, communication, and display of equipment status data, metered electrical parameter values, power quality evaluation data, event and alarm signals, tabulated reports, and event logs.
- F. Scene: Digital light level associated with a preset.
- G. System Backbone: Devices used to connect and manage otherwise separate spaces, including bridging devices and gateways or system controllers. Used to expose devices to software configuration via TCP/IP.

1.3 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct conference at **Project site**.
- B. Preinstallation Coordination Meeting(s): For digital-network lighting controls. Conduct meeting(s) **as videoconference**.
 - 1. Attendees: Installers, fabricators, representatives of manufacturers, and administrators for field tests and inspections. Notify Architect of scheduled meeting dates.
 - 2. Engage factory-authorized service representative to attend preinstallation conference and review the submittal drawing, sequence of operation, and device installation best practices with Project team.
 - 3. Engage factory-authorized service representative to perform cellular signal strength measurements during site walk through and compare to Project plans to verify the placement of cellular antennas and quantity of lighting control system RF access points.

1.4 ACTION SUBMITTALS

- A. Product Data:
 - 1. Bill of Materials necessary to install the networked lighting control system.
 - 2. Product Specification Sheets indicating general device descriptions, dimensions, electrical specifications, wiring details, and nomenclature.
 - 3. Information Technology (IT) connection information pertaining to interconnection with facility IT networking equipment and third-party systems.
 - 4. Other Diagrams and Operational Descriptions - as needed to indicate system operation or interaction with other system(s).
- B. Shop Drawings:
 - 1. Riser Diagrams showing device wiring connections of system backbone and typical per room/area type.

1.5 INFORMATIONAL SUBMITTALS

- A. Contractor Startup/Commissioning Worksheet.
- B. Service Specification Sheets indicating general service descriptions, including startup, training, post-startup support, and service contract terms.
- C. Field quality-control reports.
- D. Sample Warranty: For manufacturer's special warranty.

1.6 CLOSEOUT SUBMITTALS

- A. Maintenance Contracts:
 - 1. Hardware and Software Operation Manuals
 - 2. Maintenance service agreement.
 - 3. Software service agreement.
- B. Warranty documentation.

1.7 QUALITY ASSURANCE

- A. Manufacturer Qualifications:
 - 1. Phone Support: Toll-free technical support available from manufacturer through an online tool to schedule a technical support appointment and provide 24/7 emergency support.
 - 2. Remote Support: Manufacturer capable of providing remote support and ability to virtually connect with customers to address issues with visual guidance overlaid on images of real-world objects.
 - 3. Cellular Connectivity: Manufacturer capable of cellular connectivity to a networked lighting control systems available to provide remote support within the continental United States.
 - 4. On-Site Support: Manufacturer capable of providing a 72-hour, on-site response time within the continental United States.
 - 5. Service Contracts: Manufacturer capable of providing service contracts for continued on-site and remote support of the lighting control system post-installation for terms up to 10 years from substantial completion, including:
 - a. Remote and on-site emergency response.
 - b. Remote system performance checks.
 - c. Remote diagnostics.

- d. Replacement parts.

1.8 WARRANTY

- A. Warranty: Manufacturer and Installer warrant that installed lighting control devices perform in accordance with specified requirements and agree to repair or replace, including labor, materials, and equipment, devices that fail to perform as specified within extended warranty period.
 - 1. Failures include, but are not limited to, the following:
 - a. Faulty operation of lighting control hardware.
 - b. Faulty operation of lighting control firmware.
 - 2. Minimum Warranty Period: Five years from date of shipment.

PART 2 PRODUCTS

2.1 SYSTEM COMPLIANCE

- A. System components manufactured in accordance with UL 916 and UL 924 standards where applicable.
- B. System components manufactured in accordance with CFR Title 47, Part 15 standards where applicable.
- C. System components manufactured in accordance with ISED Canada RSS-247 standards where applicable.
- D. System components manufactured in accordance with IFT-008-2015 and NOM-208-SCFI-2016 standards where applicable.
- E. System listed as qualified under Design Lights Consortium Networked Lighting Control System Specification v5.0.
- F. Performance Criteria:
 - 1. Regulatory Requirements:
 - a. Listed and labeled in accordance with CEC, by qualified electrical testing laboratory recognized by authorities having jurisdiction and marked for intended location and application.

2.2 SYSTEM PERFORMANCE REQUIREMENTS

- A. System Architecture:
 - 1. System architecture based upon the following concepts:
 - a. Networkable intelligent lighting control devices.
 - b. Standalone lighting control zones using distributed intelligence.
 - c. Optional system backbone for remote, time-based, and global operation.
 - 2. Intelligent lighting control devices with individually addressable network communication capability and having one or more basic lighting control components including: occupancy sensor, photosensor, relay, dimming output, contact closure input, analog 0-10 V(dc) input, and manual wall station capable of indicating switching, dimming, and/or scene control. Combining one or more of these components into a single device enclosure permissible to minimize overall system device count.
 - 3. System capable of interfacing directly with networked luminaires such that either low-voltage network cabling is used to interconnect networked luminaires with control components such as sensors, switches, and system backbone.

4. Networked luminaires and intelligent lighting control devices support individual (unique) configuration of device settings and properties, with such configuration residing within the networked luminaires and intelligent control devices.
5. Lighting control zones consisting of one or more networked luminaires and intelligent lighting control devices capable of providing automatic control from sensors (occupancy and/or photosensor) and manual control from local wall stations without requiring connection to a higher-level system backbone.
 - a. Lighting control zones (wired) support at least 128 devices per zone.
 - b. Capable of being networked with a higher-level system backbone to provide time-based control, control from inputs or systems external to control zone, and remote configuration and monitoring through a software interface.
6. Networked luminaires and intelligent lighting control devices with distributed intelligence programming stored in non-volatile memory, such that following any loss of power the lighting control zones operate according to their defined default settings and sequence of operations.
7. System to include one or more system controllers that provide time-based control.
8. System controller provides means of connecting the lighting control system to a system software interface and building management systems via BACnet/IP or BACnet MS/TP protocol.
9. System controller supports low voltage wired within a single controller device.
10. System devices support firmware update, either remotely or from within the application space, for purposes of upgrading functionality at a later date.
11. System capable of reporting lighting system events and performance data to management software for display and analysis.

B. Wired Networked Control Zone Characteristics:

1. Connections to devices within a wired networked lighting control zone and to backbone components accomplished with a single type of low-voltage network cable, compliant with CAT5e specifications or higher. Use of mixed types of low-voltage network cables is unacceptable.
2. Devices connected in "daisy-chain" topology. "Hub-and-spoke" topology, requiring all individual networked devices to be connected to a central component, is unacceptable, to reduce the total amount of network cable required for each control zone.
3. Pre-terminated, plenum-rated, low-voltage network cabling supplied with hardware.
4. Following proper installation and provision of power, all networked devices connected with low-voltage network cable must automatically form a functional lighting control zone without requiring any type of programming, regardless of the programming mechanism (e.g. software application, handheld remote, pushbutton).
 - a. The "out of box" default sequence of operation is intended to provide typical sequence of operation to minimize the system startup and programming requirements and to also have functional lighting control operation prior to system startup and programming.
5. System software capable of automatic discovery of all connected devices without requiring any provisioning of system or zone addresses.
6. Networked devices capable of detecting improper communication wiring and LED notification to alert installation/startup personnel.
7. Networked control devices suitable for control of egress or emergency light sources without additional, externally mounted UL 924 shunting or 0-10 V(dc) disconnect devices, to provide a compliant sequence of operation while reducing the overall installation and wiring costs of the system. Capable of supporting the following sequence of operation:
 - a. Low-Voltage Power Sensing: Devices automatically provide 100 percent light level upon detection of loss of power sensed via low-voltage network cable connection where applicable.

- b. Line-Voltage Power Sensing: Devices listed as UL 924 emergency relays which automatically close load-control relay and provide 100 percent light output upon detection of loss of power sensed via line voltage connection to normal power.
 - 8. Global Control Zones: Networked luminaires and intelligent lighting control devices located in different areas able to transmit and track information within at least 128 system-wide control zones to support required sequences of operation that may span multiple areas. Occupancy, photosensor inhibit, and switch commands available across multiple controllers.
 - 9. Wired Networked Wall Station Scene-Control Capabilities:
 - a. Preset Scenes that activate a specific combination of light levels across multiple local and global channels.
 - b. Local Profile Support: Profile Scenes that modify the sequence of operation for devices in the area (group) in response to a button press to dynamically optimize occupant experience and lighting energy usage.
 - 1) Wall stations able to manually start and stop local profiles, or local profile capable of ending after a specific duration of time between five minutes and 12 hours.
 - 2) Configurable Parameters:
 - a) Fixture light level.
 - b) Occupancy time delay.
 - c) Response to occupancy sensors (including enabling/disabling response).
 - d) Response to daylight sensors (including enabling/disabling response).
 - e) Enabling/disabling wall stations.
 - c. Three-Way or Multi-Way Control: Multiple wall stations capable of controlling the same local and global control zones, to support "multi-way" preset scene and profile scene control.
- C. System Integration Capabilities:
 - 1. Capable of interface with third-party building management systems (BMS) to support two-way communication using BACnet/IP protocol, BACnet MS/TP protocol, and RESTful API including the following system integration capabilities:
 - a. "Write" messages for control of individual devices, including control of relay and dimming output.
 - b. "Write" messages for control of groups of devices through a single command, including control of relay and dimming output of all devices.
 - c. "Read" messages for individual device status information.
 - 1) Available status will vary based on device type and capabilities, which may include relay state, dimming output, power measurement, occupancy sensor status, and photosensor light measurement.
 - d. "Read" messages for group status information for occupancy, relay state, and dimming output.
 - e. Activation of pre-defined system Global Profiles.
 - 2. Activation of Global Profiles from third-party systems via dry contact closure output signals or digital commands via RS-232 or RS-485.
 - 3. Activation of demand response levels from Demand Response Automation Servers (DRAS) via OpenADR 2.0a protocol.
- D. Supported Sequence of Operations:
 - 1. Control Zones:
 - a. Local Control Zones: Networked luminaires and intelligent lighting control devices installed in an area (also referred to as a group of devices) capable of transmitting and tracking occupancy sensor, photosensor, and manual switch information within at least 48 unique control zones to support different and reconfigurable sequences of operation within area. These will also be referred to as local control zones.

- b. Adjacent Control Zones: Networked luminaires and intelligent lighting control devices capable of tracking occupancy broadcasts from adjacent zones. When this feature is enabled, luminaire output for a vacant zone will reduce to a configurable dimmed state if one or more adjacent zones are occupied. Luminaires will turn off when both primary and adjacent zones are vacant.
 - c. Global Control Zones: Networked luminaires and intelligent lighting control devices located in different areas able to transmit and track information within at least 128 system-wide control zones to support required sequences of operation that may span across multiple areas. Occupancy, photosensor inhibit, and switch commands available across multiple controllers.
- 2. Wall Station Capabilities:
 - a. Wall stations support the following capabilities:
 - 1) On/Off of a local or global control zone.
 - 2) Continuous dimming control of light level of a local or global control zone.
 - b. Multi-Way Control: Multiple wall stations capable of controlling the same local or global control zones, to support "multi-way" switching and dimming control.
- 3. Occupancy Sensing Capabilities:
 - a. Occupancy sensors configurable to control a local or global zone.
 - b. Multiple occupancy sensors capable of controlling the same local or global zones. This capability combines occupancy sensing coverage from multiple sensors without consuming multiple control zones.
 - c. Occupancy sensing sequence of operation modes:
 - 1) On/Off Occupancy Sensing.
 - 2) Partial-On Occupancy Sensing.
 - 3) Partial-Off Occupancy Sensing.
 - 4) Vacancy Sensing (Manual-On / Automatic-Off).
 - d. On/Off, Partial-On, and Partial-Off Occupancy Sensing Modes Sequence of Operation:
 - 1) Occupancy automatically turn lights on to a designated level when occupancy is detected. Designated occupied light level support at least 100 dimming levels.
 - 2) Occupancy sensors automatically turn lights off or to a dimmed state (Partial-Off) when vacancy occurs or if sufficient daylight is detected. Designated unoccupied dim level support at least 100 dimming levels.
 - 3) System capable of combining Partial-Off and Full-Off operation by dimming lights to a designated level when vacant and turning the lights off completely after an additional time delay.
 - 4) Photosensor readings, if enabled in occupancy sensing control zone, automatically adjust light levels during occupied or unoccupied conditions as necessary.
 - 5) Wall station activation changes the dimming level or turn lights off as selected by the occupant. Lights optionally remain in this manually specified light level until the zone becomes vacant. Upon vacancy, normal sequence of operation resumes.
 - e. Vacancy Sensing or Manual-On/Automatic-Off Mode Sequence of Operation:
 - 1) Activation of a wall station is required turn lights on. System capable of programming the zone to turn on to either a designated light level or previous user-set light level. Initially occupying the space without using a wall station must not result in lights turning on.
 - 2) Occupancy sensors automatically turn lights off or to a dimmed state (Partial-Off) when vacancy occurs or if sufficient daylight is detected. Designated unoccupied dim level support at least 100 dimming levels.
 - 3) System capable of dimming the lights when vacant and then turning the lights off completely after an additional time delay.

- 4) System capable of an "automatic grace period" immediately following detection of vacancy, during which time any detected occupancy results in the lights reverting to the previous level. After the grace period has expired, the use of a wall station is required to turn lights on.
- 5) Photosensor readings, if enabled in the Occupancy Sensing control zone, capable of automatically adjusting the light level during occupied or unoccupied conditions as necessary.
- 6) Wall station interaction changes the dimming level or turn lights off as selected by occupant. Lights remain at manually specified light level until zone becomes vacant; normal sequence of operation resumes upon vacancy.
- f. Occupancy time delays before dimming or shutting off lights separately programmable for all control zones from 15 seconds to 2 hours.
4. Photosensor Sensing Capabilities (Automatic Daylight Sensing):
 - a. Photosensor devices configurable to control a local zone.
 - b. Photosensor-Based Control:
 - 1) Continuous Dimming: Control zone automatically adjusts dimming output in response to photosensor readings, to maintain a minimum light level consisting of both electric light and daylight sources. Photosensor response configurable to adjust set point and dimming rates.
5. Schedule Capabilities:
 - a. System capable of time schedules for time-of-day to override devices including offsets from dusk and dawn.
 - b. System capable of providing a visible "blink warning" five minutes prior to the end of the schedule.
 - c. Wall stations may be programmed to provide timed extensions/overrides that turn the lights on for an additional time period.
 - 1) Timed override/extension duration programmable for each individual device, zone of devices, or customized group of devices, from five minutes to 12 hours.
6. Global Profile Capabilities:
 - a. System capable of automatically modifying the sequence of operation for selected devices in response to any of the following:
 - 1) Time-of-day schedule.
 - 2) Contact closure input state.
 - 3) Manually triggered wired wall station input.
 - 4) RS-232/RS-485 command to wired input device.
 - 5) BACnet input command.
 - b. Global Profile Capabilities:
 - 1) Global Profiles stored within and executed from the system controller (via internal timeclock). Dedicated software host or server is not required to be online to support automatic scheduling and/or operation of Global Profiles.
 - 2) Global Profile time-of-day schedules capable of recurrence settings including daily, specific days of week, every "n" number of days, weekly, monthly, and yearly. Lighting control global profile schedules support definition of start date, end date, end after "n" recurrences, or never ending.
 - 3) Daylight savings time adjustments capable of being performed automatically, if desired.
 - 4) Global Profile holiday schedules follow recurrent settings for specific U.S. holiday dates regardless if they always occur on a specific date or are determined by day/week of the month.
 - 5) Global Profiles capable of being scheduled to run according to timed offsets relative to sunrise or sunset. Sunrise/sunset times automatically derived from location information using an astronomical clock.
 - 6) Software management interface capable of displaying a graphic calendar view of profile schedules for each control zone.

- 7) Global Profiles capable of manual activation directly from system controller, specially programmed wired input devices, scene-capable wired wall stations, and software management interface.
- 8) Global Profiles selectable to apply to a single device, zone of devices, or customized group of devices.
- 9) Global Profile Configurable Parameters:
 - a) Fixture light level.
 - b) Occupancy time delay.
 - c) Response to occupancy sensors (including enabling/disabling response).
 - d) Response to daylight sensors (including enabling/disabling response).
 - e) Enabling/disabling of wall stations.
- c. Local and Global Profiles backed up and stored on software's host server such that Profile backup can be applied to a replacement system controller or wired wall station.
- 7. System supports automated demand response capabilities with automatic reduction of light level to at least three levels of demand response, configurable for each output device.

2.3 SYSTEMS SOFTWARE INTERFACES

- A. Management Interface:
 - 1. Web-based management interface for remote system control, live status monitoring, and configuration of lighting control settings and schedules.
 - 2. Compatible with industry-standard web browser clients.
 - 3. Minimum of 100 unique password-protected user accounts.
 - 4. Minimum of three user permission levels: read-only, read and change settings, and full administrative system access.
 - 5. Capable of restricting access for user accounts to specific devices within the system.
 - 6. All system devices capable of being given user-defined names.
 - 7. Device identification information displayed in the Management interface including:
 - a. Model number.
 - b. Model description.
 - c. Serial number or network ID.
 - d. Manufacturing date code.
 - e. Custom label.
 - f. Parent network device.
 - 8. Management interface capable of displaying live status of a networked luminaire or intelligent control device including:
 - a. Luminaire on/off status.
 - b. Dim level.
 - c. Power consumption.
 - d. Device temperature.
 - e. PIR occupancy sensor status.
 - f. Microphonic occupancy sensor status.
 - g. Remaining occupancy time delay.
 - h. Photosensor reading.
 - i. Active Profiles.
 - 9. Management interface capable of displaying and modifying the current active settings of a networked luminaire or intelligent control device including:
 - a. Dimming trim levels.
 - b. Occupancy sensor and photosensor enable/disable.
 - c. Occupancy sensor time delay and light level settings.
 - d. Occupancy sensor response (normal or vacancy).
 - e. Photosensor setpoints and transition time delays.

10. Management interface capable of applying settings changes for a zone of devices or a group of selected devices using a single action that does not require the user to apply settings changes for each individual device.
 11. Management interface capable of compiling a printable network inventory report.
 12. Management interface capable of compiling a printable report detailing all system profiles.
 13. All sensitive information stored encrypted.
 14. System software updates available for automatic download and installation via the Internet.
- B. System Energy Analysis and Reporting:
1. Intuitive graphical screens to facilitate simple viewing of system energy performance.
 2. Energy Scorecard: Summarized display that indicates calculated energy savings in dollars or KWh.
 3. Software calculates allocation of energy savings by control measures including occupancy sensors, photosensors, and manual switching.
 4. Energy savings data calculated for the system as a whole.
 5. Time-scaled graph showing all relay transitions.
 6. Time-scaled graph showing zone occupancy time delays.
 7. Time-scaled graph showing the total light level.
 8. Software capable of storing information remotely onto an open-source, object-relational database, such as PostgreSQL.
 9. Data stored in the database will be accessed utilizing an open standard, application programming interface, such as Open Database Connectivity (ODBC).
- C. Visualization and Programming Interfaces:
1. System provides an optional web-based visualization interface that displays a graphical floorplan.
 2. Graphical floorplan will offer the following types of system visualization:
 - a. Full Device Option: Master graphic of entire building, by floor, showing each control device installed with zones outlined including:
 - 1) Controls embedded light fixtures.
 - 2) Controls devices not embedded in light fixtures.
 - 3) Daylight sensors.
 - 4) Occupancy sensors.
 - 5) Wall switches and dimmers.
 - 6) Scene controllers.
 - 7) Networked relays.
 - 8) Wired bridges.
 - 9) System Controllers.
 - 10) Wired relay panels.
 - 11) Group outlines.
 - b. Group-Only Option: Master graphic of the entire building, by floor, showing only control groups outlined.
 - c. Pan and zoom commands supported to allow smaller areas to be displayed on a larger scale simply by panning and zooming each floor's master graphic.
 - d. Selecting any control device displays the following as applicable:
 - 1) Device catalog number.
 - 2) Device name and custom label.
 - 3) Device diagnostic information.
 - 4) Link to further information on device including status or current configuration.
 3. Programming capabilities through the application will include the following:
 - a. Switch, occupancy sensor, and photosensor zone configuration.
 - b. Manual-on or automatic-on modes.
 - c. Turn-on and dim to dimming levels.
 - d. Occupancy sensor time delays and PIR sensitivity.

- e. Dual technology occupancy sensors sensitivity.
 - f. Photosensor calibration adjustment and auto-setpoint.
 - g. Multiple photosensor zone offset.
 - h. Trim level settings.
 - i. Preset scene creation and copy for scene-capable devices.
 - j. Application of custom device labels to the Bluetooth Low-Energy Programming Devices and individual connected lighting control devices.
 - k. Fade rate settings.
- D. Smartphone Programming Interface for Wired Devices:
- 1. Interface provided for both Apple iOS and Android operating systems that allows configuration of lighting control settings.
 - 2. Application supports configuration of wired networked control devices.
 - a. Connected device access granted through user-defined passcode at initial install.
 - b. Indication of signal strength where multiple Bluetooth Low-Energy Programming Devices are available for configuration.
 - 3. Programming Capabilities:
 - a. Switch, occupancy sensor, and photosensor group configuration.
 - b. Manual-on or automatic-on modes.
 - c. Turn-on and dim to dimming levels.
 - d. Occupancy sensor time delays and PIR sensitivity.
 - e. Dual technology occupancy sensors sensitivity.
 - f. Photosensor calibration adjustment and auto-setpoint.
 - g. Multiple photosensor zone offset.
 - h. Trim level settings.
 - i. Preset scene creation.
 - j. Application of custom device labels for individual connected lighting control devices.
 - k. Fade rate settings.

2.4 SYSTEM BACKBONE AND SYSTEM INTEGRATION EQUIPMENT

- A. System Controller: Multi-tasking, real-time digital control processor consisting of modular hardware with plug-in enclosed processors, communication controllers, and power supplies.
- 1. Basis-of-Design Product: Subject to compliance with requirements, provide nLight; Acuity Brands Lighting, Inc.; nECY or comparable product by one of the following:
 - a. Cooper Industries, Inc.
 - b. Leviton Manufacturing Co., Inc.
 - 2. System Controller Processor: 32-bit microprocessor operating at a minimum of 1 GHz.
 - 3. System Controller Memory: Minimum of 512MB memory, with a minimum of 4GB non-volatile flash, to support operating system and databases.
 - 4. System Controller Functions:
 - a. Time-based control of downstream wired network devices.
 - b. Linking into an Ethernet network.
 - c. Integration with Building Management Systems (BMS) and Heating, Ventilation and Air Conditioning (HVAC) equipment.
 - d. Connection to various software interfaces, including management interface, historical database and analytics interface, and visualization interface.
 - 5. Integral web server to support system controller configuration and diagnostics.
 - a. Web Server Control Interface:
 - 1) Display associated devices within the context of a graphical floorplan.
 - 2) Provide control of output-capable devices through virtual sliders, toggle buttons, preset level widgets, and transparent layers on floorplan.
 - 3) Control Capabilities:
 - a) Control of individual output devices, including control of relay state and analog dimming level where applicable.

- b) Control of local lighting control zones, including control of relay state and analog dimming level where applicable.
 - c) Control of global lighting control zones, including control of relay state and analog dimming level where applicable.
 - d) Control of Global Profiles.
 - b. Visualization Interface:
 - 1) Customizable display with the ability to superimpose colored, transparent layers representing real-time property values, including occupancy status, dimming level status, light level status, and online or offline status where applicable.
 - 2) Ad hoc display of trended information via an intuitive values-over-time graph.
 - 3) Report Creation:
 - a) Reports accept and graphically display trended status datasets for creator selected devices or zones of devices.
 - b) Report information displayed over a user-defined interval and date range.
 - c) Reports exportable to a standard CSV format.
- 6. Graphical touch screen to support configuration and diagnostics.
- 7. Minimum of three RJ-45 networked lighting control ports for connection to any of the following:
 - a. Graphical touch screen.
 - b. Wired communication bridges.
 - c. Direct connection to networked wired luminaires and intelligent lighting control devices (up to 128 total devices per port).
- 8. Device will automatically detect all network-connected devices.
- 9. Capable of managing and operating a minimum of 750 networked devices (wired) per system controller.
- 10. Multiple System Controllers capable of connection via LAN for scalability to a minimum of 20,000 networked devices.
- 11. Supports BACnet/IP and BACnet MS/TP protocols to directly interface with BMS and HVAC equipment without additional protocol translation gateways.
 - a. BACnet MS/TP Connection Speed: 9600 to 115200 baud rate.
 - b. BACnet Testing Laboratory (BTL listed) using Device Profile BACnet Building Controller (B-BC) with outlined enhanced features.
- 12. Integral FIPS 140-2, Level 1 cryptographic module.
- 13. Supports RESTful API for control of BACnet objects, user management, date and time, and file management.
- 14. NEMA 1 enclosure with Class 1 and Class 2 separation.
 - a. Power Supply Voltage: **120 to 277V(ac)**.
- 15. System Controller Security Provisions:
 - a. Disallow the use of default passwords and require passwords to be updated prior to use.
 - b. Support user role-based access, such as administrator, user, and viewer.
 - c. Signed firmware to ensure that unmodified, authentic software is always installed.
 - d. IP-based communication protected with strong encryption algorithms such as AES or TLS1.2+.
 - e. Prevent rollback of firmware to firmware versions with known, critical vulnerabilities.
 - f. Valid cybersecurity listing through a third party.
- 16. Cellular Remote Access: Cellular router and modem for remote access.
 - a. Router supports remote access to at least five system controllers on its local area network or network subnet.
 - b. Remote access capable of device setting updates, schedule updates, system performance optimization, and diagnostics.

- c. Remote access enabled through outbound communication from router to an outside source. Solutions that begin communication via inbound requests for network access are unacceptable.
- d. Router supports outbound communication to manufacturer-hosted portal using TLS1.2 or greater in-transit encryption over a cellular or Ethernet connection.
- e. Router with integral firewall to prevent unauthorized access to devices connected to its local area network port.
- f. Router includes cellular SIM capable of connection to AT&T, T-Mobile, Sprint, US Cellular, Alaska Wireless, Telefonica, Tellus, Bell, or Sasktel networks where carrier service is available.
- g. Outbound communication from the router limited to whitelisted endpoints. Devices that allow unrestricted communication are unacceptable.
- h. Outbound communication from router includes only lighting control system information.

2.5 WIRED NETWORKED DEVICES

- A. Wired Networked Wall Switches, Dimmers, Scene Controllers:
 - 1. Basis-of-Design Product: Subject to compliance with requirements, provide nLight; Acuity Brands Lighting, Inc.; or comparable product by one of the following:
 - a. Cooper Industries, Inc.
 - b. Leviton Manufacturing Co., Inc.
 - 2. Mounting: Suitable for installation in single-gang switch box.
 - 3. Communication and low-voltage power delivered via standard low-voltage network cabling with RJ-45 connectors.
 - 4. All switches detect valid communication and blink a unique LED pattern to visually indicate a potential wiring issue.
 - 5. Devices with mechanical push buttons provide tactile and LED user feedback.
 - 6. Devices with mechanical push buttons manufactured with custom button labeling.
 - 7. Wall switch and dimmer options:
 - a. Control Types Supported:
 - 1) On/Off.
 - 2) On/Off/Dimming.
 - 3) On/Off/Dimming/Correlated Color Temperature Control for specific luminaire types.
 - b. Color: **White**.
 - 8. Scene Controller Options:
 - a. Control Types Supported:
 - 1) On/Off.
 - 2) On/Off/Dimming.
 - 3) Preset Level Scene Type.
 - 4) On/Off/Dimming/Preset Level for Correlated Color Temperature.
 - 5) Reprogramming of other devices within daisy-chained zone to implement user-selected lighting scene including manual start/stop from the scene controller, or optionally programmed automatic stop after a user-selectable duration between five minutes and 12 hours.
 - 6) Selecting a lighting profile to be run by device's upstream controller to implement a selected lighting profile across multiple zones including manual start/stop from the scene controller, or optionally programmed automatic stop after a user selectable duration between five minutes and 12 hours.
 - b. Color: **White**.

- B. Networked Graphic Wall Stations:
1. Basis-of-Design Product: Subject to compliance with requirements, provide nLight; Acuity Brands Lighting, Inc.; nPOD TOUCH or comparable product by one of the following:
 - a. Cooper Industries, Inc.
 - b. Leviton Manufacturing Co., Inc.
 2. Mounting: Suitable for installation in single-gang switch box.
 3. Integral 3.5-inch (88 mm) capacitive full-color touch screen.
 4. Power via polarity insensitive Class 2 low-voltage 15 to 24V (dc) power supply.
 5. Device enables mobile application control of control zones and scenes through Bluetooth.
 6. Communication over standard low-voltage network cabling with RJ-45 connectors.
 7. User-customizable screen saver utilizing uploaded image file in common file format including jpg, png, gif, bmp, or tif.
 8. Capable of configuration of all switches, dimmers, control zones, and lighting preset scenes via password-protected setup screens.
 9. Graphic Wall Station Options:
 - a. Number of Control Zones: Up to 16.
 - b. Number of Scenes: Up to 16.
 - c. Profile Scene Duration: User configurable from five minutes to 12 hours.
 - d. Color: **White**.
- C. Digital Time Clock:
1. Basis-of-Design Product: Subject to compliance with requirements, provide nLight; Acuity Brands Lighting, Inc.; nDTC or comparable product by one of the following:
 - a. Cooper Industries, Inc.
 - b. Leviton Manufacturing Co., Inc.
 2. Controls a linear bus of lighting devices supplying all time functions without connection to a system controller.
 - a. Programming of the linear bus of lighting devices must not require additional hardware, including computers, specialized dongles, or other connection devices.
 - b. Programming of the linear bus exclusively done through the touch-screen interface.
 3. Capable of up to 32 schedules. Each schedule consists of one set of On and Off times per day for each day of the week and for each of two holiday lists. Schedules assignable to any individual relay or group of relays.
 4. Operates from non-volatile memory so that all system programming is retained indefinitely.
 5. Mounted inside a relay panel to eliminate the necessity for additional enclosures for complete installation.
 6. Capacitive 3.5-inch (88 mm), full-color touch screen.
- D. Wired Networked Digital Key Switches:
1. Basis-of-Design Product: Subject to compliance with requirements, provide nLight; Acuity Brands Lighting, Inc.; nPODA KEY or comparable product by one of the following:
 - a. Cooper Industries, Inc.
 - b. Leviton Manufacturing Co., Inc.
 2. Mounting: Suitable for installation in single-gang switch box.
 3. Communication and low-voltage power delivered via standard low-voltage network cabling with RJ-45 connectors.
 4. All switches detect valid communication and blink a unique LED pattern to visually indicate a potential wiring issue.
 5. LED user feedback to provide indication of on/off status of the programmed lights or scene, as well as indication of device power.

6. Digital Key Switch Options:
 - a. Control Types Supported:
 - 1) On/Off.
 - 2) On/Off/Dimming.
 - 3) Preset Level Scene Type.
 - 4) On/Off/Dimming/Preset Level for Correlated Color Temperature.
 - 5) User-programmed local lighting scene run within a daisy-chained group including manual start/stop from the switch, or optionally programmed automatic-stop after a user-selectable duration between five minutes and 12 hours.
 - 6) User-programmed global lighting profile run by an upstream controller across multiple groups including manual start/stop from the switch, or optionally programmed automatic-stop after a user-selectable duration between five minutes and 12 hours.
 - b. Color: **White**.
- E. Wired Networked Auxiliary Input/ Output (I/O) Devices:
 1. Basis-of-Design Product: Subject to compliance with requirements, provide nLight; Acuity Brands Lighting, Inc.; nIO series or comparable product by one of the following:
 - a. Cooper Industries, Inc.
 - b. Leviton Manufacturing Co., Inc.
 2. Plenum rated.
 3. Communication and low-voltage power delivered to each device via standard low-voltage network cabling with RJ-45 connectors.
 4. Auxiliary Input/ Output Devices Options:
 - a. Contact closure or pull-high input.
 - 1) Input programmable to support maintained or momentary inputs that can activate local or global scenes and profiles, activate lights at a preconfigured level, ramp light level up or down, or toggle lights on/off.
 - b. 0-10V analog input.
 - 1) Input supports zero to 10 V dimming output control from a dimmer switch.
 - 2) Input programmable to function as a daylight sensor.
 - c. RS-232/RS-485 digital input.
 - 1) Input supports activation of up to four local or global scenes and profiles, and on/off/dimming control of up to 16 local control zones.
 - 2) Provides relay and dimming level status to external device (e.g. Touchscreen) when polled.
 - d. 0-10V dimming control output, capable of sinking up to 20mA.
 - 1) Output programmable to support all standard sequence of operations supported by system.
 - e. Digital control output via eidoLED LEDcode communication.
 - 1) Output programmable to support light intensity control, as well as optional correlated color temperature (CCT) control, of the connected luminaire.
- F. Wired Networked DMX Interface Stations:
 1. Basis-of-Design Product: Subject to compliance with requirements, provide nLight; Acuity Brands Lighting, Inc.; nPWDMX or comparable product by one of the following:
 - a. ETC.
 - b. Lutron.
 2. Description: Multi-protocol, bidirectional DMX512 playback (snapshot) and lighting control gateway.
 - a. Capable of control of networked luminaire or all normal power lighting load types.
 - b. Capable of control of DMX lighting through:
 - 1) DMX input for snapshot capture of lighting presets.
 - 2) Live control of intensity, hue, and saturation of configured DMX Zones from connected stations.

- c. Integral LED indicators for power, network traffic, processor health, identify, DMX port configuration and status.
- d. Support recall of up to 16 (total):
 - 1) Prerecorded scenes/snapshots for playback.
 - 2) DMX zones.
- e. Capable of preset playback as activated by any connected control station.
- f. Capable of DMX pass-through for real-time output of incoming DMX levels.
- g. Support four universes of ANSI E1.31 sACN-Streaming ACN (sACN), including priorities, for snapshot capture and recall.
- h. Support ANSI E1.20 RDM with PC-based software.
- i. Act as an ANSI E1.33 RDMnet controller.
- 3. General Requirements:
 - a. Operating Voltages:
 - 1) PoE Class 2 Device.
 - 2) 24 V(dc) (not used if using PoE), 7 W maximum power consumption.
 - b. Operating Temperature: Minus 32 to plus 113 deg F (0 to 45 deg C).
 - c. DIN-Rail Mounted on DIN 43880 (35/7.5) rail.
 - d. NEMA Type 1 enclosure.
 - 1) Enclosure Size: 10 inches (260 mm) wide by 13 inches (330 mm) high by 4.5 inches (114 mm) deep.
- 4. Features:
 - a. Lighting control ports supports:
 - 1) Communication through lighting control (RJ-45) ports that supply 40 mA of power to each device via standard Category 5e low-voltage network cabling.
 - 2) Detection of valid communication and blinking of a unique LED pattern to visually indicate a potential wiring issue.
 - b. DMX Ports:
 - 1) Comply with the requirements of ANSI E1.11 USITT DMX512-A standards.
 - 2) Configurable as Input or Outputs.
 - 3) Support ANSI E1.31 sACN.
 - 4) Support Pathway Secure Streaming ACN (ssACN).
 - 5) Comply with California Title 1.81.26.
 - 6) Comply with ANSI E1.20 RDM.
 - 7) Capable of withstanding fault voltages of up to 250 V(ac) without damage.
 - c. Dry contact closure input to connect with external control systems to control a lighting control zone or scene.
 - d. Ethernet Ports:
 - 1) Support IEEE 802.3af Power-over-Ethernet in absence of 24 V(dc).
 - 2) Support auto-negotiated 10/100MB connections speeds.
 - 3) Support IEEE 802.1AB Link Layer Discovery Protocol.
 - e. Test Functions:
 - 1) Operate without need of a configuration PC to check local wiring.
 - 2) Test connectivity with DMX lights and networked luminaire or all normal power lighting load types.
 - f. Complies with the following:
 - 1) RoHS 2011/65/EU + A1 2015/863.
 - 2) FCC.

G. Wired Networked Occupancy and Photosensors:

- 1. Basis-of-Design Product: Subject to compliance with requirements, provide nLight; Acuity Brands Lighting, Inc.; or comparable product by one of the following:
 - a. Cooper Industries, Inc.
 - b. Leviton Manufacturing Co., Inc.
- 2. Detect the presence of human activity within space and fully control the on/off function of lights.

3. Utilize passive infrared (PIR) technology, which detects occupant motion, to initially turn lights on from an off state, thus preventing false on conditions. Ultrasonic and Microwave-based sensing technologies are unacceptable.
4. Dual technology sensors used in locations where a second method of sensing is necessary to adequately detect maintained occupancy (such as in rooms with obstructions).
5. Dual technology sensors must have one sensing technology not motion dependent to detect occupancy. Acceptable dual technology includes PIR/Microphonics (also known as Passive Dual Technology or PDT), which detects both occupant motion and sounds indicating occupants. Sensors where both technologies detect motion (PIR/Ultrasonic) are unacceptable.
6. All sensing technologies are acoustically passive, meaning they do not transmit sound waves of any frequency (for example in the Ultrasonic range), as these technologies have the potential for interference with other electronic devices within the space (such as electronic white board readers and hearing devices). Acceptable detection technologies include Passive Infrared (PIR), and/or Microphonic technology. Ultrasonic and Microwave-based sensing technologies are unacceptable.
7. Ceiling, fixture, recessed, and corner mounted sensors available, with multiple lens options available customized for specific applications.
8. Communication and low-voltage power delivered to each device via standard low-voltage network cabling with RJ-45 connectors.
9. All sensors detect valid communication and blink a unique LED pattern to visually indicate a potential wiring issue.
10. Sensor programming parameter available and configurable remotely from the software and locally via the device push button.
11. Ceiling mount occupancy sensors include one integrated dry contact switching relay, capable of switching 1 A at 24 V, resistive only.
12. Sensors available with one or two occupancy "poles," each of which provides a programmable time delay.
13. Photosensor/daylight override, automatic dimming control, and low temperature/high humidity operation.
14. Photosensor provide one on/off set-point and include a dead band to prevent the artificial light from cycling. Delay incorporated into the photosensor to prevent rapid response to passing clouds.
15. Photosensor and dimming sensor's set-point and dead band automatically calibrated through the sensor's microprocessor by initiating an "Automatic Set-Point Programming" procedure. Min and max dim settings as well as set-point may be manually entered or modified.
16. Dead band setting verified and modified by the sensor automatically every time the lights cycle to accommodate physical changes in the space (i.e., furniture layouts, lamp depreciation, or lamp outages).
17. Dual zone option available for On/Off Photosensor, Automatic Dimming Control Photosensor, or Combination units. The secondary daylight zone capable of being controlled as an "offset" from the primary zone.

H. Wired Networked Wall Switch Sensors:

1. Basis-of-Design Product: Subject to compliance with requirements, provide nLight; Acuity Brands Lighting, Inc.; or comparable product by one of the following:
 - a. Cooper Industries, Inc.
 - b. Leviton Manufacturing Co., Inc.
2. Mounting: Suitable for installation in single-gang switch box.
3. Communication and low-voltage power delivered via standard low-voltage network cabling with RJ-45 connectors.
4. All switches detect valid communication and blink a unique LED pattern to visually indicate a potential wiring issue.
5. Devices with mechanical push buttons provide tactile and LED user feedback.

6. Wall Switch Sensor Options:
 - a. User Input Control Types: **On/Off/Dimming**.
 - b. Occupancy Sensing Technology: **PIR only**.
 - c. Daylight Sensing Option: Inhibit Photosensor.
 - d. Color: **White**.

- I. Wired Networked Embedded Fixture Sensors:
 1. Basis-of-Design Product: Subject to compliance with requirements, provide nLight; Acuity Brands Lighting, Inc.; nES or comparable product by one of the following:
 - a. Cooper Industries, Inc.
 - b. Leviton Manufacturing Co., Inc.
 2. Network system sensors with occupancy sensors and/or dimming photosensors that can be embedded into luminaire such that only the lens shows on luminaire face.
 3. Occupancy sensor detection pattern suitable for 7.5 to 20-ft. (2.2 to 6-m) mounting heights.

- J. Wired Networked Power Packs:
 1. Basis-of-Design Product: Subject to compliance with requirements, provide nLight; Acuity Brands Lighting, Inc.; nPP16 series or comparable product by one of the following:
 - a. Cooper Industries, Inc.
 - b. Leviton Manufacturing Co., Inc.
 2. Plenum rated.
 3. Communication will be delivered to each device via standard low-voltage network cabling with RJ-45 connectors.
 4. Supply Voltage: **120 to 277V(ac)**.
 5. Relay Output: Class 1 relay rated for 16 A at **277 V(ac)** and 1/2 HP at 120 V(ac).
 6. Dimming Output: 0-10 VDC Dimming output.
 7. Sink Current: 100 mA at 0-10 V(dc).
 8. Mounting: Integral 1/2-inch (16-mm) chase nipple. Plastic clips into junction box are unacceptable.

- K. Wired Networked Relay and Dimming Panel:
 1. Basis-of-Design Product: Subject to compliance with requirements, provide nLight; Acuity Brands Lighting, Inc.; ARP or comparable product by one of the following:
 - a. Cooper Industries, Inc.
 - b. Leviton Manufacturing Co., Inc.
 2. Field Configurable Relays (FCR):
 - a. Field configurable to operate in single-, double-, or triple-pole relay groupings.
 - b. Field configurable to operate as normally closed or normally open.
 - c. Provides visual status of current state and manual override control of each relay.
 - d. Minimum Relay Contact Ratings:
 - 1) 40 A at 120-480 V(ac) Ballast.
 - 2) 16 A at 120-277 V(ac) Electronic.
 - 3) 20 A at 120-277 V(ac) Tungsten.
 - 4) 20 A at 48V (dc) Resistive.
 - 5) 2 HP at 120 V(ac).
 - 6) 3 HP at 240-277 V(ac).
 - 7) 65kA SCCR at 480 V(ac).
 3. Dimming Output Rating: Minimum of 100 mA sink current per dimming output.
 4. Relay and dimming outputs individually programmable.
 5. Listing: UL 924 for control of emergency lighting circuits.
 6. Power Supply: Integrated **120-277V(ac)** supply.
 7. Low-Voltage Sensor Input:
 - a. Configurable to support any of the following input types:
 - 1) Indoor Photosensor.

- 2) Outdoor Photosensor.
 - 3) Occupancy Sensor.
 - 4) Contact Closure.
 - b. Low-voltage sensor input provides 24 V(dc) power for sensor so additional auxiliary power supplies are not required.
 - c. Sensor input supports all standard sequence of operations.
 - 8. Integrated Digital Time Clock for local schedule control.
 - 9. Contact Closure Input: One for each group of eight output relays that acts as a panel override to activate the normally configured state of all associated relays (i.e., normally open or normally closed).
 - 10. Panel supplies current limited low-voltage power to other networked devices connected via low-voltage network cable.
 - 11. Enclosure:
 - a. Enclosure Rating: NEMA 1.
 - b. In "Mounting" Subparagraph below, flush-mounted option is only available for panels with up to 16 relay outputs.
 - c. Mounting: **Surface** mounted.
 - d. In "Cover" Subparagraph below, screw-fastened cover option is only available for panels with up to 16 relay outputs.
 - e. Cover: **Hinged cover with keyed lock.**
- L. Wired Networked Bluetooth Low-Energy Programming Device:
- 1. Basis-of-Design Product: Subject to compliance with requirements, provide nLight; Acuity Brands Lighting, Inc.; nIO BT or comparable product by one of the following:
 - a. Cooper Industries, Inc.
 - b. Leviton Manufacturing Co., Inc.
 - 2. Plenum rated, inline wired, and screw mountable.
 - 3. Communication and low-voltage power delivered to device via standard low-voltage network cabling with RJ-45 connectors.
 - 4. Bluetooth communication allows connection from smartphone application for programming device settings within the local daisy-chain zone.
 - 5. Device provides visual indication of remote Bluetooth connection via LED integrated into device enclosure such that it is visible from all angles while the zone is being programmed.
- M. Wired Networked Communication Bridge:
- 1. Basis-of-Design Product: Subject to compliance with requirements, provide nLight; Acuity Brands Lighting, Inc.; nBRG or comparable product by one of the following:
 - a. Cooper Industries, Inc.
 - b. Leviton Manufacturing Co., Inc.
 - 2. Suitable for surface mount to a standard 4 by 4-inch (100 by 100 mm) square junction box.
 - 3. Communication Ports: Eight RJ-45 ports for connection to lighting control zones (up to 128 devices per port), additional network bridges, and System Controller.
 - 4. Capable of aggregating communication from multiple lighting control zones for purposes of minimizing backbone wiring requirements back to System Controller.
 - 5. Power Input: Class 2 low-voltage supplied locally via a directly wired power supply.
 - 6. Wired Bridge capable of redistributing power from its local supply and connected lighting control zones with excess power to lighting control zones with insufficient local power. Architecture enables loss of power to a particular area to be less impactful on network lighting control system.

PART 3 EXECUTION

3.1 INSTALLATION OF WIRING

- A. Wiring Method: Comply with Section 26 05 19 "Low-Voltage Electrical Power Conductors and Cables".
 - 1. Comply with requirements for raceways and boxes specified in Section 26 05 33 - Raceway and Boxes for Electrical Systems"
- B. Wiring within Enclosures: Bundle, lace, and train conductors to terminal points with no excess and without exceeding manufacturer's limitations on bending radii. Install lacing bars and distribution spools.

3.2 IDENTIFICATION

- A. Identify system components, wiring, cabling, boxes, cabinets, and terminals. Comply with identification requirements specified in Section 26 05 53 "Identification for Electrical Systems."
- B. Identify field-installed conductors, interconnecting wiring, and components; install warning signs complying with Section 26 05 53 "Identification for Electrical Systems."
- C. Identify all controls with device address.
- D. Label each device cable within 6 inch (152 mm) of connection to bus power supply or termination block.

3.3 FIELD QUALITY CONTROL

- A. Acceptance Testing Preparation:
 - 1. Test continuity of each circuit.
- B. Field tests and inspections must be witnessed by **Architect**.
- C. Tests and Inspections: **Engage a factory-authorized service representative to perform** test inspections.
 - 1. Test each zone using local and remote control hardware.
 - 2. Perform each visual and mechanical inspection and electrical test stated in NETA ATS. Certify compliance with test parameters.
- D. Nonconforming Work:
 - 1. Lighting controls will be considered defective if they do not pass tests and inspections.
 - 2. Correct malfunctioning units on-site, where possible, and retest to demonstrate compliance; otherwise replace with new units and retest.
- E. Field Test Reports: Engage a factory-authorized service representative to prepare field test reports.
 - 1. Prepare functionality and inspection reports, including a certified report that identifies controls included and describes test results. Include notation of deficiencies detected, remedial action taken, and observations made after remedial action.
 - 2. Include list of all points created from actual tests of all addressed control points for lamps, ballasts, manual controls, and sensors.

3.4 REMOTE ACCESS

- A. Digital network lighting control system capable of remote access by manufacturer with the following features:
 - 1. System diagnostics including detection of fault condition in hardware or connected devices.
 - 2. Access to all connected devices for complete programming including scheduling of time-of-day events and device parameters necessary to meet required sequence of operations.
 - 3. Browser-based interface to verify system functionality.
 - 4. On-demand access to manufacturer technical support for remote troubleshooting, diagnostics, configuration, and programming.
 - 5. Owner training on the digital network lighting control system available remotely.
- B. Remote access system fully functional over commercial cellular connection or Internet-connected ethernet network.
- C. All hardware associated with remote access including cellular modem and cellular antenna are to remain on-site regardless of warranty or cellular contract status.

3.5 SYSTEM STARTUP

- A. Engage a factory-authorized service representative to perform startup service.
 - 1. Complete installation and startup checks in accordance with manufacturer's published instructions.
 - 2. Activate luminaires and verify that all maximum output levels match output levels detailed in an Owner-approved sequence of operations.
 - 3. Confirm correct communications wiring, initiate communications between control devices and controller/gateways, and program the lighting control system in accordance with approved configuration schedules, time-of-day schedules, and input override assignments.
 - 4. Program network devices to meet required sequence of operations.
 - 5. Program and verify all sequence of operations.
 - 6. Create backup of system programming.
 - 7. Assist in installation of system software on customer-provided workstation or server.
 - 8. Verify bidirectional communication of manufacturer-provided cellular router with manufacturer-managed remote access portal.
- B. Commissioning Walkthrough: **Engage factory-authorized service representative to collaborate with third-party commissioning agent** to demonstrate lighting control system functionality and verify the system meets the specified Project requirements.

3.6 CLOSEOUT ACTIVITIES

- A. Enhanced Documentation: Engage lighting system manufacturer to provide comprehensive system documentation including detailed programming, sequence of operation data per Project specifications, and related code requirements.
- B. Training: Engage lighting system manufacturer to provide comprehensive system overview, software overview, and documentation relating to system operation and maintenance.

3.7 PROTECTION

- A. After installation, protect digital network lighting controls from construction activities. Remove and replace items that are contaminated, defaced, damaged, or otherwise caused to be unfit for use prior to acceptance by Owner.

3.8 MAINTENANCE

- A. Engage a factory-authorized service representative to perform on-site system adjustments.
 - 1. On-Site Occupancy Adjustments: When requested within 12 months from date of Substantial Completion, provide on-site settings adjustments to suit actual occupied conditions. Provide up to **two** visits to Project during other-than-normal occupancy hours for this purpose.
 - 2. Prepare and submit report after each visit that details activities performed.
- B. Engage a factory-authorized service representative to perform remote system adjustments.
 - 1. Remote Occupancy Adjustments: When requested within 12 months from date of Substantial Completion and project registration with lighting control system manufacturer, provide remote settings adjustments to suit actual occupied conditions. Provide up to 2 sessions to Project during other-than-normal occupancy hours for this purpose.
 - a. System to include manufacturer-provided cellular communication hardware and connection to the system for a minimum of 12 months after substantial completion to allow for factory representative assistance with settings adjustments and system sustainment.
 - b. For the remaining duration of the maintenance term, or in the event cellular connectivity is not available, manufacturer assistance must be available through an Owner-provided, Internet-connected network.
 - 2. Prepare and submit report after each session that details activities performed.
- C. Maintenance Service Agreement:
 - 1. Beginning at Substantial Completion, verify that maintenance service agreement includes 12 months' full maintenance by manufacturer's authorized service representative.
 - 2. Preventative maintenance to include:
 - a. System diagnostic reports.
 - b. System performance checks.
 - c. Device firmware updates.
 - d. Programming adjustment as required for proper lighting system operation.
 - e. Expedited factory direct warranty processing, replacement, and programming of defective components.
 - 3. Verify that parts and supplies are manufacturer's authorized replacement parts and supplies.

END OF SECTION 26 09 43.13

SECTION 26 20 00

ELECTRICAL DISTRIBUTION EQUIPMENT

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Conditions of the Contract Documents and Division 01 - General Requirements as applicable, apply to this Section.

1.2 SUMMARY

- A. Provide all electrical distribution and motor control equipment and accessories required to distribute electrical power to all motors, outlets and systems requiring power.

1.3 QUALITY ASSURANCE

- A. New: Provide all new equipment.
- B. Single Manufacturer: All equipment of each type shall be the product of one manufacturer.
- C. UL: Equipment shall be UL listed. Service entrance equipment shall bear UL Service Entrance label.
- D. CEC: Equipment and installation shall comply with the California Electrical Code.
- E. Wet Locations: Equipment and enclosures installed outdoors and in wet locations shall be approved for this purpose.
- F. IEEE: Institute of Electrical and Electronics Engineers Standard 1015-1997 (Blue Book) Recommended Practice for Applying Low-Voltage Circuit Breakers Used in Industrial and Commercial Power Systems.

1.4 LABELING

- A. Nameplates and labeling shall be provided in accordance with Section 26 05 53. All feeders shall be labeled on the feeder device.

1.5 FINISHES

- A. All equipment shall have a factory applied gray finish applied over a rust inhibiting treatment. Any items which have the finish marred shall be touched up or refinished to a new condition before final acceptance. This shall include, but shall not be limited to, sanding and properly removing rust or other contaminants and completely repainting equipment if damage is extensive. Overall acceptance is subject to approval of the Engineer.

1.6 SUBMITTALS

- A. Provide complete product data for each equipment type. Provide electric service studies when required.
- B. Submittal shall include written recommendation from manufacturer of settings for all electronic trip adjustment setting on all equipment furnished with adjustable trip settings. Contractor is responsible for adjusting all electronic trip settings per manufacturer recommendations.

- C. Electrical connections to all equipment furnished by any other division shall be coordinated with final approved equipment submittals from other divisions including but not limited to circuit breaker sizes, conduit sizes, wire sizes, fuse sizes, disconnect switch sizes and starter sizes that differ from those shown on the drawings prior to submitting Electrical Distribution Equipment submittal.

1.7 SHORT CIRCUIT CURRENT RATINGS

- A. General: All switchboards and panelboards shall be fully rated and marked with a maximum short circuit current rating. The equipment manufacturer shall have verified this rating with high-amperage testing. All short circuit current ratings are expressed as amperes RMS symmetrical at the applied voltage unless otherwise noted. All equipment shall withstand the specified level of fault current. All overcurrent devices shall interrupt the specified level of fault current.

1.8 ELECTRIC SERVICE STUDIES

- A. Standard: Submit studies in accordance with ANSI/ IEEE Standard 242 Recommended Practice for Protection and Coordination of Industrial and Commercial Power Systems.
- B. Submit one-line diagram for each electrical service. Key all equipment and components on diagram to items in the studies.
- C. Provide a short-circuit current analysis for each main switchboard. Short-circuit analysis shall calculate short-circuit levels at service transformer secondary, switchboard main breaker, each feeder breaker and all levels of downstream distribution equipment. Assume infinite source bus.
- D. Provide a time-current coordination study for each main switchboard. Coordination study shall compare the operating levels and times of the protective devices to the withstand levels and times that the equipment can sustain without damage or failure. Determine electronic trip unit settings necessary to achieve optimal selective coordination between 480 volt main service circuit breakers and first level of feeder distribution devices. Determine setting for all adjustments of trip units of all electronic circuit breakers that are linked by zone-selective-interlocking. Furnish time-current curves for the two (or more) levels of distribution protected with electronic trips, plus the first additional distribution level served from the switchboard feeder. Show a separate composite plot for each feeder breaker trip rating with the main breaker. Plot composite time-current curves on log-log background. Add a typical frame size of downstream molded-case circuit breaker to each switchboard feeder composite plot.
- E. Provide arc-flash calculation and labeling for equipment in the project.
- F. The contractor shall make all adjustments to circuit breakers per electric service study and provide written documentation that all adjustments have been made.

1.9 OWNER'S INSTRUCTION

- A. Provide a four-hour period of instruction to the Owner's designated personnel upon completion of the main switchboard's installation. Review manufacturer's recommended switchboard maintenance. The Operations and Maintenance Manual shall be complete and on-site at the time of Owner instruction.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Unless indicated otherwise, all equipment in this section shall be provided by a single manufacturer. The product designations listed are to establish a level of quality. Acceptable manufacturers are:
 - 1. Square D.
 - 2. Siemens.
 - 3. G.E.
 - 4. Cutler-Hammer.

2.2 ENCLOSED SWITCHES

- A. General: Provide heavy duty enclosed switches similar to Square D Class 3100 Type HD.
- B. Switch Interior:
 - 1. All switches shall have switchblades which are visible when the switch is OFF and the cover is open.
 - 2. Lugs shall be front removable and UL Listed for 75 degrees Celsius conductors.
 - 3. All current carrying parts shall be plated to resist corrosion.
 - 4. Switches shall have removable arc suppressors to facilitate easy access to line side lugs.
 - 5. Switches shall have provisions for a field installable electrical interlock.
- C. Switch Mechanism:
 - 1. Switch operating mechanism shall be quick-make, quick-break such that, during normal operation of the switch, the operation of the contacts shall not be capable of being restrained by the operating handle after the closing or opening action of the contacts has started.
 - 2. The operating handle shall be an integral part of the box, not the cover.
 - 3. Provisions for padlocking the switch in the OFF position with at least three padlocks shall be provided.
 - 4. The handle position shall travel at least 90 degrees between OFF and ON positions to clearly distinguish and indicate handle position.
 - 5. All switches shall have a dual cover interlock mechanism to prevent unintentional opening of the switch cover when the switch is ON and prevent turning the switch ON when the cover is open. The cover interlock mechanism shall have an externally operated override, but the override shall not permanently disable the interlock mechanism. The tool used to override the cover interlock mechanism shall not be required to enter the enclosure in order to override the interlock.
- D. Switch Enclosures:
 - 1. Switch covers shall be attached with welded pin-type hinges.
 - 2. The enclosure shall be finished with gray baked enamel paint, which is electrodeposited on cleaned, phosphate pre-treated steel.
 - 3. The enclosure shall have ON and OFF markings stamped onto the cover.
 - 4. The operating handle shall be provided with a dual colored, red/ black position indication.
 - 5. All switches shall have provisions to accept up to three (3) 3/8-inch hasp padlocks to lock the operating handle in the OFF position.
 - 6. Tangential knockouts shall be provided to facilitate ease of conduit entry.
- E. Switch Ratings:
 - 1. Switches shall be horsepower rated for ac and/ or dc as indicated on the plans.
 - 2. The UL Listed short circuit current rating of the switches shall be 200,000 rms symmetrical amperes when used with or protected by Class J fuses.
 - 3. Non-Fusible: 10,000 rms symmetrical amps.

- F. Fuse Clips: NEMA FU 1, Class J fuses.

2.3 SINGLE CIRCUIT BREAKERS WITH ENCLOSURES

- A. Product Description: Enclosed, molded-case circuit breaker conforming to NEMA AB 1, suitable for use as service entrance equipment where applied.
- B. Circuit Breakers: Molded case, quick make, quick break, trip free, common thermal magnetic trip.
- C. Ratings: Continuous current, poles as required, 480 volt system breaker shall interrupt short circuits up to 14,000 rms amps symmetrical; on 120/ 208 - 240 volt system, 10,000 amp rms symmetrical.
- D. Enclosure: NEMA AB 1, to meet conditions. Fabricate enclosure from steel finished with manufacturer's standard gray enamel.
 - 1. Interior Dry Locations: Type 1.
 - 2. Exterior Locations: Type 3R.
- E. Nameplate: Provide a nameplate showing load served.

2.4 FRACTIONAL HORSEPOWER MANUAL MOTOR CONTROLLER

- A. Square D - Class 2510 Type F:
 - 1. Description: NEMA ICS 2, ac general-purpose Class A manually operated, full-voltage controller for fractional horsepower induction motors, with thermal overload unit, red pilot light and toggle operator.
 - 2. Enclosures: ANSI/ NEMA ICS 6, Type as indicated.

2.5 MAGNETIC MOTOR CONTROLLERS

- A. Square D - Class 8536 Type S:
 - 1. Description: NEMA ICS 2, ac general-purpose Class A magnetic controller for induction motors rated in horsepower.
 - 2. Coil Operating Voltage: Provide as required to interface with controls system, including control power transformer.
 - 3. Coil: Be of encapsulated type.
 - 4. Poles: as indicated.
 - 5. Size: as indicated.
 - 6. Contacts: Totally enclosed, double-break, silver-cadmium-oxide power contacts. Contact inspection and replacement shall be possible without disturbing line or load wiring.
 - 7. Wiring: Straight-through wiring with all terminals clearly marked.
 - 8. Overload Relay: NEMA ICS:
 - a. Solid State: Trip current rating will be established by selection of overload relay and shall be adjustable (3 to 1 current range). The overload shall be self-powered. Provide phase loss, phase unbalance protection, permanent tamper guard, Trip Class 10 or 20 and a mechanical test function.
 - b. Outputs: Units shall be designed for addition of either a normally open or normally closed auxiliary contact and shall be field convertible. Provide one (1) set of N.O. and N.C. contacts in each starter.
 - c. Reset: Unit shall include both manual reset and remote reset using an external module.

- d. Select overload current setting based on the motor nameplate data of the actual motor to be protected. All standard NEMA sizes may be used for the overload relay, including Size 00.
9. Enclosure: ANSI/ NEMA ICS 6, Type 1, 3R or 4X.
10. Control Power Transformers: 120 volt secondary. VA minimum, in each motor starter. Provide fused primary and secondary.
11. Provide red LED running pilot light and H-O-A switch.

2.6 MAGNETIC MOTOR CONTROLLERS - TWO - SPEED

- A. Square D - Class 8810 Type S:
 1. Description: Include integral time delay transition between FAST and SLOW speeds. Starters shall be electrically and mechanically interlocked to prohibit both starters being energized simultaneously.
 2. Coil operating voltage: Provide as required to interface with controls system, including control power transformer.
 3. Coil: Be of encapsulated type.
 4. Poles: as indicated.
 5. Size: as indicated.
 6. Contacts: Totally enclosed, double-break, silver-cadmium-oxide power contacts.
 7. Contact inspection and replacement shall be possible without disturbing line or load wiring.
 8. Wiring: Straight-through wiring with all terminals clearly marked.
 9. Overload Relay: NEMA ICS.
 - a. Solid State: Trip current rating will be established by selection of overload relay and shall be adjustable (3 to 1 current range). The overload shall be self-powered. Provide phase loss, phase unbalance protection, permanent tamper guard, Trip Class 10 or 20 and a mechanical test function.
 - b. Outputs: Units shall be designed for addition of either a normally open or normally closed auxiliary contact and shall be field convertible. Provide one (1) set of N.O. and N.C. contacts in each starter.
 - c. Reset: Unit shall include both manual reset and remote reset using an external module.
 - d. Select overload current setting based on the motor nameplate data of the actual motor to be protected. All standard NEMA sizes may be used for the overload relay, including Size 00.
 10. Enclosure: ANSI/ NEMA ICS 6, Type 1, 3R or 4X.
 11. Two speed motor controllers shall be designed for type of motor winding specified in Division 23 Mechanical Specifications, Drawings, or Equipment Schedule. Coordinate with Division 23 prior to submittal.
 12. Provide red-high, amber-low running pilot lights and H-O-L-A switch.
 13. Provide two speed motor controllers for all two speed motors specified in Division 23 Mechanical Specifications, Drawings, or Equipment Schedule. Coordinate with Division 23 prior to submittal.

2.7 COMBINATION DISCONNECT/ MOTOR STARTERS

- A. Square D - Class 8538 Type S (Fusible or no fuse, as shown on plans):
 1. Description: Combine magnetic motor controllers with fusible switch disconnect in common enclosure. The switch shall have a color coded externally operated handle. Operating handle shall give positive visual indication of ON/ OFF with red and black color-coding.
 2. Fusible Switch Assemblies: NEMA KS 1, enclosed knife switch with externally operable handle. Fuse clips: Designed to accommodate Class J fuses and visible blades. Operating handle shall give positive visual indication of ON/ OFF with color-coded operating handle.

3. Magnetic Motor Controllers: Refer to paragraph(s) specifying magnetic motor controllers for requirements.

2.8 FUSES (600 VOLTS AND BELOW)

- A. Manufacturers:
 1. Bussmann.
 2. Little Fuse.
 3. Ferraz Shawmut.
- B. Dimensions and Performance: NEMA FU 1, Class as specified or as indicated on Drawings.
- C. Voltage: Rating suitable for circuit phase-to-phase voltage.
- D. Class J (Time Delay) Fuses:
 1. Dimensions and Performance: NEMA FU 1.
 2. Voltage: Rating suitable for circuit phase-to-phase voltage.
 3. Dual-element, time delay ten (10) seconds (minimum) at 500 percent rated current.
- E. Spares: Spare fuses shall be provided in the amount of ten (10) percent of each type and size installed. Replacement for fuses and limiters blown during construction shall not count as spares.

2.9 TWO-WINDING TRANSFORMERS

- A. Product Description: Provide transformers in accordance with the following standards, where applicable:
 1. Underwriter's Laboratory 1561, Standard for Safety for Dry-Type General Purpose and Power Transformers.
 2. Underwriter's Laboratory 506, Standard for Safety for Specialty Transformers.
 3. NEMA ST 20, Dry Type Transformers for General Applications.
 4. NEMA 250, Enclosures for Electrical Equipment (1000 V Max).
 5. ANSI/ IEEE C57.12.91, Standard Test Code for Dry-Type Distribution and Power Transformers.
 6. U.S. Department of Energy 10 CFR Part 431 Energy Conservation Program: Energy Conservation Standards for Distribution Transformers; Final Rule, dated April 18, 2013. These efficiency standards shall take effect January 1, 2016. All transformers covered in the scope of this document and this specification, manufactured after December 31, 2015, shall be compliant with the new standard.
- B. Ratings as indicated on Drawing.
- C. Primary Voltage: 480 volts, 3 phase or as indicated on plans.
- D. Secondary Voltage: 208Y/ 120 Volts, 3 phase or as indicated on plans.
- E. Insulation system and average winding temperature rise 150 degrees Celsius over 40 degrees Celsius ambient.
- F. Winding Taps:
 1. 2 at 2.5 percent above rated voltage.
 2. 4 at 2.5 percent below rated voltage.
- G. Sound Levels: NEMA ST 20. Noise levels shall not exceed NEMA and ANSI Standards.

- H. Basic Impulse Level: 10 kV for transformers less than 300 kVA.
- I. Ground core and coil assembly to enclosure by means of visible flexible copper grounding strap.
- J. Mounting:
 - 1. 1-15 kVA: Suitable for wall mounting.
 - 2. 16-75 kVA: Suitable for floor mounting.
 - 3. Larger than 75 kVA: Suitable for floor mounting.
- K. Coil Conductors: Continuous copper windings with terminations brazed or welded.
- L. Enclosure: NEMA ST 20, Type 1 or Type 3R ventilated. Furnish lifting eyes or brackets.
- M. Isolate core and coil from enclosure using vibration-absorbing mounts.
- N. Nameplate: Include transformer connection data and overload capacity based on rated allowable temperature rise.

2.10 TRANSFORMERS FOR NONLINEAR LOADS

- A. Nonlinear load transformer shall be as specified for two winding transformers except as modified by this Section.
- B. Product Description: NEMA ST 20, factory-assembled, air cooled dry type transformers, designed to supply nonlinear load, UL K-9 rated.
- C. Primary Voltage: 480 volts, 3 phase.
- D. Secondary Voltage: 208Y/ 120 volts, 3 phase.
- E. Insulation and temperature rise: Class 220 insulation system with 115 degrees Celsius average winding temperature rise over 40 degrees Celsius ambient.
- F. Coil Conductors: Continuous copper windings with terminations brazed or welded. Individually insulate secondary conductors and arrange to minimize hysteresis and eddy current losses at harmonic frequencies. Size secondary neutral conductor at 1.73 times the phase conductor ampacity.
- G. Enclosure: NEMA ST 20, Type 1 or Type 3R ventilated. Furnish lifting eyes or brackets.
- H. Isolate core and coil from enclosure using vibration-absorbing mounts.
- I. Nameplate: Include transformer connection data and overload capacity based on rated allowable temperature rise.

2.11 DISTRIBUTION PANELBOARDS

- A. Product Description: NEMA PB 1, circuit breaker type panelboard.
- B. Panelboard Bus: copper current carrying components, ratings as indicated on Drawings. Furnish copper ground bus in each panelboard.

- C. Molded Case Circuit Breakers: NEMA AB 1, circuit breakers with integral thermal and instantaneous magnetic trip in each pole. Furnish circuit breakers UL listed as Type HACR for air conditioning equipment branch circuits.
- D. Main Circuit Breaker:
 - 1. When distribution panel has main circuit breaker, provide molded case circuit breaker with electronic trip unit. Current sensing to be true-rms.
 - 2. Main breaker shall have minimum interrupting rating of 65,000 amperes rms symmetrical at applied voltage.
 - 3. Electronic trip shall be Square D micrologic with adjustable long-time, short-time and instantaneous pick-up set points.
- E. Cabinet Front: Safety dead front type. Conform to NEMA 1; NEMA 3R if located outdoors. All panelboards located in kitchen areas shall be flush mount with NEMA 4X Stainless Steel enclosures.

2.12 BRANCH CIRCUIT PANELBOARDS

- A. Product Description: NEMA PB1, circuit breaker type, lighting and appliance branch circuit panelboard.
- B. Panelboard Bus: Copper current carrying components, ratings as indicated on Drawings. Furnish copper ground bus in each panelboard.
- C. For non-linear load applications subject to harmonics furnish 173 percent rated, plated copper, solid neutral.
- D. Minimum Integrated Short Circuit Rating: 10,000 amperes rms symmetrical for 208-240/ 120 volt panelboards; 22,000 amperes rms symmetrical for 480 volt panelboards.
- E. Molded Case Circuit Breakers: NEMA AB 1, bolt-on type thermal magnetic trip circuit breakers, with common trip handle for all poles, listed as Type SWD for lighting circuits, Type HACR for air conditioning equipment circuits, Class A ground fault interrupter circuit breakers as indicated on Drawings. Do not use tandem circuit breakers.
- F. Enclosure: NEMA PB 1, Type 1 or Type 3R. All panelboards located in kitchen areas shall be flush mount with NEMA 4X Stainless Steel enclosures.
- G. Cabinet Front: Safety dead front type with concealed trim clamps, concealed hinge, metal directory frame, and flush lock keyed alike. Finish in manufacturer's standard gray enamel.
- H. Provide ground-fault circuit breaker for each heat trace branch circuit.
- I. Panelboards indicated to have thru-feed lugs shall be furnished with thru-feed lugs in all sections of panelboard.

2.13 ROOF MOUNTED PEDESTALS

- A. Roof Utility Pedestal with 20 Amp GFCI/ Weatherproof receptacle - Provide MAPA Products utility roof pedestal #MPX-20G: 36/ 12.
- B. Roof Pedestal with Non-Fused Disconnect Switch and 20 Amp GFCI/ Weatherproof receptacle - Provide MAPA Products roof pedestal. See plans for disconnect sizes.

PART 3 - EXECUTION

3.1 MOUNTING

- A. General: All equipment shall be securely fastened in place.
- B. Locations: In all cases mounting locations shall comply with the requirements of the California Electrical Code. This shall include providing suitable working clearances.
- C. Concrete Pads:
 - 1. Provide concrete in accordance with the Division of the Specifications for that product.
 - 2. Indoor concrete pads shall consist of a four (4) inch pad with beveled edges extending two (2) inches beyond the perimeter of supported equipment. Switchboards, motor control centers, transformers greater than 15 KVA, and engine generators shall be installed on a pad. Refer to the drawings and the specifications for each piece of equipment to determine what other equipment shall be mounted on a pad.
 - 3. All equipment, ground mounted outdoors, shall be mounted on a pad. Outdoor pads shall be minimum of one foot thick reinforced with #4 rebar one (1) foot on center each way. Size outdoor pads with at least four (4) feet working clearance in front of equipment and one (1) foot on all sides. Provide anchor bolts for pad-mounted equipment. Refer to Detail on drawings.
- A. Wall Mounted Equipment: Wall mounted equipment shall be suitably positioned on the wall. Equipment mounted on the exterior basement wall shall have unistrut channels between the wall and the equipment to prevent condensation problems. Where wall mounted equipment is specified, but a convenient wall not available, a suitable unistrut mounting stanchion anchored in concrete shall be provided. In lieu of this stanchion, small devices may be mounted on to the equipment served if approved by the equipment manufacturer.
- B. Motor rated disconnects: Install disconnects in a vertical orientation with off in the down position.

3.2 DELIVERY, STORAGE AND HANDLING

- A. General:
 - 1. Store all types of electrical power distribution equipment in a clean, heated building affording appropriate physical protection. Control access to prevent unauthorized tampering with the equipment. However, equipment may be stored in other inside or outside environments under approved conditions.
 - 2. Inspect equipment when received at Project site for shipping damage. Report as required by freight carrier to recover repair or replacement costs from the freight carrier in the event damage was sustained.
 - 3. Covers are required unless indoor, ventilated storage conditions exist. Canvas tarpaulins or the equivalent are preferred over other coverings because they provide better humidity control and enclosure scuff protection. Where exposed to moisture, covers shall be waterproof.
 - 4. The manufacturer's shipping skids shall be left on the equipment to provide structural support until the equipment is set in the final resting place.
 - 5. Refer to Section 26 05 00 for additional requirements. Contractor shall furnish new equipment to replace any equipment that is exposed to weather or subjected to other deleterious effects of construction.
- B. Approved Conditions for Equipment Storage:
 - 1. General: Where storage conditions specified above are not available, indoor or outdoor storage shall comply with the following.

2. Switchboards, Motor Control and Other General Distribution and Utilization Equipment:
 - a. Store metal-enclosed equipment in an upright position. Provide good ventilation of the shelter and protection from dirt, moisture and physical damage.
 - b. Space heaters furnished with the equipment shall be connected to a continuous source of power of the proper rating. Where space heaters are supplied from auxiliary power transformers, care shall be taken that low-voltage heater circuits are properly isolated before power source connection to prevent inadvertent energizing of the auxiliary transformer and associated high-voltage primary wiring.
 - c. Ambient conditions may allow condensation inside waterproof covers. If condensation is occurring, temporary heaters or lamp banks shall be provided of sufficient wattage to prevent condensation.
 - d. Contractor shall ensure that equipment stored in shipping cases receives adequate ventilation to avoid mildew and prevent condensation.
- C. Transformer
 1. Indoor storage shall be provided for all transformers.

3.3 GROUND FAULT PROTECTION OF EQUIPMENT

- A. General: Provide for system performance testing as required by the California Electrical Code. Provide each ground fault relay, sensing device or ground fault protection system with instructions and a test form. The form shall be retained by those in charge of the building's electrical installation and be available to the authority having jurisdiction. The instruction content shall be as required by UL.

3.4 TRANSFORMER VIBRATION ISOLATION

- A. Floor Mounted Transformers: Install on concrete housekeeping pad with Mason Industries Type WM Neoprene Waffle pad, or equal. Provide Type WM isolation for elevated rack installation.
- B. Wall Mounted Transformers: Install Mason Industries Type WM Neoprene Waffle pad between the wall brackets and the wall.
- C. Suspended Transformers: Install Mason Industries PC30 Pre-compressed spring hanger with neoprene isolator.
- D. Floor Mounted Transformers Greater than 150 kVA: Install on Mason Industries, Inc, or equal, unhoused spring isolators with acoustical pad bonded to bottom. Isolators shall be undamped free-standing spring isolators sized for a minimum of two (2) inches of static deflection. The spring outside diameter shall be no less than 80 percent of the spring operating height. The spring shall have remaining travel to solid of no less than 50 percent of the static deflection. Provide a 1/4-inch neoprene friction pad bonded to the spring base. Bolt each vibration isolator unit to concrete pad, and bolt transformers to the vibration isolator units, using the leveling bolts and nuts provided with the unit.

3.5 TRANSFORMER VENTILATION

- A. Transformers with ventilating openings shall be installed so that the ventilating openings are not blocked by walls or other obstructions. The required clearances shall be clearly marked on the transformer.

3.6 LABELING

- A. Nametag: Provide a nametag for each piece of distribution equipment; see Section 26 05 53, Electrical Identification.

END OF SECTION 26 20 00

SECTION 26 27 26

WIRING DEVICES

PART 1 GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. This Section Includes:
 - 1. Wiring devices.
- B. Related Sections:
 - 1. Section 26 05 00: Common Work Results for Electrical.
 - 2. Section 26 05 19: Low-Voltage Electrical Power Conductors and Cables.
 - 3. Section 26 05 26: Grounding and Bonding for Electrical Systems.
 - 4. Section 26 05 33: Raceway and Boxes for Electrical Systems.
- C. Reference Standards:
 - 1. California Electrical Code (CEC). California Code of Regulations, Title 24, Part 3.
 - 2. National Electrical Manufacturers Association (NEMA):
 - a. WD 1 General Color Requirements for Wiring Devices.
 - b. WD 6 Wiring Devices - Dimensional Specifications.
 - 3. National Electrical Manufacturers Association (NECA):
 - a. 1 Good Workmanship in Electrical Construction.
 - 4. National Electrical Testing Association (NETA):
 - a. ATS Acceptance Testing Specifications for Electrical Power Distribution Equipment and Systems.
 - 5. Underwriters Laboratories, Inc. (UL):
 - a. 20 Safety General-Use Snap Switches.
 - b. 231 Standard for Power Outlets.
 - c. 498 Attachment Plugs and Receptacles.
 - d. 943 Ground-Fault Circuit-Interruption.
 - e. 1436 Standard for Outlet Circuit Testers and Similar Indicating Devices.
 - f. 1472 Solid-State Dimming Controls.

PART 2 PRODUCTS

2.1 MANUFACTURERS

- A. Receptacles, Switches, Wall Plates:
 - 1. Cooper Wiring Devices; Division of Cooper Industries, Inc.
 - 2. Hubbell Incorporated; Wiring Device-Kellems.
 - 3. Leviton Mfg. Company, Inc.
 - 4. Pass & Seymour/ Legrand.

2.2 RECEPTACLES

- A. General for all receptacles:
 - 1. Device shall be listed by UL

2. Mounting straps shall be plated steel, with break-off plaster ears and shall include a self-grounding feature (this feature does not substitute for a grounding conductor terminated on grounding strap of device). Terminal screws shall be brass, brass plated or a copper alloy metal.
 3. Receptacles shall be of a screw terminal type, "pressure type quick wire" terminations are not allowed.
- B. Duplex receptacles shall be premium specification grade single phase, 20 ampere, 120 volts, 2-pole, 3-wire, and conform to the NEMA 5-20R configuration in NEMA WD 6. The duplex type shall have bussing break-off feature for two-circuit operation. The ungrounded pole of each receptacle shall be provided with a separate terminal:
1. Wiring device color shall be standard white. Contractor to verify device color with Architect prior to procurement.
 2. Ground Fault Interrupter Duplex Receptacles - Shall be an integral unit suitable for mounting in a standard outlet box:
 - a. Ground fault interrupter shall be commercial grade and consist of a differential current transformer, solid state sensing circuitry and a circuit interrupter switch. It shall be rated for operation on a 60 Hz, 120 volt, 20-ampere branch circuit. Device shall meet CEC requirements. Device shall have a minimum nominal tripping time of 1/30th of a second. Devices shall meet UL 943.
- C. Receptacles; 20, 30 and 50 ampere, 250 volts: Shall be complete and match with appropriate cord grip plug. Devices shall meet UL 231.
- D. Weatherproof Receptacles: Shall consist of a listed weather resistant duplex receptacle, mounted in box with a gasketed, while in use weatherproof, cast metal cover plate and cap receptacle opening. The cap shall be permanently attached to the cover plate by a spring-hinged flap.

2.3 SWITCHES

- A. Toggle switches shall be totally enclosed tumbler type with bodies of phenolic compound. Toggle handles color to match receptacle device color unless otherwise specified:
1. Shall be single unit toggle, butt contact, quiet AC type, heavy-duty general-purpose use with an integral self-grounding mounting strap with break-off plaster ears and be of a screw terminal type.
 2. Shall be color coded for current rating, listed by UL, and meet the requirements of NEMA WD 1, Heavy-Duty and UL 20.
 3. Ratings:
 - a. 120 volt circuits: 20 amperes at 120-277 volts AC.
 - b. 277 volt circuits: 20 amperes at 277 volts AC.
 4. The switches shall be mounted on the strike plate side of doors.
 5. Incorporate barriers between switches with multi-gang outlet boxes where required by the CEC.
 6. All toggle switches shall be of the same manufacturer.

2.4 WALL PLATES

- A. Wall plates for switches and receptacles shall be type 302 stainless steel.
- B. Standard NEMA design, so that products of different manufacturers will be interchangeable. Dimensions for openings in wall plates shall be accordance with NEMA WD1.
- C. For receptacles or switches ganged together, wall plates shall be a single ganged plate.

- D. Wall plates for data, telephone or other communication outlets shall be as specified in the associated specification.
- E. Surface mounted boxes, NEMA1, shall be industrial grade raised galvanized steel covers. In shop areas, all receptacles shall be dust proof and or waterproof where applicable.
- F. Waterproof device covers shall be cast iron, 4-corner screw type, for FS and FD type mounting. Device covers shall be zinc galvanized finish. Weatherproof covers shall be lockable.

PART 3 EXECUTION

3.1 INSTALLATION

- A. Installation shall be in accordance with the CEC, NECA "Standard of Installation", and as shown as on the drawings.
- B. Ground terminal of each receptacle shall be bonded to the outlet box with an approved green bonding jumper, and also be connected to the green equipment grounding conductor.
- C. General: Devices shall be of the type specified herein. All devices shall be installed with "pigtailed" leads from the outlet box. No device shall be used in the "feed through" application. Screw terminals shall be used to connect all devices to the circuit and shall be grounded by means of a ground wire where grounding terminals are provided in the device.
- D. Installation: Devices and plates shall be installed in a "plumb" condition and must be flush with the finish surface of the wall where boxes are recessed.
- E. Mounting heights: All control and convenience devices shall comply with California Code of Regulations Title 24, ADA, and CBC with respect to accessibility requirements. Mounting heights indicated on plans shall have precedence.
- F. Install switches with the off position down.
- G. Clean debris from outlet boxes.
- H. Provide extension rings as required to bring outlet boxes flush with finished surface or casework.
- I. Test each receptacle device for proper polarity.

END OF SECTION 26 27 26

SECTION 26 51 00

INTERIOR LIGHTING

PART 1 GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. This Section Includes:
 - 1. Interior lighting systems, including luminaires, LED's, and emergency lighting equipment.
- B. Related Sections:
 - 1. Section 26 05 00: Common Work Results for Electrical.
 - 2. Section 26 05 19: Low-Voltage Electrical Power Conductors and Cables.
 - 3. Section 26 05 26: Grounding and Bonding for Electrical Systems.
 - 4. Section 26 05 33: Raceway and Boxes for Electrical Systems.
- C. Reference Standards:
 - 1. California Electrical Code (CEC) based on NFPA 70 (NEC). California Code of Regulations, Title 24, Part 3.
 - 2. California Energy Code. California Code of Regulations, Title 24, Part 6.
 - 3. National Electrical Manufacturers Association (NEMA).
 - a. 50 Enclosures for Electrical Equipment.
 - b. 67 Panelboards.
 - c. 489 Molded Case Circuit Breakers and Circuit Breaker enclosures.
 - 4. Underwriters Laboratories, Inc. (UL).
 - a. 50 Enclosures for Electrical Equipment.
 - b. 67 Panelboards.
 - c. 489 Molded Case Circuit Breakers and Circuit Breaker enclosures.
 - 5. Aluminum Association Inc. (AA).
 - 6. Illuminating Engineering Society of North America (IESNA or IES).

1.3 SUBMITTALS

- A. Submit in accordance with Section 26 05 00: Common Work Results for Electrical.
- B. Shop Drawings:
 - 1. Sufficient information, clearly presented, shall be included to determine compliance with drawings and specifications.
 - 2. Include electrical ratings, dimensions, mounting, details, materials, terminations, wiring and connection diagrams, photometric data, ballasts, luminaires, lamps, and controls.

1.4 DEFINITIONS

- A. Lighting terminology used herein is defined in IES.
- B. Exception: The term "driver" is used herein to cover both drivers and power supplies, where applicable.

- C. Clarification: The term "LED light source(s)" is used herein per IES to cover LED package(s), module(s), and array(s).

PART 2 PRODUCTS

2.1 MATERIALS AND EQUIPMENT

- A. Materials and equipment shall be in accordance with CEC, UL, ANSI, and as shown on the drawings and specified.

2.2 LIGHTING FIXTURES (LUMINAIRES)

- A. Shall be in accordance with CEC, UL 1598 and shall be as shown on drawings and as specified. All luminaires shall have been certified to the California Energy Commission by its manufacturer to comply with the efficiency standards as per California Code of Regulations Title 24, Part 6, Section 111 referencing the Appliance Efficiency Regulations in Title 20. Post certification with building permit.
- B. Sheet Metal:
1. Shall be formed to prevent warping and sagging. Housing, trim, and lens frame shall be true, straight (unless intentionally curved) and parallel to each other as designed.
 2. Wireways and fittings shall be free of burrs and sharp edges and shall accommodate internal and branch circuit wiring without damage to the wiring.
 3. When installed, any exposed fixture housing surface, trim frame, door frame and lens frame shall be free of light leaks; lens doors shall close in a light tight manner:
 - a. Hinged door closure frames shall operate smoothly without binding when the fixture is in the installed position, and latches shall function easily by finger action without the use of tools.
- C. Recessed fixtures shall be of the type approved for the ceiling and insulation conditions and appropriate for the installation location. Insulation must be held back from the fixture to provide manufacturers' recommended clearances for proper operation. Thermal tripping shall be the installer's responsibility to correct. Where installed in fire rated ceilings, coordinate installation of fire rated enclosures around the ceiling penetrations. Fixtures shall contain the proper through wiring capacity for that which is shown on the plans.
- D. Recessed fixtures shall be provided with the appropriate trims and hardware compatible with the ceiling type shown. Plaster frames are required where plaster or gypsum board ceilings are encountered.
- E. Fixtures with louvers or light transmitting panels shall have hinges, latches, and safety catches to facilitate safe, convenient cleaning and relamping.
- F. Mechanical Safety: Lighting fixture closures (lens doors, trim frame, hinged housings, etc.) shall be retained in a secure manner by captive screws, chains, captive hinges, or fasteners such that they cannot be accidentally dislodged during normal operation or routine maintenance.
- G. Metal Finishes:
1. The manufacturer shall apply standard finish (unless otherwise specified) over a corrosion resistant primer, after cleaning to free the metal surfaces of rust, grease, dirt, and other deposits. Edges of pre-finished sheet metal exposed during forming, stamping, or shearing processes shall be finished in a similar corrosion resistant manner to match the adjacent surface(s). Fixture finish shall be free of stains or evidence of rusting, blistering, or flaking.

2. Interior light reflecting finishes shall be white with not less than 85 percent reflectance's, except where otherwise specified on the drawing.
 3. Exterior finishes shall be as shown on the drawings.
- H. Provide all lighting fixtures with a specific means for grounding metallic wireways and housings to an equipment grounding conductor.
- I. Light Transmitting Components for Fixtures:
1. Shall be 100 percent virgin acrylic plastic or water white, annealed, crystal glass.
 2. Flat lens panels shall have not less than 1/8 inch of average thickness. The average thickness shall be determined by adding the maximum thickness to the minimum unpenetrated thickness and dividing the sum by 2.
 3. Unless otherwise specified, lenses, diffusers and louvers shall be retained firmly in a metal frame by clips or clamping ring in such a manner as to allow expansion and contraction of the lens without distortion or cracking.
- J. Recessed compact LED fixtures shall be manufactured specifically for LED lamps with drivers integral to the fixture. Assemblies designed to retrofit fixtures are prohibited except when described in this fashion.

2.3 LED LUMINAIRE REQUIREMENTS

- A. General Requirements:
1. Luminaire shall have an external label per ANSIC136.15.
 2. Luminaire shall have an internal label per ANSIC136.22.
 3. Luminaires shall start and operate in -20°C to +40°C ambient.
 4. LED light source(s) and driver(s) shall be RoHS compliant.

2.4 EMERGENCY FIXTURE POWER SUPPLY

- A. Self-contained battery-operated power supply for operating specified fixture for a minimum output of 90 minutes.
- B. The power supply shall be installed within the luminaire ballast compartment or wireway. Provide with test switch and charge indicator installed integral to the luminaire. The test switch and charge indicator may be installed in a remote ceiling mounted flush J-box for recessed downlights which cannot accept integral components.
- C. Performance: Emergency operation lumen output for specified fixtures shall be a minimum of 600 lumens.

2.5 LED DRIVER

- A. Driver:
1. Rated case temperature shall be suitable for operation in the luminaire operating in the ambient temperatures as indicated.
 2. Shall accept the voltage or voltage range indicated and shall operate normally for input voltage fluctuations of plus or minus 10 percent. Consistent with NEMA SSL 1.
 3. Shall have a minimum Power Factor (PF) of 0.90 at full input power and across specified voltage range.
- B. Electromagnetic interference:
1. Shall have a maximum Total Harmonic Distortion (THD) of 20% at full input power and across specified voltage range.
 2. Shall comply with FCC 47 CFR part 15 non-consumer RFI/ EMI standards.

- C. The following shall be in accordance with corresponding sections of ANSIC136.37:
1. Wiring and grounding.
 2. All internal components shall be assembled and pre-wired using modular electrical connections.
 3. Mounting provisions.
 4. Terminal blocks for incoming AC lines.
 5. Latching and hinging.
 6. Ingress protection.

2.6 LAMPS

- A. Led Light Source:
1. Minimum Color Rendering Index (CRI): 60.
 2. Correlated Color Temperature (CCT):
 - a. CCT shall be as listed in Table 1 below:

Table 1. Allowable CCT

Manufacturer-Rated Nominal CCT (K)	Allowable LM-79 Chromaticity Values Measured CCT (K)
2700	2580 to 2870
3000	2870 to 3220
3500	3220 to 3710
4000	3710 to 4260
4500	4260 to 4746
5000	4745 to 5311
5700	5310 to 6020
6500	6020 to 7040

PART 3 EXECUTION

3.1 INSTALLATION

- A. Installation and furnishing of lighting fixtures shall be in accordance with the CEC, manufacturer's instructions and as shown on the drawings or specified. Fixtures damaged in transit and storage prior to completion shall be replaced at Contractor's expense.
- B. Align, mount and level the lighting fixtures uniformly.
- C. Avoid interference with and provide clearance for equipment. Where the indicated locations for the lighting fixtures conflict with the locations for equipment, change the locations for the lighting fixtures by the minimum distances necessary as approved by the Architect. The Architectural reflected ceiling plan will take precedence over electrical plans.
- D. For suspended lighting fixtures, the mounting heights shall provide the clearances between the bottoms of the fixtures and the finished floors as shown on the drawings.

- E. Lighting Fixture Supports:
1. Contractor shall provide support for all of the fixtures independent of suspended ceilings. Supports may be anchored to channels of the ceiling construction, to the structural slab or to structural members within a partition, or above a suspended ceiling.
 2. Shall maintain the fixture positions after cleaning and re-lamping.
 3. Shall support the lighting fixtures without causing the ceiling or partition to deflect.
 4. Hardware for recessed fluorescent fixtures:
 5. Fixtures shall be supported as detailed on drawings and as required by DSA standards.
 6. Installation: Fixtures shall be securely mounted on ceilings and walls with appropriate fastening devices. "Drop-in" type T-bar fixtures shall be secured with #12 gauge safety "earthquake wires" as described by California Code of Regulations Title 24 Part 2, Chapter 47. "Tek Screws" will be required for fastening to the T-bar system in addition to safety wire. Surface mounted fluorescent fixtures shall be solidly screwed or clipped into framing above drywall with 4-#10 sheet metal screws into each fixture. Provide blocking for screw supports behind all surface mounted lighting fixtures weighing more than 15 lbs.
 7. Surface mounted lighting fixtures:
 - a. Fixtures shall be bolted against the ceiling independent of the outlet box at four points spaced near the corners of each unit. The bolts shall be minimum 1/4-20 bolt, secured to structural ceiling. Non-turning studs may be attached to the building structure by 12 gauge safety hangers.
 8. Fixtures mounted in open construction shall be secured directly to the building structure with approved bolting and clamping devices.
 9. Single or double pendent mounted lighting fixtures:
 - a. Each stem shall be supported by an approved outlet box, mounted swivel joint and canopy which holds the stem captive and provides spring load (or approved equivalent) dampening of fixture oscillations. Outlet box shall be supported vertically from the building structure and be allowed to swing to a 45 degree angle.
 10. Outlet boxes for support of lighting fixtures (where permitted) shall be secured directly to the building structure with approved devices or supported vertically in a hung ceiling from the building structure with a nine gauge wire hanger and be secured by an approved device to a main ceiling runner or cross runner to prevent any horizontal movement relative to the ceiling.
- F. Coordinate between the electrical and ceiling trades to ascertain that approved lighting fixtures are furnished in the proper sizes and installed with the proper devices (hangers, clips, trim frames, flanges), to match the ceiling system being installed.
- G. Bond lighting fixtures and metal accessories to the grounding system as specified in Section 26 05 26: Grounding and Bonding for Electrical Systems.
- H. Provide unswitched leg of interior lighting branch circuit to integral emergency battery pack light fixtures, exit signs and night lights as applicable per lighting plans.
- I. Wallmount fixtures in walkway areas shall not project more than 4 inches from wall when projection occurs lower than 80 inches.

END OF SECTION 26 51 00

SECTION 26 56 00

EXTERIOR LIGHTING

PART 1 GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. This section specifies the furnishing, installation, and connection of exterior luminaires, controls, poles and supports.
- B. Related Sections:
 - 1. Section 26 05 00: Common Work Results for Electrical.
 - 2. Section 26 05 19: Low-Voltage Electrical Power Conductors and Cables.
 - 3. Section 26 05 26: Grounding and Bonding for Electrical Systems.
 - 4. Section 26 05 33: Raceway and Boxes for Electrical Systems.
 - 5. Section 26 51 00: Interior Lighting.
- C. Reference Standards:
 - 1. American Society for Testing and Materials (ASTM).
 - 2. American Concrete Institute (ACI).
 - 3. American National Standards Institute (ANSI).
 - 4. Aluminum Association Inc. (AA).
 - 5. Illuminating Engineering Society of North America (IESNA).
 - 6. National Electrical Manufacturers Association (NEMA).
 - 7. National Fire Protection Association (NFPA).
 - 8. Underwriters Laboratories, Inc. (UL).

1.3 SUBMITTALS

- A. Submit in accordance with Section 26 05 00: Common Work Results for Electrical.
- B. Shop Drawings:
 - 1. Sufficient information, clearly presented, shall be included to determine compliance with drawings and specifications.
 - 2. Include electrical ratings, dimensions, mounting, details, materials, required clearances, terminations, wiring and connection diagrams, photometric data, ballasts, poles, luminaires, effective projected area (EPA), lamps and controls.

PART 2 PRODUCTS

2.1 MATERIALS AND EQUIPMENT

- A. Materials and equipment shall be in accordance with CEC, UL, ANSI, as shown on the drawings and as specified.

2.2 LUMINAIRES

- A. UL 1598 and ANSI C136.17. Luminaires shall be weatherproof, heavy duty, outdoor types designed for efficient light utilization, adequate dissipation of lamp and ballast heat and safe cleaning and relamping.
- B. Light emitting diode (LED)-based solid state lighting (SSL) products shall be factory tested in accordance to the International Engineering Society (IES) LM-79 recommendations and meet ANSI C78.377-2008 standards.
- C. LED light sources shall be factory tested in accordance to IES LM-80 recommendations.
- D. LED-based SSL product shall incorporate an external heat sink, integral to the luminaire.
- E. IESNA HB-9 and RP-8 light distribution pattern types shall be as indicated on the drawings.
- F. Lenses shall be frame-mounted heat-resistant, borosilicate glass, prismatic refractors. Attach the frame to the luminaire housing by hinges or chain.
- G. Pre-wire internal components to terminal strips at the factory.
- H. Bracket mounted luminaires shall have leveling provisions and clamp type adjustable slip-fitters with locking screws.
- I. Materials shall be rustproof. Latches and fittings shall be non-ferrous metal.
- J. LED-based SSL luminaires shall be manufactured specifically for LED lamps with drivers integral to the luminaire housing.

2.3 LED-BASED SOLID STATE DRIVERS

- A. Shall be listed by either U.L. or equal listing agency and comply with IEEE C.62.41-1991, Class A operation.
- B. Provide a minimum power factor of 0.9.
- C. Minimum operating temperature appropriate for outdoor environments.
- D. Shall operate at a frequency greater than or equal to 120Hz.

PART 3 EXECUTION

3.1 INSTALLATION

- A. Install lighting in accordance with the CEC, as shown on the drawings, and in accordance with manufacturer's recommendations.

3.2 GROUNDING

- A. Ground noncurrent-carrying parts of equipment including metal poles, luminaries, mounting arms, brackets, and metallic enclosures as specified in Section 26 05 26: Grounding and Bonding for Electrical Systems. Where copper grounding conductor is connected to a metal other than copper, provide specially treated or alloyed connectors suitable and listed for this purpose.

END OF SECTION 26 56 00

SECTION 27 00 00

BASIC MATERIALS AND METHODS

PART 1 – GENERAL

1.01 RELATED WORK

- A. The entire drawing and specification package apply to the work specified in the telecommunications sections of the specifications and shall be complied with in every respect. The Contract Documents are comprised of the drawings and specifications. The Contractor shall examine these Contract Documents, and coordinate required work indicated in each.

1.02 SCOPE OF WORK

- A. The work covered by the specifications includes furnishing materials, labor, transportation, tools, permits, fees, utilities, and incidentals necessary for the complete installation of work required in the Contract Drawings.
- B. It is the intent of the Contract Documents to provide an extension of the existing installed systems interfaced with new systems, complete in every respect.
- C. The Contractor shall be responsible for coordination and proper relation of his work to the building structure and to the work of all trades. The Contractor shall visit the premises and thoroughly familiarize himself with the existing site conditions, details of the work and the working conditions, and verify dimensions in the field. The Contractor shall advise the Engineer of any discrepancy prior to bidding. The submission of bids shall be deemed evidence of the Contractor's site visit; coordination of existing conditions and include consideration for existing conditions.
- D. Provide line-by-line specification review for each Division 27 section annotated to certify compliance or deviation.

1.03 DRAWINGS AND SPECIFICATIONS

- A. The drawings and these specifications are complementary to each other, and what is required by one shall be as binding as if required by both.
- B. If variations or departures from the drawings are deemed necessary by the Contractor, details of such departures and the reasons therefore shall be submitted to the Engineer for review. No departures shall be made without prior written acceptance of the Engineer.
- C. Should the drawings or specifications disagree in themselves or with their counterpart, the better quality or greater quantity of work or materials shall be estimated upon, and unless otherwise directed by the Engineer in writing, shall be performed or furnished. In case the specifications should not fully agree with the Schedules, the latter shall govern. Figures indicated on drawings govern scale measurements and large scale details govern small scale drawings.
- D. Items specifically mentioned in the specifications but not shown on the drawings and/or items shown on the drawings but not specifically mentioned in the specifications shall be installed by the Contractor under the appropriate section of work as if they were both specified and shown.

1.04 CODES AND STANDARDS

- A. All work shall comply with the applicable articles of the National Electrical Code, the National Electrical Safety Code, the National Fire Codes (published by National Fire Protection Association), and City Codes and Ordinances, as well as any other authorities that may have lawful jurisdiction pertaining to the work specified. None of the terms or provisions of this specification shall be construed as waiving any of the rules, regulations, or requirements of these authorities.
- B. Contractor is responsible for knowledge and application of current versions of all applicable standards and codes. In cases where listed standards and codes have been updated, Contractor shall adhere to the most recent revisions, including all relevant changes or addenda at the time of installation.
- C. ANSI/TIA:
 - 1. ANSI/TIA-526-7-A (July 2015) Measurement of Optical Power Loss of Installed Single-Mode Fiber Cable Plant
 - 2. TIA-526.2-A (July 2015) Effective Transmitter Output Power Coupled into Single-Mode Fiber Optic Cable - Adoption of IEC 61280-1-1 ed. 2 Part 1-1: Test Procedures for General Communication Subsystems – Transmitter Output Optical Power Measurement for Single-Mode Optical Fiber Cable
 - 3. ANSI/TIA-4994 (March 2015) Standard for Sustainable Information Communications Technology
 - 4. ANSI/TIA-526-14-C (April 2015) Optical Power Loss Measurements of Installed Multimode Fiber Cable Plant
 - 5. ANSI/TIA-568.0-D (September 2015) Generic B (supersedes TIA-568-C.0 and TIA-568-C-1)
 - 6. ANSI/TIA-568.1-D (September 2015) Commercial Building Telecommunications Infrastructure Standard (supersedes ANSI/TIA-C.1)ANSI/TIA-568.2-D (September 2018) Balanced Twisted-Pair Telecommunications Cabling and Components Standard
 - 7. ANSI/TIA-568.3-D (June 2016) Optical Fiber Cabling Components Standard
 - 8. ANSI/TIA-568.4-D (August 2020) Broadband Coaxial Cabling Components Standard
 - 9. ANSI/TIA-569-E (May 2019) Telecommunications Pathways and Spaces
 - 10. ANSI/TIA-598-D (July 2014) Optical Fiber Cable Color Coding
 - 11. ANSI/TIA-570-C (August 2012) Residential Telecommunications Infrastructure Standard
 - 12. ANSI/TIA-606-C (June 2017) Administration Standard for Telecommunications Infrastructure
 - 13. ANSI/TIA-607-D (July 2019) Generic Telecommunications Bonding and Grounding (Earthing) for Customer Premises
 - 14. ANSI/TIA-758-B (March 2012) Customer-Owned Outside Plant Telecommunication Infrastructure Standard
 - 15. ANSI/TIA-862-B (February 2016) Structured Cabling Infrastructure Standard for Intelligent Building Systems
 - 16. ANSI/TIA-942-B (July 2017) Telecommunications Infrastructure Standard for Data Centers
 - 17. ANSI/TIA-1005-A (May 2012) Telecommunications Infrastructure Standard for Industrial Premises
 - 18. ANSI/TIA-1005-A-1 (January 2015) Telecommunications Infrastructure Standard for Industrial Premises, Addendum 1- M12-8 X-Coding Connector - Addendum to TIA-1005-A
 - 19. ANSI/TIA-1183 (August 2012) Measurement Methods and Test Fixtures for Balun-Less Measurements of Balanced Components and Systems

20. ANSI/TIA-1183-1 (January 2016) Measurement Methods and Test Fixtures for Balun-Less Measurements of Balanced Components and Systems, Extending Frequency Capabilities to 2 GHz - Addendum to TIA-1183
21. TIA-1152 (November 2016) Requirements for Field Test Instruments and Measurements for Balanced Twisted-Pair Cabling
22. TIA-1179-A (September 2017) Healthcare Facility Telecommunications Infrastructure Standard
23. ANSI/TIA-4966 (May 2014) Telecommunications Infrastructure Standard for Educational Facilities
24. TIA-455-104-B (February 2016) FOTP 104- Fiber Optic Cable Cyclic Flexing Test (supersedes TIA-455-104-A)
25. TIA/EIA-455-25-D (February 2016) FOTP-25 Impact Testing of Optical Fiber Cables
26. TIA-604-18 (November 2015) FOCIS 18 Fiber Optic Connector Intermateability Standard – Type MPO-16
27. TIA-604-5-E (November 2015) FOCIS 5 Fiber Optic Connector Intermateability Standard- Type MPO
28. TIA-5017 (March 2016) Telecommunications Physical Network Security Standard
29. TIA-TSB-155-A (Reaffirmed 10-6-2014) Guidelines for the Assessment and Mitigation of Installed Category 6 Cabling to Support 10GBASE-T
30. TSB-184 (July 2009) Guidelines for Supporting Power Delivery Over Balanced Twisted-Pair Cabling
31. TSB-4979 (August 2013) Practical Considerations for Implementation of Multimode Launch Conditions in the Field
32. TSB-190 (June 2011) Guidelines on Shared Pathways and Shared Sheaths
33. TIA-TSB-162-A (November 2013) Telecommunications Cabling Guidelines for Wireless Access Points
34. TSB-5018 (July 2016) Structured Cabling Infrastructure Guidelines to support Distributed Antenna Systems
35. TIA-492AAAE (June 2016) Detail Specification for 50- μ m Core Diameter/125- μ m Cladding Diameter Class 1a Graded-Index Multimode Optical Fibers with Laser-Optimized Bandwidth Characteristics Specified for Wavelength Division Multiplexing
36. TIA-492AAAB-A (November 2009) Detail specification for 50- μ m core diameter/125- μ m cladding diameter class 1a graded-index multimode optical fibers
37. TIA-455-243 (March 2010) FOTP-243 Polarization-mode Dispersion Measurement for Installed Single-mode Optical Fibers by Wavelength-scanning OTDR and States-of-Polarization Analysis
38. TSB-172-A (February 2013) Higher Data Rate Multimode Fiber Transmission Techniques

D. ISO/IEC:

1. ISO/IEC TR 11801-99-01 Information technology – Generic cabling for customer premises: Guidance for balanced cabling in support of at least 40 GBit/s data transmission: Parts 1 and 2
2. ISO/IEC TR 29106 AMD 1 Information technology -- Generic cabling -- Introduction to the MICE environmental classification
3. ISO/IEC 24764 AMD 1 Information technology – Generic cabling for data centers
4. ISO/IEC 11801 AMD 1 AMD 2 Information technology – Generic cabling for customer premises
5. ISO/IEC 15018 AMD 1 Information technology – Generic cabling for homes
6. ISO/IEC 24702 AMD 1 Information technology – Generic cabling – Industrial premises
7. ISO/IEC 14763-1 AMD 1 Information technology – Implementation and operation of customer premises cabling – Part 1: Administration
8. ISO/IEC 14763-2 Information technology – Implementation and operation of customer premises cabling – Part 2: Planning and installation

9. ISO/IEC 14763-2-1 Information technology – Implementation and operation of customer premises cabling – Part 2-1: Planning and installation – Identifiers within administration systems
 10. ISO/IEC 14763-3 Ed 2.0 Information technology -- Implementation and operation of customer premises cabling -- Part 3: Testing of optical fiber cabling
 11. ISO/IEC TR 24704 Information technology – Customer premises cabling for wireless access points
 12. ISO/IEC TR 24750 Information technology – Assessment and mitigation of installed balanced cabling channels in order to support 10GBASE-T
 13. ISO/IEC TR 29125 IT Telecommunications cabling requirements for remote powering of terminal equipment
- E. BICSI – Building Industry Consultative Services International – Published Standards
1. ANSI/BICSI 001-2009, Information Transport Systems Design Standard for K-12 Educational Institutions
 2. ANSI/BICSI 002-2014, Data Center Design and Implementation Best Practices
 3. ANSI/BICSI-003-2014 Building Information Modeling (BIM) Practices for Information Technology Systems
 4. BICSI 004-2012, Information Technology Division Systems Design and Implementation Best Practices for Healthcare Institutions and Facilities
 5. ANSI/BICSI 005-2016, Electronic Safety and Security (ESS) System Design and Implementation Best Practices
 6. BICSI 006-2015 Distributed Antenna System (DAS) Design and Implementation Best Practices
 7. ANSI/NECA/BICSI 568-2006, Standard for Installing Commercial Building Telecommunications Cabling
 8. NECA/BICSI 607-2011, Standard for Telecommunications Bonding and Grounding Planning and Installation Methods for Commercial Buildings
 9. BICSI – Building Industry Consultative Services International – Manuals
 10. Telecommunications Distribution Methods Manual, 14th Edition (2020)
 11. Information Transport Systems Installation Methods Manual (ITSIMM), 6th Edition
 12. Outside Plant Design Reference Manual, 5th Edition
 13. BICSI's ICT Terminology Handbook, Version 1.0
 14. Telecommunications Project Management Manual (TPMM), 1st edition
 15. Telecommunications Project Management Reference Document (TPMRD), 2nd Edition
 16. BICSI's Special ICT Design Considerations, Version 1.0
 17. Essentials of Bonding and Grounding, Version 1.0
- F. National Electric Codes
1. National Electrical Safety Code (NESC) (IEEE C2-2012)
 2. NFPA 70-2020, National Electrical Code® (NEC®)
 3. ANSI/IEEE C2-207, National Electrical Safety Code®
 4. National Electrical Code (NEC) (NFPA 70)
 5. NFPA 72 National Fire Alarm and Signaling Code
- G. ASHRAE
1. ASHRAE Standard 90.4P, Energy Standard for Data Centers and Telecommunications Buildings
- H. OSHA Standards and Regulations – all applicable
- I. Local Codes and Standards – all applicable

- J. Anywhere cabling standards conflict with one another or with electrical or safety codes, Contractor shall defer to the NEC and any applicable local codes or ordinances, or default to the most stringent requirements listed by either.
- K. Knowledge and execution of applicable standards and codes is the sole responsibility of the Contractor.
- L. Any violations of applicable standards or codes committed by the Contractor shall be remedied at the Contractor's expense.
- M. In any instance where these Specifications call for materials for construction of a better quality or larger size than required by the codes, the provisions of these Specifications shall take precedence. The codes shall govern in case of direct conflict between the Codes and the Drawings.

1.05 EXISTING UTILITIES

- A. The Contract Documents reflect the general location and routing for all telecommunications services known to exist on this project.

1.06 BUILDING CONSTRUCTION AND LAYOUT OF WORK

- A. General: It shall be the responsibility of the Contractor to consult the Engineering Drawings and Details so as to thoroughly familiarize himself with the type and quality of construction to be provided on this project.
- B. The drawings are diagrammatic in nature and do not show every connection in detail or every line or conduit in its exact location. These details are subject to the requirements of all codes and ordinances as well as all structural and architectural conditions. The Contractor shall carefully investigate structural and finish conditions and shall coordinate the separate trades in order to avoid interference between the various phases of work. Work shall be laid out so that it will be concealed in furred chases unless specifically noted or indicated to be exposed. Work shall be installed to avoid crippling of structural members; therefore, inserts to accommodate conduit hangers shall be set before concrete is poured, and proper openings through floors, walls, beams, etc. shall be provided as hereinafter specified or as otherwise indicated or required before concrete is poured. All work shall be run parallel or perpendicular to the lines of the building unless otherwise noted.
- C. The approximate location of equipment items is indicated on the drawings. Exact locations are to be determined by coordination of dimensions from approved equipment submittals and site-verified field measurements and will in all cases be subject to the approval of the Engineer. The Engineer reserves the right to make any reasonable changes in the indicated locations prior to installation for no additional cost.
- D. In areas of existing special ceiling construction the removal and restoration must be carefully planned such that the existing condition of the ceilings is maintained. It may be necessary for the Contractor to procure a Subcontractor familiar with this work to achieve this requirement.

PART 2 – PRODUCTS

2.01 GENERAL MATERIALS AND EQUIPMENT REQUIREMENTS

- A. Materials, in general, shall conform to the National Electrical Code requirements and shall be listed, inspected, and approved by the Underwriters Laboratories and shall bear the UL label where labeling service is available. The label or listing of the Underwriters Laboratories, Inc. will be accepted as evidence that the materials or equipment conform to the applicable standards of that agency. In lieu of this listing, the Contractor may submit a statement from a nationally recognized, adequately equipped testing agency, indicating that the items have been tested in accordance with required procedures, and that the materials and equipment comply with all Contract requirements.

2.02 STANDARD PRODUCTS

- A. Materials and equipment shall be the standard catalog products of manufacturers regularly engaged in the manufacture of products conforming to these specifications, and shall essentially duplicate materials and equipment that have been in satisfactory use at least two (2) years prior to bid opening. Where custom or special items are required, these shall be fully described using drawings, material lists, etc., which fully describe in detail the item proposed for use on this project.

2.03 MANUFACTURER'S INSTRUCTIONS

- A. The Contractor is responsible for furnishing the proper telecommunications equipment and/or material and for seeing it is installed as intended by the manufacturer. The Contractor shall, wherever necessary, request advice and supervisory assistance from equipment manufacturers as required for the proper installation, operation, or start-up. The Contractor shall notify the Engineer in writing of any conflict between the Contract Documents and the manufacturer's recommendations and shall obtain from the Engineer instructions/direction before proceeding with the work. The Contractor shall pay for all costs resulting from deficiencies created by installation not in accordance with the manufacturer's recommendations or the instructions of the Engineer.

2.04 RUST PREVENTION

- A. Metallic materials shall be protected against corrosion. Exposed metallic parts of equipment exposed to the elements shall be given a rust inhibiting treatment and standard finish by the manufacturer. Components such as boxes, bodies, fittings, guards, and miscellaneous parts shall be protected in accordance with the ASTM A123 or A153, except where other equivalent protective treatment is specifically approved in writing.

2.05 STORAGE AT SITE

- A. The Contractor shall not receive material or equipment at the job site until ready for installation or until there is suitable space provided to properly protect equipment from rust, weather, humidity, dust, or physical damage.

2.06 CONDITION OF MATERIALS

- A. All materials required for the installation of the telecommunications systems shall be new and unused. Any material or equipment damaged in transit from the factory, during delivery to premises, while in storage on premises, while being erected and installed, or while being tested, until time of final acceptance, shall be replaced by this Contractor without extra cost to Owner.

2.07 NAMEPLATES

- A. Factory assembled components and equipment shall be provided with embossed nameplates, securely attached to the equipment with rivets or screws. Nameplates will have information required to specifically identify the equipment in the future such as the manufacturer's name, address, catalog number, serial number, etc. All data on nameplates shall be legible at the time of final inspection.

PART 3 – EXECUTION

3.01 ACCEPTABLE MANUFACTURERS

- A. The specifications contain the names of manufacturers which are considered acceptable based on the quality of the product.
- B. Where acceptable manufacturers are listed, only products of those manufacturers may be provided. Additionally, the product must meet all the detailed requirements of the specifications.
- C. If no manufacturer's name is mentioned, the Contractor shall provide equipment and material which meet the specifications.
- D. The drawings represent the manufacturer's equipment scheduled. The listing of acceptable manufacturers in the specifications is not intended to imply that equipment of these other manufacturers will fit in the space provided or have the same electrical, structural or other requirements as the equipment scheduled. The Contractor must ensure that the equipment provided will meet all project requirements prior to submitting data on that equipment.

3.02 SPACE AND EQUIPMENT ARRANGEMENT

- A. Equipment and components shall be installed in a manner to permit access to parts requiring service. Telecommunications equipment shall be installed in such a manner as to allow removal for service without disassembly of adjacent equipment.
- B. Large equipment or apparatus which is to be installed in the building, and which is too large to permit access through stairways, doorways, or shafts shall be brought to the job and placed in the space before the enclosing structure is completed. Following placement in the space, such apparatus shall be thoroughly protected from damage.
- C. Equipment shall have working clearances as required by applicable codes and standards.

3.03 SUBMITTAL AND REVIEW OF MATERIALS

- A. After the Contract is awarded, but prior to proceeding with the Work, the Contractor shall obtain, check, certify, and submit complete Shop Drawings and Brochures from Manufacturers, Suppliers, Vendors, etc., for all materials and equipment specified herein. Submit Shop Drawings and Brochures in sufficient time so as not to impede the progress of work. Three weeks will be required for the processing of Shop Drawings and Brochures in the Engineer's office, exclusive of transmittal time. This time shall be considered by the Contractor when scheduling submittal data. After the Contract is awarded, the Contractor will advise the Engineer in writing of the schedule for submission of shop drawings and product data and the persons authorized to sign submittal data on behalf of the Company.

- B. The Engineer's review of Shop Drawings and Brochures shall not relieve the Contractor of the responsibility for dimensions, errors that may be contained therein, or deviations from Contract Document requirements. It shall be clearly understood that the Engineer's noting some errors but overlooking others does not grant the Contractor permission to proceed in error. Regardless of any information contained in the Shop Drawings, the requirements of the Contract Documents shall govern and are not waived or superseded in any way by the submittal data review.
- C. Before submission of Shop Drawings and Brochures, the Contractor shall certify that each Shop Drawing and each item of material or equipment complies with the Contract Documents for this Project. Such certification shall be made by the Owner, a Partner, a Corporate Officer of the Contractor, or by a person duly authorized to sign for the Contractor. Unless so certified, Shop Drawings and/or Brochures will be returned for resubmittal. Certifications shall be in the form of rubber stamp impressions or typed letter which states:

I hereby certify that this Shop Drawing and/or brochure and the equipment and material shown on this Shop Drawing and/or Brochure complies in all aspects (except as noted*) with the requirements of the Contract Documents for this Project. I further certify that all data shown herein as to performance, dimensions, construction, materials, and other pertinent items are true and correct.

Name of Contractor _____

Signed _____

Position _____

Date _____

*Refer to exception requirements herein.

- D. Each Shop Drawing shall indicate in the lower right hand corner and each Brochure shall indicate on the front cover the following: Title of the Sheet or Brochure; name and location of the building; names of the Engineer, Contractor, Manufacturer, Supplier, Vendor, etc., the date of submittal; and the date of each correction and revision. So far as is practical, each Shop Drawing and/or Brochure shall bear a cross-reference note to the sheet number or numbers of the Contract Drawings and Specifications showing the same work. Shop Drawings and Brochures shall be prepared as follows:
1. Shop Drawings: Drawings shall be newly prepared and not reproduced from the Contract Documents, drawn to a scale that can be easily read and shall contain sufficient plans, elevations, sections, and isometrics to describe clearly the items in question. Drawings shall be prepared by a draftsman skilled in this type of work. All equipment layouts and similar Shop Drawings shall be drawn to at least 1/4-inch = 1'-0" scale.
 2. All Shop Drawings shall indicate the equipment actually purchased. The elevation, location, support points, load imposed on the structure at support and anchor points, shall be indicated. All beam penetrations and slab penetrations shall be indicated and sized and shall be coordinated. All Design Drawing space allocations shall be maintained, such as ceiling height, chase walls, equipment room size, etc., unless proper written authorization is required from the Engineer to change them. All associated equipment shall be coordinated and clearly shown on the Shop Drawings.

3. Brochures: Brochures submitted to the Engineer shall be published by the Manufacturers and shall contain complete and detailed engineering and dimensional information to show that the equipment will fit into the allotted space.
 4. Brochures submitted shall contain only information which is relevant to the particular equipment or materials to be furnished. Do not submit catalogs that describe several different items other than those items to be used unless all irrelevant information is marked out or relevant information is clearly marked.
- E. The submittal format shall follow the Specifications format with a submittal required for each required section. The submittal shall be contained in a three-ring hard back binder. Copies of each submittal shall be three-hole punched and arranged (or folded if required) for the Engineer's filing convenience. Provide one copy of updated TABLE OF CONTENTS and progressive-tabbed index sheets also for the Engineer's filing convenience.
 - F. Submittal data for each section must be complete. Partial submittals will not be reviewed. To the greatest extent possible all sections shall be submitted with the first submission. No more than three additional submissions will be allowed to complete the submittal package.
 - G. Unless a greater number is indicated within Division One of these specifications, submit six (6) copies of all Brochures for review. Submit one (1) reproducible and one (1) blueprint of shop drawings for review. Comments will be made on the reproducible to facilitate copying.
 - H. Any submittal that is disapproved must be resubmitted within two (2) weeks following notification of such disapproval. If no satisfactory material is submitted within the two-week period, the Engineer reserves the right to require the Contractor to furnish items exactly as described in the Contract Documents.
 - I. No allowances will be made for submittals which are not made in a timely fashion or which are turned down because they do not meet the specifications. Should delivery problems arise due to the above, affecting the completion time of the project, the Contractor will furnish and install acceptable alternates until the proper materials arrive and then replace the alternate materials with the approved materials, all at no cost to the Owner. If the Contractor is not able to furnish an acceptable alternate until the proper materials arrive, he will assume all costs for furnishing and installing all alternates as directed by the Engineer and/or will pay a suitable penalty for the inconvenience experienced by the Owner. This penalty will be set by the Owner based on the particular circumstances.

3.04 SUPERVISION

- A. A competent certified foreman or superintendent, approved by the Engineer, shall be maintained at the project site to receive instructions and to act for the Contractor. Once this superintendent has been approved, no change shall be made without approval of the Owner or his authorized representative. The Owner and his authorized representative shall have the right to observe the work at any time. The Contractor shall have a representative present when his work is being observed, and he shall give assistance as required.

3.05 CUTTING AND PATCHING

- A. Where it is necessary to cut through walls, floors, or ceilings to permit installation of work under this section of the Contract, or to repair any defects that may appear, up to the expiration of guarantee period, such cutting shall be done under the supervision of the Engineer. The Contractor shall not be permitted to cut or modify any structural members without the written permission of the Engineer.

- B. Patching of all openings and repairing of any damage to the work of other trades occasioned by cutting operations, or occasioned by the failure of any part of work installed under this Contract, shall be performed by the trade whose work is involved, and shall be paid for by the Contractor.
- C. Openings cut through exterior walls or roofs shall be provided with suitable covers to protect the property or materials involved. Openings cut through walls below grade shall be properly protected to prevent entrance of water or other foreign elements. Openings cut between fire zones or plenums shall be sealed to maintain the fire integrity of the wall or floor. Conduits and cable tray through plenum wall shall be sealed using materials complying with UL 1479, NEC 300-21, and NEC 800-3(C), and shall be UL classified.

3.06 HOISTING, SCAFFOLDING, AND TRANSPORTATION

- A. Provide hoisting and scaffolding facilities as required to set materials and equipment in place.

3.07 CLEANING

- A. The Contractor shall at all times keep the premises free from accumulations of waste material or rubbish. Debris shall be removed from the site and from any street or alley adjacent to the site.
- B. At completion of the project, the Contractor shall remove all tools, scaffolding, and surplus materials. Contractor shall leave the area "broom clean". Before final acceptance, vacuum all panels, cabinets, racks and other equipment enclosures. Wipe clean all fixture lenses and reflectors, all panelboard and switchboard interior and exterior surfaces, being careful to remove all stray paint, construction materials, dust, and particles. Touch-up all marred surfaces to restore existing conditions to those provided by the manufacturer.

3.08 CONDUIT SLEEVES

- A. Where conduits pass through walls or floors not on fill, galvanized sheet metal sleeves shall be provided and shall be sealed to prevent air and noise transmission. In walls, they shall be flush with each finished surface. In pipe chases, they shall extend 1-1/2 inches above floor slab and be cemented in a water tight manner. Size of these sleeves shall be at least 1/2 inch greater than outside diameter of the conduit.
- B. For conduits passing through outside walls, provide and install galvanized steel sleeves having an inside diameter at least 4 inches greater than the outside diameter of contained conduit. Where these occur in walls having a waterproof coating applied, the sleeves shall have welded flanges to build into waterproofing. When conduits are installed, the annular space between pipe and sleeve shall be effectively sealed, using shredded lead hammered in place or an approved mastic sealer.
- C. Pipe and duct sleeves, pitch pockets, and flashings compatible with the roofing installation shall be provided for roof penetrations.

3.09 GROUNDING

- A. Ground buses shall be provided in each Telecommunications room by Division 16 Contractor unless noted on Contract Drawings.

- B. Telecommunications grounding system shall be a single point grounding from the building entrance electrical ground to each Telecommunications room. This Grounding system shall be provided by Division 16 Contractor unless notes on Contract Drawings.
- C. All Conduit systems, cabinets' racks, cable trays, protector blocks, SCTP patch panels and/or miscellaneous equipment, etc. shall be grounded by being connected to the common telecommunications grounding system. The conductors shall be a #6awg solid with a green jacket

3.10 RECEDENCE OF WORK

- 1. This Contract includes many different systems furnished and installed by different trades. All trades shall coordinate their work with that of all other trades so that it may be installed in the most direct and workmanlike manner without hindering or handicapping other trades.

3.11 RECORD DRAWINGS

- A. The Contractor shall keep a set of Drawings on the job, noting daily all changes made in these Drawings in connection with the final installation, including exact dimensioned locations of all new and uncovered existing active and inactive utilities outside the building, and shall turn over a clean, neatly marked set of mylar reproducible Drawings showing "as-installed" work to the Engineer for delivery to the Owner. All underground utilities, services, and systems shall be accurately located by the Contractor and dimensioned on the "as-installed" Drawings.

3.12 OPERATING AND MAINTENANCE MANUAL

- A. The Contractor shall furnish indexed operating and maintenance manuals with complete technical data for each system, piece of equipment, and material installed under this Contract.
- B. Two (2) copies of the manual, bound in hardback binders or an approved equivalent, shall be provided. One copy shall be completed and delivered to the Engineer prior to the time that system and equipment tests are performed. The second copy shall be delivered prior to final acceptance.
 - 1. Provide one (1) operation and Maintenance manual for each building. Provide one (1) as-built floor plan and one CD for each building.
- C. The manual shall include the following information
 - 1. Manufacturer's installation instructions.
 - 2. Manufacturer's local representative and/or distributor's name and address.
 - 3. Manufacturer's operating and maintenance instructions.
 - 4. Manufacturer's internal wiring diagrams.
 - 5. Contractor's installation wiring diagrams.
 - 6. Replacement part number listings and descriptions.
 - 7. Framed operating instructions, when required, in individual Specification sections.
 - 8. Warranties and guarantees.
 - 9. Provide an approved submittal at the front of each section.
- D. The manuals shall be identified on the cover as "Operating and Maintenance Manual" with additional cover display of the name and location of project, the Owner, the Engineers, the General Contractor, and the Subcontractors installing equipment represented in the brochure.

- E. The manual shall have a Table of Contents and shall be grouped in sections according to the sections of Division 27. Each section shall have a copy of the pages of the Specifications covered within the section. Sections shall be organized as follows:
1. Each section in the manual shall identify the grouping of all literature required for the system or equipment included.
 2. The contents of each section shall be arranged in the following sequence: First, the approved engineering submittals with complete performance and technical data; second, the manufacturer's installation brochure; third, the manufacturer's operating and maintenance brochure; fourth, the manufacturer's installation wiring diagram; fifth, the Contractor's field wiring diagram, if different; and sixth, the manufacturer's brochure listing replacement part numbers and description.
 3. Provide a final section entitled, "Warranties and Guarantees", for all equipment, etc.

3.13 EXISTING FACILITIES

1. The Contractor shall be responsible for loss or damage to the existing facilities and shall be responsible for repairing or replacing such loss or damage. The Contractor shall send proper notices and receive written permission from the Owner to enter existing areas. Before beginning work in existing areas, the Contractor shall make necessary arrangements and perform other services required for the care, protection, and in-service maintenance of all electrical, communication, plumbing, heating, air condition, and ventilating services for new and existing facilities. The Contractor shall erect temporary barricades with necessary safety devices to protect personnel from injury, removing all such temporary protection upon completion of the work.
2. The Contractor shall provide temporary or new services to existing facilities as required to maintain their proper operation when normal services are disrupted as a result of the work being accomplished under this project.
3. Where existing construction is removed to provide working and extension access to existing utilities, the Contractor shall remove doors, piping, conduit, outlet boxes, wiring, light fixtures, air condition ductwork, and equipment, etc. to provide this access and shall reinstall same upon completion of work.
4. Where partitions, walls, floors, or ceilings of existing construction are indicated to be removed, the Contractor shall remove and reinstall in locations approved by the Engineer all devices required for the operation of the electrical systems installed in the existing construction. This is to include, but is not limited to, temperature control system devices, electrical switches, relays, fixtures, piping, conduit, etc.

3.14 DEMOLITION AND RELOCATION

1. The Contractor shall modify, remove, and relocate all materials and items so indicated on the drawings or required by the installation of new facilities. All removals and/or dismantling shall be conducted in a manner as to produce maximum salvage. Salvage materials shall remain as directed by the Owner. Materials and items scheduled for relocation and which are damaged during dismantling or reassembly operations shall be repaired and restored to the approval of the Owner. The Contractor may substitute new materials and items of like design and quality in lieu of materials and items to be relocated, if approved by the Owner.

2. All items scheduled for relocation and/or reuse shall be inspected by the Contractor and the Owner or his authorized representative. A written report of the condition of each item shall be made and provided to the Engineer. Where items scheduled for relocation and/or reuse are considered unsuitable for reuse, the Contractor shall so notify the Engineer and await reinstallation instructions before proceeding with removal. Items damaged in reinstallation shall be repaired or replaced by the Contractor as directed by the Owner at not additional cost to the Owner or the Engineer.
3. All items which are to be relocated shall be carefully removed in reverse to original assembly or placement and protected until relocated. The Contractor shall clean, repair, and provide all new materials, fittings, and appurtenances required to complete the relocation and to restore the items to good operative order. All relocations shall be performed by workmen skilled in the work and in accordance with standard practice of the trades involved.
4. Service lines and wiring to items to be removed, salvaged, or relocated shall be removed to points as indicated on the drawings, specified, or acceptable to the Owner. Service lines and wiring not scheduled for reuse shall be removed to the points at which reuse is to be continued or service is to remain. Such services shall be sealed, capped, or otherwise tied off or connections into the existing facilities in such a manner as to result in minimum interruption of services to adjacent occupied areas. Services to existing areas or facilities which must remain in operation during the construction period shall not be interrupted without prior specific written approval of the Engineer.

3.15 OUTAGES

1. Outages of services as required by the project will be permitted, but only at a time approved by the Owner. The Contractor shall notify the Owner in writing two (2) weeks in advance of the requested outage in order to schedule required outages. No outages shall be taken unless written approval has first been received from the Owner. The time allowed for outages will not be during normal working hours unless otherwise approved by the Owner. All costs of outages, including overtime charges, shall be included in the Contract amount.

END OF SECTION

SECTION 27 02 00

GENERAL REQUIREMENTS FOR STRUCTURED CABLING SYSTEMS

CONDITIONS OF THE CONTRACT AND DIVISION 1, as applicable, apply to this Section.

PART 1 - GENERAL

1.1 RELATED WORK

- A. Section 27 00 00 – BASIC MATERIALS AND METHODS

1.2 DESCRIPTION

- A. Summary of Work:
1. The Scope of Work covered by this document is to furnish and install the Structured Cabling Systems and Pathways and Spaces systems for CFISD Technology. This work will provide for the structured cabling system (SCS) for all Voice and Data systems. Work on this project will commence after the award of the bid to a successful bidder.
 2. Structured Cabling Designer:

Name: LEAF Engineers Technology Department
Company: LEAF Engineers
- B. Telecommunications system shall include the following systems:
1. Structured Cabling System (SCS) For Telecommunications Systems
 2. Pathways for Telecommunications Systems
 3. Grounding and Bonding System (GBS) For Telecommunications Systems
 4. Firestopping for Telecommunications Systems

1.3 ADDITIONAL REQUIREMENTS

- A. Integration: Responsibility for overall telecommunications system integration and coordination of work among trades, subcontractors, and suppliers shall rest with Contractor named in construction contract issued by Owner's Representative. Work covered by this division of specifications shall be coordinated with related work indicated on drawings or specified elsewhere under project specifications. Work related to telecommunications system shall be performed under direct supervision of telecommunications system installer in a manner approved by product manufacturer.
- B. Coordination of work: Contractor shall be responsible for coordination of work among project specification divisions and contractor/subcontractors involved in this project. This coordination of Work Includes following instructions provided the Construction Manager or General Contractor if project is managed by such. See section 1.4 for additional information.
- C. General compliance requirements: Provide a complete and operable system in compliance with project drawings, specifications, referenced standards, applicable building codes, and Authority Having Jurisdiction (AHJ) requirements. Scope of this contract includes planning, design, materials, equipment, labor, configuration, programming, testing, startup and commissioning services, and documentation costs for complete and operable system that meets all requirements indicated on drawings or contained in specifications. Comply with all contract documents, specifications, drawings, manufacturer's instructions, and Owner and AHJ requirements. In case of conflict among applicable documents or standards, contractor shall notify owner's representative in writing of apparent conflict, and then comply with most

stringent requirements unless otherwise directed in writing from owner's representative. Work Includes all items required for complete system whether or not identified in specification or drawings.

- D. Information about general construction and architectural features and finishes all be derived from structural and architectural drawings and specifications only.
- E. Architectural drawings will include size of MDF/IDF, the size of MDF should be 14X14, or min 12X12 and all IDF 10X10 or min 8X8.
- F. Items referred to in singular number in Contract Documents shall be provided in quantities necessary to complete work.
- G. SCS contractor shall be trained, certified and accredited by CommScope and will be required to provide a 25-year CommScope Extended Product Warranty and Application Assurance upon successful completion of the installation.
- H. Work related to telecommunications system shall be installed by an SCS manufacturers authorized or certified trained installer and supervised an SCS manufacturers authorized or certified SCS Engineer. Owner reserves the right to review and approves any personnel assigned to this project in a supervisory or managerial role.
- I. SCS contractor shall have had at least 10 years of experience with telecommunications projects. As part of the proposal, SCS installer shall submit at least three (5) comparable Project reference descriptions with reference contacts. Comparable projects shall equal or exceed size and complexity of work on drawings.
- J. Complete and usable work: Refer to and comply with requirements in section 1.11 outlined below.

1.4 RELATED DOCUMENTS AND DRAWINGS

- A. General: The project drawings and general conditions of Contract shall apply to this section.
- B. Coordination: Coordinate with work specified in other sections and divisions of specifications.
- C. Reference: Codes and standards as referenced in section 1.5 may define additional specifications or requirements not specifically called out within this division. However, contractor shall adhere to most stringent requirements as defined herein, or as defined by reference within section 1.5.
- D. Architectural and Engineering specifications may have additional conditions or requirements that affect the work defined by this division of specifications. Contractor shall be responsible for the coordination of all conditions and other trade requirements that may impact schedule, scope of work, work progress, or other factors that may affect the overall ability for contractor to execute the requirements of this division of specifications.

1.5 CODES AND STANDARDS

- A. General: All work, including but not limited to: cabling, pathways, support structures, wiring, equipment, installation and workmanship shall comply with the latest editions of the requirements of the Authority Having Jurisdiction (AHJ), National Electrical Code, National Electrical Safety Code, all applicable local rules and regulations, equipment manufacturer's instructions, and the National Electrical Contractors Association (NECA) Standard of Installation. In case of discrepancy or disagreement between the documents noted above, the Contractor shall satisfy the most stringent requirements.

- B. Other sections of this document contain References to Codes and Standards that are applicable to the section.
- C. Insulated Cable Engineers Association (ICEA)
 - ANSI/ICEA S-80-576-2002, Category 1 & 2 Individually Unshielded Twisted-Pair Indoor Cables for Use in Communications Wiring Systems
 - ANSI/ICEA S-84-608-2002, Telecommunications Cable, Filled Polyolefin Insulated Copper Conductor
 - ANSI/ICEA S-90-661-2002, Category 3, 5, & 5e Individually Unshielded Twisted-Pair Indoor Cable for Use in General Purpose and LAN Communication Wiring Systems
 - ICEA S-102-700-2004, ICEA Standard for Category 6 Individually Unshielded Twisted-Pair Indoor Cables for Use in LAN Communication Wiring Systems Technical Requirements, 2004
- D. National Fire Protection Association (NFPA)
 - NFPA 70, National Electrical Code® (NEC®)
 - NFPA 70E, Standard for Electrical Safety Requirements for Employee Workplaces,
 - NFPA 72, National Fire Alarm Code®
 - NFPA 75, Standard for the Protection of Electronic Computer/Data Processing Equipment
 - NFPA 76, Recommended Practice for the Fire Protection of Telecommunications Facilities
 - NFPA 90A, Standard for the Installation of Air Conditioning and Ventilating Systems
 - NFPA 101, Life Safety Code®
 - NFPA 255, Standard Method of Test of Surface Burning Characteristics of Building Materials
 - NFPA 262, Standard Method of Test for Flame Travel and Smoke of Wires and Cables for Use in Air-Handling Spaces
 - NFPA 780, Standard for the Installation of Lightning Protection Systems
 - NFPA 5000™, Building Construction and Safety Code
- E. Telecommunications Industry Association (TIA)
 - ANSI/NECA/BICSI 568-2006, Standard for Installing Telecommunications Systems
 - ANSI X3T9.5, Requirements for UTP at 100 Mbps
 - ANSI/TIA-526.7-A, Measurement of Optical Power Loss of Installed Single-Mode Fiber Cable Plant
 - ANSI/TIA-568.0-D, Generic Telecommunications Cabling for Customer Premises
 - ANSI/TIA-568.1-D, Commercial Building Telecommunications Cabling Standard
 - ANSI/TIA-568-C.2, Balanced Twisted-Pair Telecommunication Cabling and Components Standard
 - ANSI/TIA-568.3-D, Optical Fiber Cabling and Components Standard
 - ANSI/TIA-568-C.4, Broadband Coaxial Cabling and Components Standard
 - ANSI/TIA-569-D, Telecommunications Pathways and Spaces
 - ANSI/TIA-606-C, Administration Standard for Telecommunications Infrastructures
 - ANSI/TIA-862-B, Structured Cabling Infrastructure Standard for Intelligent Building Systems
 - ANSI/TIA-942-B, Telecommunications Infrastructure Standard for Data Centers
 - J-STD-607-A, Commercial Building Grounding (Earthing) and Bonding Requirements for Telecommunications
 - T-526-14-C, Optical Power Loss Measurements of Installed Single mode Fiber Cable Plant
 - TIA-598-D, Optical Fiber Cable Color Coding
 - TIA-604.3-B, FOCIS 3—Fiber Optic Connector Intermateability Standard, Type SC
 - TIA-604.10-B, FOCIS 10—Fiber Optic Connector Intermateability Standard, Type LC
 - TIA TSB-125, Guidelines for Maintaining Optical Fiber Polarity Through Reverse-Pair Positioning
 - TIA-758-B, Customer-owned Outside Plant Telecommunications Infrastructure Standard

TSB-155-A, Guidelines for the Assessment and Mitigation of Installed Category 6 Cabling to Support 10GBASE-T

- F. Other Reference Materials
ANSI/NECA/BICSI-568-2006, Standard, Installing Commercial Building Telecommunications Cabling
BICSI Outside Plant Design Reference Manual (COOSP), current edition.
BICSI Electronic Safety and Security Reference Manual (ESSDRM), current edition
BICSI Information Transport Systems Installation Methods Manual (ITSIM), current edition
BICSI Network Design Reference Manual (NDRM), current edition
BICSI Telecommunications Distribution Methods Manual (TDMM), current edition
BICSI Wireless Design Reference Manual (WDRM), current edition
Institute of Electrical and Electronic Engineers (IEEE)
National Electrical Manufacturers Association (NEMA)
Underwriters Laboratories (UL) Cable Certification and Follow Up Program

1.6 ABBREVIATIONS, ACRONYMS AND DEFINITIONS

A. Abbreviations

ACD	Automatic Call Distribution
AFF	Above Finished Floor
AWG	American Wire Gauge
BICSI	Building Industry Consulting Services International
CAT5	Category 5 Copper Cable
CAT5e	Category 5e Copper Cable
CAT6	Category 6 Copper Cable
CAT6A	Category 6A Copper Cable
CDDI	Copper Distributed Data Interface
CMP	Communications Multipurpose Plenum: cable rating
CMR	Communications Multipurpose Riser: cable rating
EIA	Electronic Industries Association
ELFEXT	Equal-Level Far-End Crosstalk
FEXT	Far End Crosstalk
Gbps	Gigabits per second
HSM	High Speed Migration
HVAC	Heating, Ventilation, and Air Conditioning
IDF	Intermediate Distribution Frame - Termination frames, relay racks, and cable management
IEEE	Institute of Electrical and Electronics Engineers
IM	Information Management
ISDN	Integrated Services Digital Network
LAN	Local Area Network
Mbps	Megabits per second
MDF	Main Distribution Frame, consisting of carrier entrance rooms and head-end
MMF	Multi-mode fiber optics, 50 or 62.5-micron laser optimized core
MUTOA	Multi-User Telecommunications Outlet Assembly
NEXT	Near End Cross Talk
NRTL	Nationally Recognized Testing Laboratories
OSHA	Occupational Safety and Health Act
PBX	Private Branch Exchange: telephone switch
PDS	Premises Distribution Systems (See SCS)
PoE	Power over Ethernet (IEEE 802.3af)
POP	Point of Presence
PSACR	Power Sum Attenuation-to-Crosstalk Ratio
PSAFEXT	Power Sum Alien Far-End Crosstalk

PSAELFEXT	Power Sum Alien Equal Level Far-End Crosstalk
PSANEXT	Power Sum Alien Near-End Crosstalk
PSELFEXT	Power Sum Equal Level Far-End Crosstalk
PSNEXT	Power Sum Near-End Crosstalk
SCC	Security Command Center
SCS	Structured Cabling System, or Structure Connectivity System; a complete cabling system
SFF	Small Form Factor
SMF	Single-mode fiber optics, 8.3-micron core
TC	Telecommunications Closet
TE	Telecommunications Enclosure
TEF	Telecommunications Entrance Facility
TIA	Telecommunications Industry Association
TR	Telecommunications Room
TO	Telecommunications Outlet
UPS	Uninterruptible Power Supply
UTP	Unshielded Twisted Pair
VoIP	Voice over Internet Protocol
WAO	Work Area Outlet
WAN	Wide Area Network
WAP	Wireless Access Point

B. Definitions

Access Floor - A floor system that has removable floor panels.

Building Backbone Cabling – Cabling used to connect Floor Distributors (FD) or other local collection points to the Building Distributor (BD). Building backbone cabling typically carries aggregate traffic and, as such, impacts multiple network devices and users. Building backbone cabling may include either fiber optic or copper cabling or both.

Building Distributor (BD) – Termination point from which all building backbone cabling emanates and interconnection point for the network backbone. Commonly referred to as BDF in Americas, Main Comm Rooms in EMEA and Communication Room, IT Lab or IT Room in AsiaPac. Referred to as BD in international and European industry standards and Intermediate Cross-connect (IC) in American industry standards. There is one BD for each building and it feeds all FD's in the same building. The BD should be located so that all FD's served are within 300 cable meters (984 cable feet). All BD's are linked to the CD.

Campus Backbone Cabling – Cabling used to connect Building Distributors (BD) or other key network segments to the Campus Distributor (CD). With rare exceptions, campus backbone cabling carries aggregate traffic and typically impacts entire buildings worth of network devices and users and, as such, link redundancy with diverse routing is highly recommended. Campus backbone cabling almost exclusively consists of fiber optic cabling. Copper cabling may be used in short-distance (< 90m) applications. In such cases, lightning protection will usually be required by code.

Campus Distributor (CD) – Termination point from which all campus backbone cabling emanates and highest-level interconnection point for the network backbone. Commonly referred to as NOC in Americas and Main Comm Rooms in EMEA. Referred to as CD in international and European industry standards and Main Cross-connect (MC) in American industry standards. On smaller campuses, there is one CD for the campus. On larger campuses, there might be several CD's with each CD serving several buildings. Besides linking to each of the BD's it serves, the CD is also the network interconnection point for data center links and links to service providers.

Category 3 (Cat 3) – A category of transmission performance, defined in TIA standards, that specifies electrical properties up to 10 MHz. Cat 3 is the minimum performance grade permissible and is used typically for analog voice distribution.

Category 5e (Cat 5e) / Class D – A category/class of transmission performance that specifies electrical properties up to 155.5 MHz. Capable of supporting copper-based, four-pair Gigabit Ethernet (IEEE 802.3ab 1000BASE-T) applications. Category 5e is defined in TIA-568-C standard. Class D is defined in the ISO 11801 standard.

Category 6 (Cat 6) / Class E – A category/class of transmission performance that specifies electrical properties up to 250 MHz. Refer to the TIA- 568-C family of standards for more information on Category 6 and ISO/IEC 11801 for more information on Class E requirements. Also, refer to CENELEC EN50173.

Category 6A (Cat 6A) / Class EA – A category/class of transmission performance that specifies electrical properties up to 500 MHz and capable of supporting data applications operating at 10Gbps. Refer to the TIA-568-C family of standards for more information on Category 6 and ISO/IEC 11801 for more information on Class EA requirements.

Category 7 / Class F – Backward compatible with Class D/Category 5e and Class E/Category 6. Class F features even stricter specifications for crosstalk and system noise than Class E. To achieve this, shielding has been added for individual wire pairs and the cable as a whole.

Category 8 – Ratified by the TR43 working group under ANSI/TIA 568-C.2-1. It is defined up 2000 MHz and only for distances from 30 to 36m depending on the patch cords used. ISO is expected to ratify the equivalent in 2018 but will have 2 options: Class I channel, Category 8.1 cable and Class II channel, Category 8.2 cable. Category 8 is designed only for data centers where distances between switches and servers is short. It is not intended for general office cabling.

Certification – The testing and documentation of the transmission performance (e.g., Category 5e / Class D) of a permanent link or channel, based on sweep frequency (where applicable) testing of numerous parameters with results compared to a range of acceptable values. This project requires 100% certification (with documentation) of all permanent link cabling at the time of installation. Channel certification is optional and is the responsibility of the group using the channel.

Channel – The entire physical pathway between active equipment ports, inclusive of all patch cords, patch panels, jacks and cabling segments.

Class C – A category of transmission performance, defined in ISO and EN standards, that specifies electrical properties up to 16 MHz

Conduit - A raceway of circular cross-section.

Entrance Facility (EF) – Termination point of service provider cables that have entered the building and location of service demarcation point (MPOE) and interconnection point to the network. Commonly referred to as Telco Room in Americas, POP Room in EMEA and Building Entrance in AsiaPac. Referred to as Building Entrance Facility in international and European industry standards and Entrance Facility (EF) in American industry standards. The EF is linked to the CD, where present, or to the BD.

Floor Distributor (FD) – Termination point for horizontal cabling and interconnection point for network access. Commonly referred to as IDF in Americas and AsiaPac and as Sub Comms Room in EMEA. Referred to as Floor Distributor (FD) in international and European industry standards and Horizontal Cross-connect (HC) - FD quantities and locations are determined by building size and geometry so that all points served are within 90 cable meters (295 cable feet) of an FD. The FD feeds all Telecommunication Outlets (TO's) in its service zone. All FD's in a building are linked to the building's Building Distributor (BD) via backbone cabling.

Horizontal Cabling – Cabling used to connect individual work area outlets to local Floor Distributors (FD) or other collection points. Unlike backbone cabling, horizontal cabling does not typically carry aggregate traffic and, as such, impacts only single network devices or users. In buildings, horizontal cabling almost exclusively consists of copper cabling. Fiber optic cabling may be used where situations dictate but, unlike horizontal copper cabling, horizontal fiber optic cabling is not installed in advance as default building facilities. At this writing, horizontal copper cabling in many networks is capable of supporting Gigabit (1Gb/s) Ethernet applications as well as other applications of similar bandwidth.

Permanent Link – A stationary cabling segment, consisting of the permanently installed cable and the permanently affixed jack at both ends (typically at the outlet faceplate and closet patch panel, or on a patch panel on both ends). The concept assumes that, while patch cords might be disconnected or moved over time, the permanent cable and jacks will not be disturbed and the electrical characteristics of the permanent link will remain unaltered.

Plenum - A space within the building designed for the movement of environmental air; i.e., a space above a suspended ceiling or below an access floor.

Raceway - Any channel designed for holding wires or cables; i.e. conduit, electrical metal tubing, busways, wireways, ventilated flexible cableway.

Spine – also called a backbone, the main communications cables in an IDF.

1.7 PROJECT DRAWINGS

- A. **General Drawing Specifications:** Detail and elevation drawings shall be D size (24" x 36") with a minimum scale of 1/4" = 1'0" or larger. ER, TR and other enlarged detail floor plan drawings shall be D size (24" x 36") with a minimum scale of 1/4" = 1'0" or larger. Building composite floor plan drawings shall be D size (24" x 36") with a minimum scale of 1/8" = 1' 0".
- B. **Building composite floor plans:** Provide building floor plans showing outlet locations and jack configuration, types of jacks, run distance for each jack cable, and cable routing/locations. Identify TO's that, according to location and available pathway systems, require cable length greater than allowed by standards. Recommend alternatives for Owners Representative's consideration.
- C. **Telecommunications space plans/elevations:** Include enlarged floor plans of TRs indicating layout of equipment and devices, including receptacles and grounding provisions. Submit detailed plan views and elevations of telecommunications spaces showing racks, termination blocks, and cable paths.
- D. **Logical Drawings:** Provide logical riser or schematic drawings for all systems. Include schematic symbol key.

1.8 SUBSTITUTIONS

- A. **Substitution requests:** Substitution requests will be considered only if submitted to Owner's Representative not less than 7 working days prior to project bid date. Acceptance or rejection of proposed substitution is at Owner's Representatives sole discretion. No exceptions. Requests for substitutions shall be considered not approved unless approval is issued in writing by Owner's Representative.
- B. **Rejection:** For equipment, cabling, wiring, materials, and all other products indicated or specified as no substitutions or no alternates, Owner does not expect nor desire requests for substitutions and alternate products other than those specified. Owner reserves right for Owner's Representative to reject proposed substitution requests and submissions of alternates without review or justification.

1.9 PRE-INSTALLATION MEETING

- A. After award, convene a pre-installation meeting at least 14 calendar days prior to commencing SCS and related work. The meeting must be scheduled at least 14 days in advance. Require attendance of parties directly affecting work of this section, including other trades and utilities if necessary. Review conditions of operations, procedures and coordination with related work.
- B. **Agenda:** Comply with following agenda specifications:
 - 1. Tour, inspect, and discuss building conditions relating to telecommunications system cabling and equipment, coordination with Telephone Utility Company, Owner's telecommunications system requirements, and coordination with existing conditions and other work in contract.
 - 2. Review exact location of each item within building construction, casework, and fixtures, and their requirements.
 - 3. Review required submittals, both completed and yet to be completed.
 - 4. Review drawings and specifications.
 - 5. Review proposed equipment, cabling, and related work.
 - 6. Review and finalize construction schedule related to telecommunications system and verify availability of materials, personnel, equipment, and facilities needed to make progress and avoid delays.
 - 7. Review required inspections and testing.
 - 8. Review cable routing and support provisions.

1.10 WARRANTY

- A. Comply with additional requirements in contract general requirements and extended warranties required in other specification sections. Refer to all other 27xxxx sections for specific additional warranty requirements that exceed or are in addition to those of this section.
- B. **Contractor warranty:** Provide all services, materials and equipment necessary for successful operation of entire telecommunications system and SCS system for a period of one year after system acceptance. Scope of warranty includes all equipment, devices, wiring, accessories, software, hardware, installation, programming, and configuration required to maintain a complete and operable system. Provide manufacturer's published recommended preventative maintenance procedures during warranty period. This shall apply to all items except those specifically excluded, or items wherein a longer period of service and warranty is specified or indicated. All warranties shall be effective for one year, minimum, from date Certificate of Final Acceptance is issued. Use of systems provided under this section for temporary services and facilities shall not constitute final acceptance of work nor beneficial use by Owner and shall not institute warranty period. The warranty shall cover repair or replacement of defective materials, equipment, workmanship, and installation that may be incurred during this period. Warranty work is to be done promptly and to Owner's satisfaction. In addition, warranty shall cover correction of damage caused in making necessary repairs and replacements under warranty. Additional warranty responsibilities are:
 - 1. Obtain written equipment and material warranties offered in manufacturer's published data without exclusion or limitation, in Owner's designated name. Replace material and equipment that require excessive service during guarantee period as determined by Owner.
 - 2. Provide 2-business day service beginning on date of Substantial Completion and lasting until termination of warranty period. Service shall be at no cost to Owner. Service can be provided by installing contractor or by a separate service organization. Choice of service organization shall be subject to Owner's approval. Submit name and a phone number that will be answered on a 24-hour basis each day of week, for duration of service.

3. Submit copies of equipment and material warranties to Owner before final acceptance.
 4. At end of warranty period, transfer manufacturers' equipment and material warranties still in force to Owner.
 5. If warranty work problems cannot be corrected immediately to Owner's satisfaction, advise Owner in writing, describing efforts to correct situation, and provide analysis of cause for problem. If necessary to resolve problem, provide at no cost services of manufacturer's engineering and technical staff at site in a timely manner to analyze warranty issues, and develop recommendations for correction, for review and approval by Owner.
- C. **Owner's rights:** This section shall not be interpreted to limit Owner's rights under applicable codes and under this Contract.
- D. **Pathways Material and Installation warranty:** Provide all services, materials and equipment necessary to warrant the installation and performance of all pathway materials for a period of one year after beneficial use. Scope of warranty includes all equipment, devices, installation and other work required to maintain a complete and operable system. Provide manufacturers published recommended preventative maintenance procedures during warranty period.
- E. **Grounding and Bonding Material and Installation warranty:** Provide all services, materials and equipment necessary for successful operation of GBS for a period of one year after beneficial use. Scope of warranty includes all equipment, devices, installation and other work required to maintain a complete and operable system. Provide manufacturers published recommended preventative maintenance procedures during warranty period.
- F. **Firestopping Material and Installation warranty:** Provide all services, materials and equipment necessary to warrant the performance of all Firestopping material for a period of one year after beneficial use, or longer if required by the local AHJ. Scope of warranty includes all equipment, devices, installation and other work required to maintain a complete and operable system. Provide manufacturers published recommended preventative maintenance procedures during warranty period.
- G. **SCS Manufacturer Extended Warranty**
1. SCS Systems will be covered by a two-part certification program provided by a single manufacturer and that manufacturer's certified vendor. Manufacturer shall administer a follow-on program through the Vendor to provide support and service to the purchaser. The first part is an assurance program, which provides that the certified system will support the applications for which it is designed, during the 25-year warranty of the certified system.
 2. The second portion of the certification is a 25-year warranty provided by the manufacturer and the vendor on all products within the system (cords, telecommunications outlet/connectors, cables, cross-connects, patch panels, etc.).
 3. If the certified system ceases to support the certified application(s), whether at the time of cutover, during normal use or when upgrading, the manufacturer and vendor shall commit to promptly implement corrective action.
 4. Documentation proving the cabling system's compliance to the End-to-End Link Performance recommendations, as listed in ANSI/TIA-568-C shall be provided by the Vendor prior to the structured cabling system being installed.
 5. The cabling system must conform to the current issue of industry standard TIA-568. All performance requirements of this document must be followed. As well, workmanship and installation methods used shall be equal to or better than that found in the BICSI (Building Industry Consulting Service International) ITSIM manual.
 6. Purchaser demands strict adherence to the performance specifications listed in ANSI/TIA-568-C series standards.
 7. Manufacturer shall maintain ISO Quality Control registration for the facilities that manufacture the product used in this cabling system.

1.11 COMPLETENESS OF WORK

- A. **Complete and usable work:** The contractor is responsible for providing complete and usable work per contract documents. All materials and equipment shall be provided with all accessories and additional work required for field conditions, as well as additional work and accessories required for complete, usable, and fully functional construction and systems, even if not explicitly specified or indicated. Telecommunications system in this Contract shall be provided as complete and operable systems in full compliance with requirements on drawings and specification requirements. Drawings are diagrammatic and specifications are performance-based, and Contractor shall provide all work required to comply with drawings and specifications, even if not explicitly indicated or specified. Contractor shall be responsible for coordinating installation of electrical systems with all field conditions and work of other trades. Minimum clearances and work required for compliance with NFPA 70, National Electrical Code® (NEC®), and manufacturer's instructions shall be provided. Comply with additional requirements indicated for access and clearances. Contractor shall verify all field conditions and dimensions that affect selection and provision of materials and equipment, and shall provide any disassembly, reassembly, relocation, demolition, cutting and patching required to provide work specified or indicated, including relocation and reinstallation of existing wiring and equipment. Contractor shall protect from damage resulting from Contractor's operations existing facility, equipment, and wiring. Extra charges for completion and contract time extension will not be allowed because of field conditions or additional work required for complete and usable construction and systems. Comply with additional requirements indicated for access and clearances.
- B. **Drawings and specifications form complementary requirements:** Provide work specified and not shown, and work shown and not specified as though explicitly required by both. Except where explicitly modified by a specific notation to contrary, it shall be understood that indication or description of any item, in drawings or specifications or both, carries with it instruction to furnish and install item, provided complete.
- C. **Terms:** As used in this specification: Provide means furnish and install. Furnish means "to purchase and deliver to project site complete with every necessary appurtenance and support," and install means "to unload at delivery point at site and perform every operation necessary to establish secure mounting and correct operation at proper location in project."
- D. **Authority approvals:** Give notices, file plans, obtain permits and licenses, pay fees, and obtain necessary approvals from authorities that have jurisdiction as required to perform work per all legal requirements and with Specifications, Drawings, Addenda and Change Orders, all of which are part of Contract Documents.
- E. **Supplementary items:** Provide supplementary or miscellaneous items, appurtenances, devices and materials necessary for a sound, secure and complete installation. Examine project drawings and other Sections of specifications for section with work of other Sections and provide a complete and fully functional installation. Refer to all other drawings and other specifications sections that indicate types of construction in which work shall be installed and work of other sections with which work of this section must be coordinated
- F. **Quantities:** Items referred to in singular number in Contract Documents shall be provided in quantities necessary to complete work.

1.12 PROJECT CONDITIONS

- A. **Field verification:** Carefully verify location, use and status of all material, equipment, and utilities that are specified, indicated, or deemed necessary for removal. Verify that all materials, equipment, and utilities to be removed are completely inactive and will not be required or in use after completion of project. Replace with equivalent any material, equipment and utilities that were removed by Contractor that are required to be left in place.
- B. **Existing utilities:** As applicable, do not interrupt utilities serving facilities occupied by Owner or others unless permitted under following conditions and then only after arranging to provide temporary utility services per requirements indicated:
 - 1. Notify owner in writing at least 14 days in advance of proposed utility interruptions. Do not proceed with utility interruptions without Owner's written permission.
 - 2. Equipment installation:
 - a. Determine suitable path for moving unit substation into place; consider Project conditions.
 - b. Verify clearance requirements and locate equipment to meet installation tolerances.
 - c. Revise locations and elevations from those indicated to those required to suit Project.

1.13 DELIVERY, STORAGE AND HANDLING

- A. Contractor shall be responsible for the deliveries, storing and handling of all materials relative to the SCS systems, including materials supplied by others that are part of the SCS installation contract. Material shall be stored and protected per manufacturer's instructions. Contractor shall be responsible for the security of all material during installation. For all material provided by contractor, or delivered to contractor on site, contractor assumes full responsibility and liability for any material shortages, damage or loss due to storage and handling methods.

1.14 PERMITS AND INSPECTIONS

- A. All telecommunications systems shall meet or exceed the latest requirements of all national, state, county, municipal, and other authorities exercising jurisdiction over the telecommunications systems and the Project.
- B. Contractor shall obtain and pay for all licenses, permits, and inspection fees required by local agencies and/or other agencies having jurisdiction.
- C. Contractor agrees to furnish any additional labor or material required to comply with all local and other agencies having jurisdiction at no additional cost.
- D. Contractor shall obtain certificates of inspection and approval from all authorities having jurisdiction, and forward copies of same to Owner's Representative prior to request for Project acceptance inspections, completion inspections, substantial completion inspections, and acceptance testing/demonstrations.
- E. All required permits and inspection certificates shall be made available at the completion of the telecommunications system installation and commissioning.
- F. Any portion of the telecommunications work which is not subject to the requirements of an electric code published by a specific AHJ shall be governed by the National Electrical Code and other applicable sections of the National Fire Code, as published by the National Fire Protection Association (NFPA).

- G. Installation procedures, methods and conditions shall comply with the latest requirements of the Federal Occupational Safety and Health Administration (OSHA).

1.15 EXAMINATION

- A. Prior to submitting a proposal, Contractor shall examine site, review Project drawings and specifications, and determine exact extent of work required. Contractor shall include in their proposals all materials, labor, and equipment required to complete required work indicated. Work that is necessary to obtain complete and usable Project as specified herein shall be included in Contractor's proposal, even if not indicated or specified.
- B. **Bidders' questions:** Should bidders have questions as to intent of drawings and specifications, quality of materials to be used, and work to be performed, questions shall be submitted in writing to Owner's Representative in manner dictated by Owner's Representative. All answers and clarifications to drawings and specifications will be issued in writing.
- C. Extra payment will not be allowed for claims for due to unfamiliarity with work to be performed by other trades, existing conditions at job site, local or state laws and codes, and alterations due to field conditions.

1.16 ADDITIONAL COSTS

- A. Project acceptance inspections, completion inspections, substantial completion inspections, and acceptance testing/demonstrations shall be conducted after verification of system operation and completeness by Contractor.
- B. **Inspections and testing:** For Project acceptance inspections, final completion inspections, substantial completion inspections, and/or testing/demonstrations that require more than one site visit by Owner's Representative or Architect/Engineer to verify Project compliance for same material or equipment, Owner reserves right to obtain compensation from Contractor to defray cost of additional site visits that result from Project construction or testing deficiencies / incompleteness, incorrect information, or non-compliance with Project provisions. Owner's Representative will notify Contractor of hourly rates and travel expenses for additional site visits, and will issue an invoice to Contractor for additional site visits. Payment of additional site visit costs by Contractor is required within 30 days of invoicing. Owner reserves right to deduct additional costs defined herein that are indicated on past due invoices from Project amount due Contractor.
- C. **Exclusions:** Contractor shall not be eligible for extensions of Project schedule or additional charges resulting from additional site visits that result from Project construction or testing deficiencies/incompleteness, incorrect information, or non-compliance with Project provisions.

PART 2 – EXECUTION

2.1 GENERAL REQUIREMENTS

- A. Sequence, coordinate, and integrate various elements of telecommunications system, materials, and equipment. Comply with following requirements as a minimum.
- B. Coordinate systems, equipment, and materials installation with other building components.
- C. Verify all dimensions by field measurements.
- D. Arrange for chases, slots, and openings in other building components during progress of construction, to allow for wiring, cabling, and equipment installations.
- E. Coordinate installation of required supporting devices and sleeves to be set in poured-in-place concrete and other structural components, as they are constructed.

- F. Sequence, coordinate, and integrate installations of materials and equipment for efficient flow of Work. Give particular attention to large equipment requiring positioning prior to closing in building.
- G. Where mounting heights are not detailed or dimensioned, install systems, materials, and equipment to provide maximum headroom and access for service and maintenance as possible.
- H. Coordinate connection of materials, equipment, and systems with exterior underground and overhead utilities and services. Comply with requirements of governing regulations, franchised service companies, and controlling agencies. Provide required connection for each service.
- I. Install systems, materials, and equipment to conform with approved submittal data, including coordination drawings, to greatest extent possible. Conform to arrangements indicated by Contract Documents, recognizing that portions of Work are shown only in diagrammatic form. In case of conflict among individual system requirements, request direction in writing from Owner's Representative.
- J. Install systems, materials, and equipment level and plumb, parallel and perpendicular to other building systems and components, where installed in both exposed and un-exposed spaces.
- K. Install cabling, wiring, and equipment to facilitate servicing, maintenance, and repair or replacement of equipment components. As much as practical, connect equipment for ease of disconnecting, with minimum of interference with other installations.
- L. Provide access panel or doors where units are concealed behind finished surfaces.
- M. Install systems, materials, and equipment giving right-of-way priority to systems required to be installed at a specified slope.
- N. Comply with all requirements and work indicated on drawings.
- O. Avoid interference with structure and with work or other trades, preserving adequate headroom and clearing doors and passageways to satisfaction of Owner and per code requirements.
- P. Install equipment and cabling/wiring to properly distribute equipment loads on building structural members provided for equipment support under other Sections. Roof-mounted equipment shall be installed and supported on structural steel or roof curbs as appropriate.
- Q. Provide suspended platforms, strap hangers, brackets, shelves, stands or legs as necessary for floor, wall and ceiling mounting of equipment as required.
- R. Provide steel supports and hardware for proper installation of hangers, anchors, guides, and other support hardware.
- S. Obtain and analyze catalog data, weights, and other pertinent data required for proper coordination of equipment support provisions and installation.
- T. Structural steel and hardware shall conform to ASTM standard specifications. Use of steel and hardware shall conform to requirements of AISC Code of Practice: Section Five.
- U. Verify site conditions and dimensions of equipment to ensure access for proper installation of equipment without disassembly that would void warranty.

2.2 EQUIPMENT INSTALLATION

- A. Install equipment per manufacturer's written instructions. Install equipment level and plumb. Install wiring and cabling between equipment and all related devices.
- B. **Mounting:** If neither the Owner's Instructions nor the individual section call out the required hardware mounting, use the following.
 - 1. For equipment at walls, bolt units to wall or mount on structural steel channel strut bolted to wall

2. For equipment not at walls, provide freestanding racks fabricated of structural steel members and slotted structural steel channel strut
 3. Use feet consisting of 0.25-inch thick steel plates, 6 square inch, bolted to floor
 4. Use feet for welded attachment of vertical posts not over 3 feet on center
 5. Connect posts with horizontal U channel steel strut and bolt control equipment to channels
- C. **Cleaning:** Remove paint splatters and other spots, dirt, and debris. Touch up scratches and mars of finish to match original finish. Clean devices internally using methods and materials as recommended by manufacturer.
- D. **Connections:** Tighten wiring connectors, terminals, bus joints, and mountings, to include lugs, screws and bolts per equipment manufacturer's published torque tightening values for equipment connectors. In absence of published connection or terminal torque values, comply with torque values specified in UL 486A and UL 486B.

2.3 CUTTING AND PATCHING

- A. Perform cutting and patching per contract general requirements. In addition, following requirements apply:
1. Perform cutting, fitting, and patching of electrical equipment and materials required to uncover existing infrastructure to provide access for correction of improperly installed existing or new Work.
 2. Remove and replace defective Work.
 3. Remove and replace Work not conforming to requirements of Contract Documents.
 4. Remove samples of installed Work as specified for testing.
 5. Install equipment and materials in existing structures.
- B. **Demolition and removal:** Cut, remove, and legally dispose of selected equipment, components, and materials as indicated, including but not limited to removal of material, equipment, devices, and other items indicated to be removed and items made obsolete by new Work. Provide and maintain temporary partitions or dust barriers adequate to prevent spread of dust and dirt to adjacent areas.
- C. **Protection of work:** Protect structure, furnishings, finishes, and adjacent materials not indicated or scheduled to be removed. During cutting and patching operations, protect adjacent installations. Patch finished surfaces and building components using new materials specified for original installation and experienced installers.

2.4 PENETRATIONS AND SLEEVES

- A. Coordinate work with other sections. SCS Installation Contractor shall be responsible for the provision of cabling sleeves and conduits unless specifically provided by the Electrical Contractor. SCS Installation Contractor shall coordinate with Electrical Contractor to determine exact requirements.
- B. When required, set sleeves in forms before concrete is poured. Provide core drilling as necessary if walls are poured or otherwise constructed without sleeves and wall penetration is required. Do not penetrate structural members. Provide sleeves and packing materials at all penetrations of foundations, walls, slabs (except on-grade), partitions, and floors. Sleeves shall meet requirements of pertinent specifications. Lay out penetration and sleeve openings in advance, to permit provision in work. Set sleeves and conduit in forms before concrete is poured. Provide remedial work where sleeves and conduits are omitted or improperly placed.
- C. **Sleeve fill:** Sleeves that penetrate outside walls, basement slabs, footings, and beams shall be waterproof.
1. Fill slots, sleeves and other openings in floors or walls if not used.

2. Fill spaces in openings after installation of conduit or cable.
 3. Fill for floor penetrations shall prevent passage of water, smoke, fire, and fumes.
 4. Fill shall be fire resistant in fire floors and walls, and shall prevent passage of air, smoke and fumes. See section 27 05 32 - Firestopping for Telecommunications Systems.
 5. Sleeves through floors shall be watertight and shall extend 2 inches above floor surface.
 6. Where raceways passing through openings are exposed in finished rooms, finishes of filling materials shall match and be flush with adjoining floor, ceiling, and wall finishes.
- D. Conduit sleeves:
1. Annular space between conduit and sleeve shall be at least 1/4 inch.
 2. Sleeves shall not be provided for slabs-on-grade unless specified or indicated otherwise.
 3. For sleeves through rated fire walls and smoke partitions, comply with requirements for firestopping. See section 27 05 32 - Firestopping for Telecommunications Systems.
- E. Supports: Do not support piping risers or conduit on sleeves.
- F. Future use: Identify unused sleeves and slots for future installation

2.5 CORE DRILLING

- A. Core drilling shall be avoided where possible. Where core drilling is unavoidable, locate all required openings prior to coring.
- B. Coordinate openings with other trades and utilities and prevent damage to structural reinforcement.
- C. Thoroughly investigate existing conditions in vicinity of required opening prior to coring.
- D. Set sleeves prior to installation of structure for passage of pipes, conduit, ducts, etc. Protect all areas from damage.

2.6 CLEANING

- A. Contractor is responsible for cleanup of debris daily. Cost of cleanup is the responsibility of the Contractor.
- B. During progress of work, remove equipment and unused material. Put building and premises in neat and clean condition. Perform cleaning and washing required to provide acceptable appearance and operation of equipment to satisfaction of Owner's Representative.
- C. After completion of Project, clean exterior surface of all equipment, including concrete residue, dirt, and paint residue. Final cleaning shall be performed prior to Project acceptance by Owner's Representative.

2.7 ACCESS AND ACCESS PANELS

- A. Provide access to materials and equipment that require inspection, replacement, repair or service. Provide access panels and/or doors as required to allow service of all equipment components. Provide access panels where items installed require access and are concealed in floor, wall, furred space or above ceiling. Ceilings consisting of lay-in or removable splined tiles do not require access panels. Locations of equipment requiring access shall be noted on record drawings. Access panels shall have same fire rating classification as surface penetrated.
- B. **Coordination:** Coordinate and prepare a location, size, and function schedule of access panels required to fully service equipment and deliver to Owner.

- C. **Construction:** Panels shall be at least 12 inches by 12 inches and located to provide optimum access to equipment for maintenance and servicing. Verify access panel locations and construction with Owner's Representative.

2.8 START UP AND OPERATIONAL TESTING

- A. Owner maintains right to have access to entire project site to prepare facility for occupancy and operation. Completion of startup and field testing shall be accomplished as a prerequisite for substantial completion. Operate and maintain systems and equipment until final acceptance by Owner. All guarantees and warranties shall not begin until final acceptance of systems and equipment by Owner. Acceptance requires, at a minimum, complete systems startup and testing.

2.9 SPECIAL RESPONSIBILITIES AND INFORMATION

- A. **Coordination of information:** Cooperate and coordinate with work of other sections in executing work of this section. Perform work such that progress of entire project, including work of other sections, shall not be interfered with or delayed. Provide information as requested on items furnished under this section, which shall be installed under other sections. Obtain detailed installation information from manufacturers of equipment provided under this section.
- B. **Information gathering:** Obtain final rough-in dimensions or other information as needed for complete installation of items furnished under other sections or by Owner. Keep fully informed as to shape, size and position of openings required for material or equipment to be provided under this and other sections. Give full information so that openings required by work of this section may be coordinated with other work and other openings and may be provided for in advance. In case of failure to provide sufficient information in proper time, provide cutting and patching or have same done, at no expense to Owner.
- C. **Housekeeping pads:** Provide information as requested as to sizes, number and locations of concrete housekeeping pads necessary for floor mounted equipment
- D. **Maintenance of equipment and systems:** Maintain equipment and systems until Final Acceptance. Ensure adequate protection of equipment and material during delivery, storage, installation and shutdown and during delays pending final test of systems and equipment because of seasonal conditions.
- E. **Use of premises:** Use of premises shall be restricted as directed by Owner's Representative and as required below:
 - 1. **Cleaning and rubbish removal:** Remove and dispose of dirt and debris and keep premises clean. During progress of work, remove equipment and unused material. Put building and premises in neat and clean condition and do cleaning and washing required to provide acceptable appearance and operation of equipment, to satisfaction of Owner's Representative.
 - 2. **Rubbish Removal:** Provide for the removal from the site of all spoils, debris, boxes, packaging, crates, and trash generated from the work.
 - 3. **Storage:** Store materials maintaining an orderly, clean appearance. If stored on site in open or unprotected areas, all equipment and material shall be kept off ground by means of pallets or racks and covered with tarpaulins.
- F. Protection of fireproofing:
 - 1. Clips, hangers, clamps, supports and other attachments to surfaces to be fireproofed shall be installed, if possible, prior to start of spray fire proofing work.
 - 2. Conduits and other items that would interfere with proper application of fireproofing shall be installed after completion of spray fire proofing work.

3. Patching and repairing of fireproofing due to cutting or damaging to fireproofing during course of work specified under this section shall be performed by installer of fireproofing and paid for by section responsible for damage and shall not constitute grounds for an extra to Owner.

G. **Temporary utilities:** Refer to contract general requirements regarding requirements.

H. **Movement of materials:** Unload materials and equipment delivered to site. Pay costs for rigging, hoisting, lowering and moving equipment on and around site, in building or on roof.

2.10 DIVISION OF WORK

- A. Division of work responsibility matrix at the end of this section is for Contractor's reference to clarify roles of various manufacturers, installers, subcontractors, and trades involved in telecommunications system Project.
- B. Contractor holding contract with Owner is responsible for coordinating work of all subcontractors to provide a complete and usable Project complying with contract provisions of Project documents.
- C. Failure to coordinate work by subcontractors and suppliers will not be considered justification for additional compensation or extension of schedule.

Spec. section	System	Division of work responsibility chart				Remarks
		Gen	Elec	Mec	Telecom	
25 xx xx	Building Automation System (BAS)	1	C	C	C	BAS low voltage cabling by Division 15 uses telcom cable tray.
21 xx xx	Fire Detection And Alarm System (FDAS)	1	C	C	C	Completely separate cabling system and raceways by Division 16
26 xx xx	Electrical wiring (line voltage)	1	2,W	C	C	Completely separate cabling system and raceways by Division 16
26 xx xx	Poke-through fittings and floor boxes	1	2, E	C	C	Telcom to provide data jacks and A-V connectors
26 xx xx	Cable tray	1	2, E	C	C	Comply with Section 27 05 28
26 xx xx	Electrical raceways	1	2, E	C	C	Comply with Section 27 05 28
27 02 00	General requirements for telecommunications system	2	C	C	1	
27 10 00	Structured Cabling System (SCS) for telecommunications systems		C	C	1, E, W	
27 05 28	Pathways for telecommunications systems	1	2, P	C	1	
27 05 26	Grounding and Bonding System (GBS) for telecommunications systems	1	2, G	C	1	
27 05 32	Firestopping for telecommunications systems		2, FP	C	1, FC	

1 = primary contractual responsibility

2 = secondary responsibility

3 = tertiary responsibility

C = coordination of work responsibility

E = provision of specified equipment and devices

W = provision of specified system wiring/cabling

P = provision of specified system pathways/conduits

S = provision of specified system spaces

FP = provision of specified firestopping for pathways

FC = provision of specified firestopping for cabling

END OF SECTION

SECTION 27 05 28

PATHWAYS FOR COMMUNICATIONS SYSTEMS

CONDITIONS OF THE CONTRACT AND DIVISION 1, as applicable, apply to this Section.

PART 1 - GENERAL

1.1 RELATED WORK

- A. Section 27 00 00 – BASIC MATERIALS AND METHODS

1.2 SCOPE OF WORK

- A. Provide all labor, materials, and equipment for the complete installation of work called for in the Contract Documents.
- B. Install empty raceway system, including underfloor and overhead distribution system, fish wire, terminal cabinets, outlet boxes, floor boxes, pull boxes, cover plates, conduit, sleeves and caps, cable troughs, service poles, miscellaneous and positioning material to constitute complete system, as indicated for distribution of Telecommunications wiring which includes cables for Data, Voice, Video, Audio, Security and future signal requirements.
- C. The location at which all new telecommunications wiring will terminate is called a Telecom Outlet (TO). There are several styles of outlets:
 - 1. New construction
 - 2. Existing construction typical
 - 3. Existing construction variations
 - 4. Data/Voice (VOIP)
- D. Furnish and install split channel raceway and outlet boxes as specified in the Drawings and as specified herein.
- E. Furnish and install conduit stubs in walls and floors for cable routes.

1.3 REFERENCES

ANSI/TIA-568 Commercial Building Telecommunications Cabling Standard
ANSI/TIA-569 Telecommunications Pathways and Spaces
ANSI/TIA-606 Administration Standard for the Telecommunications Infrastructure
ANSI C80.1 Rigid Steel Conduit - Zinc Coated
ANSI C80.4 Fittings for Rigid Metal Conduit
ANSI/NFPA 70/318 – National Electric Code – Cable Trays
ANSI/NFPA 70/770 – National Electric Code – Optical Fiber Cables and Raceways
ANSI/NFPA 70/250 - National Electric Code – Ground and Bonding
ASTM A 510 - Specifications for General Requirements for Wire Rods and Coarse Round Wire, Carbon Steel
ASTM B 633 - Specifications for Electrodepositing Coatings of Zinc on Iron and Steel, Sections SC2 and SC3
ASTM A653 - Specifications for Steel Sheet, Zinc-Coated (Galvanized) by Hot Dip Process
ASTM A123 - Specifications for Zinc (Hot Galvanized) Coatings on Iron and Steel
ASTM – A276-06 Standard Specification for Stainless Steel Bars and Shapes
ASTM A580/A580M-06 Standard Specification for Stainless Steel Wire
BICSI Electronic Safety and Security Reference Manual (ESSDRM), current edition
BICSI Information Transport Systems Installation Methods Manual (ITSIM), current edition
BICSI Network Design Reference Manual (NDRM), current edition

BICSI Telecommunications Distribution Methods Manual (TDMM), current edition
BICSI Wireless Design Reference Manual (WDRM), current edition
CANSI/NFPA 70/645 – National Electric Code – Information Technology Equipment
NEMA VE 2-2006 Cable Tray Installation Guidelines
NEMA VE-1/CSA C22.2 No 126 1-02 Metal Cable Tray Systems
UL and cUL E209183

1.4 QUALITY ASSURANCE

- A. All cable and equipment shall be installed in a neat and workmanlike manner. All methods of construction that are not specifically described or indicated in the contract documents shall be subject to the control and approval of the Owner or Owner Representative. Equipment and materials shall be of the quality and manufacture indicated. The equipment specified is based upon the acceptable manufacturers listed. Where “approved equal” is stated, equipment shall be equivalent in every way to that of the equipment specified and subject to approval.
- B. Strictly adhere to all Building Industry Consulting Service International (BICSI) and Telecommunications Industry Association (TIA) recommended installation practices when installing communications/data cabling.
- C. Assure that the "as installed" system is correctly and completely documented including engineering drawings, manuals, and operational procedures in such a manner as to support maintenance and future expansion of the system.
- D. Material and work specified herein shall comply with the applicable requirements of the current revision of the following:

ANSI/TIA-568 Commercial Building Telecommunications Cabling Standard
ANSI/TIA-569 Telecommunications Pathways and Spaces
ANSI/TIA-606 Administration Standard for the Telecommunications Infrastructure
BICSI – Telecommunications Distribution Methods Manual
J-STD – 607 Joint Standard for Commercial Building Grounding (Earthing) and Bonding Requirements for Telecommunications
NFPA 70 – National Electric Code
NFPA 70B, “Recommended Practice for Electrical Equipment Maintenance”
pertaining to cable tray systems.

1.5 SUBMITTALS

- A. Product Data: For features, ratings, and performance of each component specified.
- B. Submit manufacturer’s instructions for storage, handling, protection, examination, preparation, operation, and installation of products. Include application conditions or limitations of use stipulated by any product testing agency. Submit for the following:
 - 1. Wall Boxes
 - 2. Raceway
 - 3. Conduit
 - 4. Conduit Bushings
- C. Shop Drawings:
 - 1. Component List: List manufacturer, part number, and quantity of each component.
 - 2. Include dimensioned plan and elevation views of equipment rooms, labeling each individual component. Show raceway assemblies, method of field assembly, workspace requirements, and access for cable connections.

1.6 DELIVERY, STORAGE AND HANDLING

- A. **Delivery:** Deliver materials to site in manufacturer's original un-opened containers and packaging, with labels clearly indication manufacturer and material.
- B. **Storage:** Store materials in a dry area indoors, protected from damage and in accordance with manufacturer's instructions.
- C. **Handling:** Protect materials and finishes during handling and installation to prevent damage.

PART 2 – PRODUCTS

2.1 TELECOM OUTLETS (TO)

- A. New construction TO consists of one (1) 4-11/16" square by 2-1/8" deep flush mounted box. Each outlet box shall have a EMT conduit stubbed above the drop ceiling or extended into the hallway cable tray. Conduits size is as follows:
 - 1. For Outlets with 3 or less cables, use a 1" EMT conduit
 - 2. For Outlets with 3-6 cables, use a 1.25" EMT conduit
 - 3. For all other sizes, calculate fill ratio at 40% for proper sized conduit
- B. Existing surface-mounted construction TO typically consists of surface-mounted raceway including base, cover, end fitting, entrance end fitting, and (2) 1" EMT conduits stubbed out top of entrance end fitting to above ceiling or out to nearest hallway distribution system. Size of the raceway is site dependent based on number of conductors to be installed.
- C. The intent of the installation of the TOs which consist of the raceway is as follows:
 - 1. Where ceilings are accessible, the raceway and entrance end fitting shall extend above the ceiling and the conduits installed above the ceiling in the room to the nearest hallway distribution system.
 - 2. Where ceilings are partially accessible, or if the Drawings and/or Specifications indicate installation of access panels, the raceway shall extend above the ceiling and the conduits installed above the ceiling in the room to the nearest hallway distribution system.
 - 3. Where ceilings are inaccessible or no ceilings exist, the raceway shall extend up as close to the ceiling as practical to allow installation of conduits as high as possible to the nearest hallway distribution system.

2.2 HORIZONTAL DISTRIBUTION SYSTEM

- A. Conduit System (Renovations only, where conduit exists)
 - 1. Provide conduits secured to wall above corridor ceilings as shown on the Drawings or as specified herein for installation of telecommunications cables. Any exposed conduit shall be painted to match surface.
 - 2. Corridor conduits shall be 4" EMT, furnished in 10 foot lengths wherever possible, with no sharp edges, reamed as necessary, evenly supported at two locations per 10-foot section spacing. Conduits shall be sized and quantified to account for handling cables in all TO conduits at 40% fill back to the TR and/or ER rooms. Verify size prior to installation. Bushings and/or connectors on ends of EMT are required.
 - 3. All conduits shall be installed stacked and attached to walls unless conditions exist which prohibit this type of installation. When this condition exists, mount conduits side-by-side supported with 3/8" rod attached to building structure utilizing unistrut channel to form a trapeze. Double nut the top and bottom at the unistrut. Utilize conduit clamp to secure conduits to unistrut.

4. Provide measured pull line in each conduit rated at 1200 lbs. minimum. Increments must be in 12" steps.
5. Grounding of conduits is not required per NEC #250-33, Exception No. 2. shall be painted except conduit above suspended ceilings or in mechanical, electrical or telecommunication rooms. Color to match that of surface installed upon or as directed by Owner's Representative. Coordinate with other trades prior to painting.
6. Provide restorable fire stops inside and around conduits as recommended by UL1479 or ASTM E814 for all conduits penetrating fire-rated construction. Fire rated construction to be verified with AHJ. See Section 27 05 32 for more firestopping information.

B. Corridor Cable Tray System

1. Complete wall mounted or suspended aluminum cable tray system and necessary accessories shall be provided as shown on plans. Install entire cable tray system in accordance with manufacturer's minimum installation practices and all local governing codes.
2. Coordinate installation of cable tray with other trades to allow a minimum of 12" above, 12" in front, and 12" below of clearance from piping, conduits, ductwork, etc. Allowance must be provided for access to the tray with reasonable room to work. Obstructions to the tray must be minimized and cannot block more than 6 feet of the tray at any point in the run.
3. Submittal drawings, in the form of 8 1/2"x 11" catalog cut sheets, shall be provided for the following items: cable tray, fittings, accessories and load data.
4. Cable tray shall not be loaded beyond 60% of manufacturer's recommended load capacity.
5. Install wall mounted cable tray on both sides of hallway as shown on drawings and where applicable.
6. Where a new cable tray distribution system encounters a wall, install sufficient 4" EMT sleeves through the wall so cabling does not exceed 20% fill.
7. Where cable tray is exposed below ceiling, install the appropriate solid bottom inserts to conceal cables.
8. Install cable tray dropouts where large quantities of cables exit the distribution system.
9. Cable tray must be sized to facilitate sufficient growth capacity for migration cable plant to coexist in same tray as existing cable plant, wherever possible.
10. Manufacturer of cable tray in corridors and telecom rooms shall be:

C. Telecommunication Room Cable Tray System

1. TR cable tray shall completely wrap all walls within the room. Cable tray shall extend over all equipment frames.
2. Cable tray shall be a minimum width of 2" high x 12" wide. Cable tray may be sized upwards if fill ratio requirements need to be met based on cable quantities.
3. Manufacturer of tubular ladder type cable tray in telecommunication rooms shall be CommScope.
4. Cable tray shall be 12-inch cable runway.
5. Rectangular steel tubing cross members welded at 12-inch intervals. Finish in black enamel. CommScope, Part Number CR-SLR-10L-12W (760085647) or equivalent.
 - a. 12-inch Wall Angle Assembly Kit – CommScope Part Number CR6-12WRSK (760084145) or equivalent.
 - b. 3-inch Channel Rack-To-Runway Mounting Plate - CommScope Part Number CRR2RRMK (760084053) or equivalent.
 - c. End Closing Tube - CommScope Part Number CRPECK (760084012) or equivalent.
 - d. Corner Clamp - CommScope Part Number CRTJSK (760084046) or equivalent (2 required per End Closing Tube to complete assembly).

- D. All open pathway/trays shall be installed a minimum of six (6) inches away from any light fixture or other source of EMI (Electromagnetic Interference).
- E. All pathways shall be grounded per NEC Article 250.
- F. Provide external grounding strap at expansion joints, sleeves and crossover and at other locations where pathway/tray continuity is interrupted.
- G. Support all pathways from building construction. Do not support pathways from ductwork, piping, or equipment hangers.
- H. Install cable tray level and straight unless noted on the construction drawings.

2.3 STATION CONDUITS

Station conduit is defined as conduit that originates at the TO and rises within the walls or is exposed from a raceway and extends up into the drop ceiling or over to the hallway distribution system.

- A. Provide station conduits from TOs to above the drop ceiling or extend over to the hallway distribution systems consisting of 1" EMT minimum or appropriate size as shown on the Drawings or as specified herein for installation of telecommunications cables.
- B. Provide an insulating press fit bushing on all telecommunications conduits including interconnecting nipples and stub to distribution system. To prevent conflicts with other cables or conduits to cable tray, the conduit shall be stubbed not less than 6" above or below conduit/cable tray center line. Where space permits, every effort shall be made to bend station conduits down such that the flow of installed cables promotes the minimum length back to the TR and the least amount of bends in the cables. Bushings must be rated to be used in an environmental air handling space (Plenum).
- C. Manufacturer of insulating bushing on all telecommunication conduits shall be:
- D. Provide measured pull line in 12" increments in each empty conduit to hallway distribution system.
- E. Indelibly mark station conduit at hallway distribution end with Room # that conduit serves.
- F. The use of 90-degree electrical pulling elbows is prohibited.
- G. Do not include more than two 90-degree bends between pulling points when installing station conduit runs. If the path of the station conduits requires more than 180 degrees of total bends, installation of an appropriate sized junction box is required. See section 2.4 for junction box requirements.
- H. Place an appropriate sized junction box in each individual station conduit run that exceeds 100 feet in length.
- I. The use of a third bend in a conduit is only acceptable if:
 - 1. The total conduit run is reduced by 15%.
 - 2. The conduit size is increased to the next trade size.
 - 3. One of the bends is located within 12" of the cable feed end.

2.4 JUNCTION BOX REQUIREMENTS FOR STATION CONDUITS

- A. If the station conduit route exceeds the 180 degree of total bends limitation, an appropriate sized junction box is required within a straight section of the conduit run.
- B. Each station conduit run requires a separate junction box. The sharing of a junction box by multiple conduits is prohibited.
- C. A junction box shall not be used in place of a bend. All junction boxes in station conduit paths shall be installed within a straight section of the conduit run.

2.5 SERVICE ENTRANCE CONDUITS

- A. Minimum of (4) 4" IMC conduits shall be installed from the nearest utility tunnel on outside of the building as shown on the Drawings. Terminate entrance conduits entering ER rooms from below grade to extend 4" above finished floor. Location of entrance conduits shall be within 12" of room corners.
- B. Terminate entrance conduits entering ER rooms from above ceiling height to extend 4" below finished ceiling or 12" above cable tray.
- C. Terminate entrance conduits entering an ER rooms from below ceiling height to extend 4" into the room.
- D. Entrance conduits shall be continuous into the building and to the ER. Securely fasten all entrance conduits to the building to withstand any cable placing operation. Do not include more than two 90-degree bends between pulling points when installing entrance conduits.
- E. On exterior wall penetrations, seal both sides of the wall around outside of conduit with hydraulic cement to prevent water from entering the building. Seal the inside of the conduit on both sides with conduit plugs, water plugs, or duct sealer to prevent water, vapors, or gases from entering the building.

2.6 PATHWAY REQUIREMENTS FOR ENTRANCE CONDUITS

- A. If the entrance conduits exceed the 180 degree of total bends limitation, an appropriately sized junction box, manhole, or handhole is required.
- B. As-built drawings of entrance conduit path required to be submitted to Owner's Representative before covered with soil.

2.7 RISER CONDUITS

Riser conduits shall only be used when noted on the Construction Documents for special applications only. As a rule, riser conduits are not required for the riser system. However, when required:

- A. Minimum of (2) 4" conduits shall be installed between the ER room and each TR room as shown on the Drawings.
- B. Conduits entering ER and TR rooms shall be reamed or bushed and terminated not more than 4" from entrance wall and within 12" of room corners.
- C. Conduits entering ER and TR rooms from below floor shall be terminated not more than 4" above finished floor.

- D. Conduits for riser cables shall be continuous and separate from all other conduit or enclosed raceway systems. Do not include more than two 90-degree bends between pulling points when installing riser conduits. Where junction boxes are required, locate in accessible areas, such as above suspended ceilings in hallways.
- E. Conduits shall not be less than 4" trade size and be equipped with a measured pull line at 12" increments rated at a minimum 1200-pound test.
- F. Provide restorable fire stops inside and around conduits as recommended by UL1479 or ASTM E814 for all conduits penetrating fire-rated construction. Fire-rated construction to be verified with AHJ. See Section 27 05 32 for more firestopping information.
- G. Provide an insulating press fit bushing on all telecommunications riser conduits. Bushings must be rated to be used in an environmental air handling space (Plenum).
 - 1. Manufacturer of insulating bushing on all telecommunication conduits shall be Arlington or equal.
- H. Riser conduits shall not be used for the distribution of horizontal cables.

2.8 FIRESTOPPING

- A. In all buildings, floor/ceiling assemblies, stairs, and elevator penetrations must be sealed with a 2-hour fire stop assembly at a minimum, unless otherwise noted.
- B. Contact Owner's Representative to identify walls which are fire-rated construction. Walls must be sealed with a 2-hour fire stop assembly at a minimum.
- C. Communication pathways requiring fire stopping shall utilize removable/re-usable fire stopping putties for ease of Moves, Adds, and Changes.
- D. All fire stopping penetrations shall conform to the recommended practices listed in UL1479 or ASTM.
- E. See Section 27 05 32 - Firestopping for Telecommunications Systems

PART 3 - EXECUTION

3.1 GENERAL REQUIREMENTS

- A. The intention of the telecommunications conduits is to provide a route between ER and TR rooms, routes from the TRs throughout building floors to hallways, and routes from hallway distribution systems into rooms to individual TOs for telecommunications cabling.
- B. Installation of new pathways shall not interfere with existing pathways in such a way that installation of new cables within the existing pathway is made more difficult.

3.2 EXAMINATION

- A. Examine areas to receive cable management system. Notify the Owner's Representative of conditions that would adversely affect the installation or subsequent utilization of the system.
- B. Do not proceed with installation until unsatisfactory conditions are corrected.

3.3 INSTALLATION

- A. Install in accordance with recognized industry practices, to ensure that the equipment complies with requirements of the NEC, and applicable portions of NFPA 70B and NECA "Standards of Installation" pertaining to general electrical installation practice.
- B. Coordinate installation with other trades.
- C. Field verification is required before installation.
- D. Install cable management system at locations indicated on the drawings and in accordance with manufacturer's instructions.

END OF SECTION

SECTION 27 05 29

HANGARS AND SUPPORTS FOR COMMUNICATIONS SYSTEMS

CONDITIONS OF THE CONTRACT AND DIVISION 1, as applicable, apply to this Section.

PART 1 - GENERAL

1.1 RELATED WORK

- A. Section 27 00 00 – BASIC MATERIALS AND METHODS

1.2 SCOPE OF WORK

- A. The work covered under this section consists of the furnishing of all necessary labor, supervision, materials, equipment, and services to completely execute the system of non-continuous cable supports as described in this specification. Installation of hangers and supports should not rely on existing building structure. Installers should develop cable pathways independent of other trades.

1.2 SUBMITTALS

- A. Submit product data on non-continuous cable support devices, including attachment methods. Product data to include, but not limited to materials, finishes, approvals, load ratings, and dimensional information.

1.3 QUALITY ASSURANCE

- A. Non-continuous cable supports, and cable support assemblies shall be listed by Underwriters Laboratories for both Canadian and US standards (cULus).
- B. Non-continuous cable supports shall have the manufacturers name and part number stamped on the part for identification.
- C. Manufacturer: Company specializing in manufacturing products specified in this section with a minimum of five years documented experience in the industry, and certified ISO 9000.
- D. Cable hangers and supports should be non-conductive.

1.4 COORDINATION

- A. Coordinate the installation of hangers, supports and cables with other trades.

PART 2 – PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

- A. Subject to compliance with these specifications, non-continuous cable supports shall be as manufactured by: Chatsworth Products Inc. (CPI), Panduit, Unistrut, nVent, Eaton, Erico, CE-AS.

2.2 REFERENCES

ANSI/TIA-568 Commercial Building Telecommunications Cabling Standard
ANSI/TIA-569 Telecommunications Pathways and Spaces
ASTM B633 Standard Specification for Electro-Deposited Coatings of Zinc on Iron and Steel

ASTM B 695-90 Standard Specification for coatings of Zinc Mechanically Deposited on Iron and Steel
 ASTM A123 Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products
 ASTM A924/A924M Standard Specification for General Requirements for Steel Sheet, Metallic-Coated by the Hot-Dip Process
 ASTM A109 Standard Specification for Steel, Strip, Carbon, Cold-Rolled
 ASTM A167 Standard Specification for Stainless and heat-Resisting Chromium-Nickel Steel Plate, Sheet, and Strip
 ASTM A480/A480M Standard Specification for General Requirements for Flat-Rolled Stainless and Heat-Resisting Steel Plate, Sheet, and Strip.
 ASTM A568 Standard Specification for Steel, Sheet, Carbon, and High-Strength, Low-Alloy Hot-Rolled and Cold-Rolled
 A653 G60-Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-coated (Galvannealed) by the Hot-Dip process
 ASTM A666 Standard Specification for Annealed or Cold-Worked Austenitic Stainless Steel Sheet, Strip, Plate, and Flat Bar
 ASTM A682 Standard Specification for Steel, Strip, High-Carbon, Cold-Rolled, Spring Quality
 ASTM A879 Standard Specification for Steel Sheet, Zinc Coated by the Electrolytic Process for Applications Requiring Designation of the Coating Mass on Each Surface
 ASTM B117 Standard Method of Salt Spray (Fog) Testing
 ASTM D610 Standard Test Method for Evaluating Degree of Rusting on Painted Steel Surfaces
 UL 2043 - Standard for Fire Test for Heat and Visible Smoke Release for Discrete Products and Their Accessories Installed in Air-Handling Spaces
 NFPA 70 National Electrical Code®

2.3 NON-CONTINUOUS CABLE SUPPORT SYSTEMS

- A. Non-continuous cable supports shall provide a bearing surface of sufficient width to comply with required bend radii of high-performance cables; cULus Listed
- B. Non-continuous cable supports shall have flared edges to prevent damage while installing cables
- C. Non-continuous cable supports sized 1-5/16" and larger shall have a cable retainer strap to provide containment of cables within the hanger. The cable retainer strap shall be removable and reusable and be suitable for use in air handling spaces
- D. Non-continuous cable supports shall have an electro-galvanized or G60 finish and shall be rated for indoor use in non-corrosive environments
- E. Stainless Steel non-continuous cable supports are intended for indoor and outdoor use in non-corrosive environments or where only mildly corrosive conditions apply.

2.4 FINISHES

ASTM B633 Standard Specification for Electro-Deposited Coatings of Zinc on Iron and Steel
 ASTM B695 Standard Specification for coatings of Zinc Mechanically Deposited on Iron and Steel
 ASTM A123 Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products
 ASTM A924/A924M Standard Specification for General Requirements for Steel Sheet, Metallic-Coated by the Hot-Dip Process

Non-continuous cable supports used where only mildly corrosive conditions apply shall be stainless steel, AISI type 304.

3.1 INSTALLATION

- END OF SECTION**

SECTION 27 05 33

CONDUITS AND BACKBOXES FOR COMMUNICATIONS SYSTEMS

CONDITIONS OF THE CONTRACT AND DIVISION 1, as applicable, apply to this Section.

PART 1 - GENERAL

1.1 RELATED WORK

- A. Section 27 00 00 – BASIC MATERIALS AND METHODS

1.2 OUTLETS

- A. Each data outlet in a wall shall be served by at least one 27 mm (1 in.) conduit and a double-gang deep device box with a single-gang mud ring.
- B. All outlet conduits shall be stubbed into accessible ceiling space.
- C. All outlet conduits shall have burrs and any other abrasive elements removed and an insulating bushing shall be installed on both ends.
- D. No section of conduit shall be longer than 30 m (100 ft.) between pull points.
- E. No more than 180 degrees of conduit bends shall be permitted between pull points.
- F. The minimum inside radius for any bend of an outlet conduit shall be six times the inside diameter of that conduit.

1.3 CONDUITS

- A. Electric metallic tubing: Comply with UL 797. Tubing shall have hot dipped galvanized exterior, enamel-coated interior.
- B. Flexible conduit shall not be used in lieu of conduit bends and offsets.
- C. PVC conduit: Comply with UL 651, listed for use with 90 degrees C conductors operating at 90 degrees C.

1.4 STANDARDS COMPLIANCE

- A. General standards: Comply with current revision of TIA-569 as amended.

1.5 SUBMITTALS

- A. Provide product data for the following:
 - 1. Manufacturers cut sheets, specifications and installation instructions for all products (submit with bid).

1.6 COORDINATION

- A. Coordinate installation of labels with other trades.
- B. Storage and Handling: Avoid breakage, denting and scoring finishes. Damaged products will not be installed. Store materials in original cartons and in a clean dry space; protect from weather and construction traffic. Wet materials will be unpacked and dried before storage.

PART 2 – PRODUCTS

2.1 APPROVED PRODUCTS

- A. Dry location device boxes:
 - 1. Manufacturer shall be:
 - 2. Equivalent products by other manufacturers may be used where approved in writing by Owner's Representative.
- B. Wet location boxes:
 - 1. Manufacturer shall be:
 - 2. Equivalent products by other manufacturers may be used where approved in writing by Owner's Representative.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Installation and configuration shall conform to the requirements of the current revision levels of TIA Standards 568 and 569, NFPA 70 (National Electrical Code), applicable local codes, and to the manufacturer's installation instructions.
- B. Install conduits using techniques, practices, and methods that are consistent with Category 6 or higher requirements and that supports Category 6 or higher performance of completed and linked signal paths, end to end.
- C. Follow manufacturer's recommendations for allowable fill capacity for each size non-continuous cable support.

END OF SECTION

SECTION 27 10 00

STRUCTURED CABLING SYSTEM

PART 1 - GENERAL

1.1 RELATED SECTIONS AND DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplemental Conditions and other Division 01 Specification Sections, apply to the Section.
- B. 26 05 00 – Grounding and Bonding
- C. 26 05 29 – Electrical Hangers and Supports
- D. 26 05 33 – Raceway and Boxes
- E. Drawings that are applicable to this section

1.2 DESCRIPTION

A. Summary of Work:

- 1. All Division 27 work shall be performed by one contractor. The same contractor for structured cabling shall bid the other Division 27 scope of work as defined in these specifications. This contract is for a complete turnkey infrastructure wiring system. The contractor will be required to supply any incidental accessory as required to make the equipment specified in this document work properly.
- 2. Provide a complete and tested, Structured Cabling System (SCS) for the interconnections of the Local Area Network (LAN). The SCS shall include fully terminated unshielded twisted pair cables, fiber optic cabling, raceways, conduit, back boxes, copper/fiber optic termination components, station mounting hardware, fiber optic enclosures, patch panels, copper/fiber optic patch cables, relay racks/cabinets, and other incidental and miscellaneous premises wiring system hardware as required for a complete, tested, and usable system that is in compliance with the latest NEC, ANSI/TIA, BICSI, and Authorities Having Jurisdiction codes and standards. The installation shall comply with all applicable requirements, design guidelines, and standards in effect at the job site and as indicated in the Drawings and Specifications.
- 3. Proposed structured cabling must support all current and future standards and data technology.
- 4. Data, voice, and video cabling will originate at owner provided equipment in vertical freestanding equipment racks, and/or enclosed vertical wall mounted equipment located in the MDF/IDF locations. Wiring, terminations and patch bays between these designated d-marc points and outlet locations as shown on the plans will be considered part of the contract.
- 5. All cables and termination will be labeled at all locations.
- 6. All cables will be labeled according to the County's standard.
- 7. All copper data cabling will comply with ANSI/TIA 568-B standards for Category 6 installations.
- 8. Acceptable product manufacturers shall provide a complete Category 6 solution.
- 9. No cable ties, bridle rings, or d rings shall be accepted on the project. Any use of cable ties may require replacement of the entire project cabling at Contractor's expense.

10. Provide AV cabling as shown on the drawings.
11. Cabling will terminate on one, two, or three gang wall plates equipped as shown on the drawings.
12. Prior to installation, the shop drawings shall contain all data drop numbers using the County's MDF/IDF numbering scheme. The owner must sign off shop drawings before any cabling can proceed.
13. Project documentation due upon completion of installation. Documentation includes (but not limited to) all test documentation and all as-builds.
14. The owner reserves the right to be present during installation of all systems. The owner will conduct periodic inspections throughout the construction process.
15. Any loose inventory equipment turned over to the County will require a transmittal sheet when delivered.
16. Contractor will be required to furnish a list (in Excel format) of all data drops listed by IDF/MDF number, patch panel number, and port number with the associated room number. (Number scheme listed in Section 3.2 Documentation.)
17. Provide laminated as-built drawings (full sized sheet) for each IDF and provide an addendum as-built drawing (full-sized sheet) for the MDF.

1.3 QUALITY ASSURANCE

A. Acceptable manufacturers:

1. The equipment/products described herein, and furnished per these specifications shall be the product of the specified and/or preapproved manufacturers. All references to model numbers and other detailed descriptive data is intended to establish standards of design performance, and quality, as required
2. A single manufacturer or teamed manufacturer's certifiable solution with the exception of data racks and other hardware that is not identified, as part of the channel test configuration by ANSI/TIA 568-B will supply products listed in this section.
3. The approved manufacturer's warranty shall provide a Category 6 solution with a minimum 20-year warranty.
4. Manufacturer will be ISO 9001 Certified with a minimum 7 years' experience in specified products manufacture.
5. Acceptable Category 6 product cable and connectivity shall be a complete end-to-end solution.

B. Installer Qualifications:

1. Structured Cabling System Installer shall be licensed and shall meet all applicable regulations of the State of Texas and Department of Labor insofar as they apply to this type of system. The proposer shall be a firm normally employed in the low voltage and data cabling industry.
2. Structured Cabling System Installer shall comply with all federal, state, and local laws.
3. Structured Cabling System Installer shall be certified by the cable manufacturer in all aspects including design, installation, and warranty service of products listed in this document.
4. Structured Cabling System Installer shall provide a list of five (5) similar size projects, a brief description of the project with contact names and phone numbers.
5. Structured Cabling System Installer must have a minimum of 5 years' experience installing structured cabling systems of similar size.
6. Structured Cabling System Installer will use only authorized manufactured components.

7. All on site installers must be employees of the certified Structured Cabling System Installer and at least 25% of the staff must have attended manufacturer provided training. Current certification documents shall be available upon request and included in the Structured Cabling System Installer's product submittals.
 8. A Quality Assurance Program with internal inspections to ensure work is performed according to internal as well as industry standards.
 9. Structured Cabling System Installer shall own and maintain tools and equipment necessary to properly install fiber optic cabling, Category 6 and Category 3 distribution systems.
 10. The County reserves the right to reject any bid of any Structured Cabling System Installer who has previously failed to complete projects properly, on time, or failed to perform properly.
 11. The selected, certified system partner that provided pricing, for the scope of work associated with this specification section and associated contract drawings, shall be the installer of the system. No subcontracting of any portion of this systems scope of work will be allowed beyond the original SCS proposing contractor.
- C. Pre-Construction Meeting:
1. The successful Structured Cabling System Installer will attend a mandatory pre-construction meeting with the project consultant, County technology representative, general contractor, and any other individual deemed necessary by the Owner's representative prior to project start up. Work will not begin until after this meeting.
- D. Acceptance:
1. The Owner's representative reserves the right to reject all or a portion of the work performed, either on technical or aesthetic grounds.
- E. Warranty:
1. The selected Structured Cabling System Installer shall be a certified installing contractor of the approved manufacturer's solution and hold current certification. Structured Cabling System Installer shall provide an end-to-end performance warranty of no less than 20-years on all products installed. The proposer shall provide current certification documentation. The performance warranty shall be issued by the manufacturer and shall warrant that ALL Category 6 cable channels have been tested bi-directionally (end to end) using a Level III tester, per TSB-67, and that all test results conform to the most current TIA-568-B.2-10 and TSB-67 channel values.
 2. The warranty will stipulate that all products used in this installation meet the prescribed mechanical and transmission specifications for such products as described in ISO/IEC 11801, ANSI/TIA-568-A, or EN 50173. Quality and workmanship evaluation shall be solely by the Owner/Designer and designated representatives.
 3. Structured Cabling System Extended Product Warranty and Application Assurance Program Extended Product Warranty: coverage includes product defects for all Data Cable Systems Installer and all installed Structured Cabling System components.
 4. The manufacturer's warranty starts the date of project warranty certification issue to the County from the manufacturer.
 5. Coverage includes
 - a. All components of the registered SCS to be free from manufacturer defects in material and workmanship under normal and proper use
 - b. All components of the registered SCS will exceed the TIA 568-B.1, B.2, B.3 and exceed ISO/IEC 2nd Edition standards and will confirm to the performance specifications of the manufacturer's associated product data sheet in effect at the time of warranty certification issuance.

- c. Installation exceeds the requirements of the TIA 568-B and the ISO/11801 2nd Edition Standards for cabling links/channel configurations insertion and return loss, attenuation and near end cross talk for the insertion and return loss, attenuation and near end crosstalk.
 - i. Each channel (All components are manufacturer's Category 6 passive products end-to end) will be capable of delivering 1.0 Gbps to the workstation according to the application standards.
- 6. Product Warranty, Manufacturer will (at its own expense)
 - a. Repair or replace defective product
 - b. Pay an authorized installer to repair or replace any defective product.
 - c. Replacement parts will be new. No remanufactured or used parts allowed.
- 7. Structured Connectivity Solutions Extended Product Warranty and Application Assurance shall be provided at job completion.

1.4 REGULATORY REQUIREMENTS

- A. Standards: All work shall be performed in accordance with the latest revisions of the following standards and codes:
 - 1. Latest Local Codes and Amendments
 - 2. Latest National Electrical Code

- B. Other References:

ANSI/TIA-568-B.1, COMMERCIAL BUILDING TELECOMMUNICATIONS CABLING STANDARD (AND ALL PUBLISHED ADDENDA), PART 1: GENERAL REQUIREMENTS, current version.

ANSI/TIA-568-B.2, COMMERCIAL BUILDING TELECOMMUNICATIONS CABLING STANDARD (AND ALL PUBLISHED ADDENDA), PART 2: BALANCED TWISTED PAIR CABLING COMPONENTS, current version.

ANSI/TIA-568-B.2-10 (CURRENT DRAFT), COMMERCIAL BUILDING TELECOMMUNICATIONS CABLING STANDARD, ADDENDUM 10: TRANSMISSION PERFORMANCE SPECIFICATIONS FOR 4-PAIR AUGMENTED CATEGORY 6 CABLING.

ANSI/TIA-568-B.3, OPTICAL FIBER CABLING COMPONENTS STANDARD, current version.

NATIONAL FIRE PROTECTION ASSOCIATION, INC., NFPA 70: NATIONAL ELECTRIC CODE (NEC), current version.

- 1. NEC ARTICLE 250: GROUNDING
- 2. NEC ARTICLE 386: SURFACE METAL RACEWAYS
- 3. NEC ARTICLE 388: SURFACE NON-METALLIC RACEWAYS
- 4. NEC ARTICLE 800: COMMUNICATIONS CIRCUITS
- 5. NEC ARTICLE 770: OPTICAL FIBER CABLES AND RACEWAY
- 6. ANSI/TIA-569-B, COMMERCIAL BUILDING STANDARDS FOR TELECOMMUNICATIONS PATHWAYS AND SPACES, current version.
- 7. ANSI J-STD-607-A, COMMERCIAL BUILDING GROUNDING AND BONDING REQUIREMENTS FOR TELECOMMUNICATIONS, current version.
- 8. ANSI/TIA-942, TELECOMMUNICATIONS INFRASTRUCTURE FOR DATA CENTERS, 2004.

9. ANSI/ICEA S-83-596, FIBER OPTIC PREMISES DISTRIBUTION CABLE, current version.
10. ANSI/TIA-598, COLOR CODING OF OPTICAL FIBER CABLES, current version.
11. ANSI/ICEA S-87-640, FIBER OPTIC OUTSIDE PLANT DISTRIBUTION CABLE, current version.
12. ANSI/TIA-492AAAC, DETAIL SPECIFICATION FOR 850NM LASER-OPTIMIZED 50UM CORE DIAMETER/125 UM CLADDING DIAMETER CLASS 1A GRADED INDEX MULTIMODE OPTICAL FIBERS, current version.
13. ANSI/TI/-492CAAA, DETAIL SPECIFICATION FOR CLASS IVA DISPERSION-UNSHIFTED SINGLEMODE OPTICAL FIBERS, current version.
14. ANSI/TIA-758: CUSTOMER-OWNED OUTSIDE PLANT TELECOMMUNICATIONS CABLING STANDARD, current version.
15. ANSI/TIA-526-7, OPTICAL POWER LOSS MEASUREMENTS OF INSTALLED SINGLEMODE FIBER PLANT: OFSTP-7, current version.
16. ANSI/TIA-526-14-A, OPTICAL POWER LOSS MEASUREMENTS OF INSTALLED MULTIMODE FIBER PLANT: OFSTP-14A, current version.
17. TIA-TSB-125, GUIDELINES FOR MAINTAINING OPTICAL FIBER POLARITY THROUGH REVERSE-PAIR POSITIONING, current version.
18. TIA-TSB-140, ADDITIONAL GUIDELINES FOR FIELD TESTING LENGTH, LOSS, AND POLARITY OF OPTICAL FIBER CABLING SYSTEMS, current version.
19. UNDERWRITER'S LABORATORY, INC. (UL)
 - a) *UL-5A: Standard for Non-Metallic Raceways and Fittings*
 - b) *UL-5: Standard for Surface Metal Raceways and Fittings*
 - c) *UL-5C: Standard for Surface Raceways and Fittings for Use with Data, Signal, and Control Circuits*
 - d) *UL-50: Standard for Enclosures for Electrical Equipment*
 - e) *UL-94-V0: Tests for Flammability of Plastic Materials*
 - f) *UL-498: Attachment Plugs and Receptacles*
 - g) *UL-1479: Fire Tests of Through-penetration Firestops (in Accordance with ASTM E814).*
 - h) *UL-1863: Standard for Safety of Communications Circuit Accessories*
20. NATIONAL ELECTRICAL MANUFACTURER'S ASSOCIATION (NEMA)
 - a) *ANSI/NEMA WD-6-2002: Wiring Devices – Dimensional Requirements*
 - b) *NEMA 250-2003: Enclosures for Electrical Equipment*
21. ISO/IEC 11801, ED. 2:2002, INFORMATION TECHNOLOGY – GENERIC CABLING FOR CUSTOMER PREMISES, current version.
22. ISO/IEC 18010, INFORMATION TECHNOLOGY – PATHWAYS AND SPACES FOR CUSTOMER PREMISES CABLING, current version.
23. ISO/IEC 14763-1, INFORMATION TECHNOLOGY – IMPLEMENTATION AND OPERATION OF CUSTOMER PREMISES CABLING – PART 1: ADMINISTRATION, current version.

24. FEDERAL COMMUNICATIONS COMMISSION (FCC) TITLE 47, CODE OF FEDERAL REGULATIONS, PART 68: CONNECTION OF TERMINAL EQUIPMENT TO THE TELEPHONE NETWORK, current version.
25. ANSI/TIA-569-B, COMMERCIAL BUILDING STANDARDS FOR TELECOMMUNICATIONS PATHWAYS AND SPACES, current version.
26. ANSI/TIA-606-A, ADMINISTRATION STANDARD FOR COMMERCIAL TELECOMMUNICATIONS INFRASTRUCTURE, current version.
27. ANSI/TIA-310-D, CABINETS, RACKS, PANELS, AND ASSOCIATED EQUIPMENT, 1992.
28. ANSI/TIA-604 (SERIES), FOCIS FIBER OPTIC CONNECTOR INTERMATEABILITY STANDARD, current version.
29. U.S. PUBLIC LAW 336. 101ST CONGRESS, ADA: AMERICANS WITH DISABILITIES ACT OF 1992.
30. 802.3af-2003 - IEEE Standard for Information Technology - Telecommunications and Information Exchange Between Systems - Local and Metropolitan Area Networks - Specific Requirements - Part 3: Carrier Sense Multiple Access with Collision Detection (CSMA/CD) Access Method and Physical Layer Specifications - Data Terminal Equipment (DTE) Power Via Media Dependent Interface (MDI).
31. IEEE 802.3AT (CURRENT DRAFT), DATA TERMINAL EQUIPMENT (DTE) ENHANCED POWER OVER MEDIA DEPENDENT INTERFACE (MDI).
32. IEEE 802.3AN-2006 - IEEE Standard for Information Technology - Telecommunications and Information Exchange Between Systems – LAN/MAN - Specific Requirements Part 3: CSMA/CD Access Method and Physical Layer Specifications - Amendment: Physical Layer and Management Parameters for 10 Gb/s Operation, Type 10GBASE-T
33. IEEE 802.3AE, SPECIFICATION FOR 10 GBIT/S ETHERNET OPERATION OVER OPTICAL FIBER.
34. TELECOMMUNICATIONS DISTRIBUTION METHODS MANUAL, 12TH ED., BUILDING INDUSTRY CONSULTING SERVICES INTERNATIONAL (BICSI), 2009.
35. INFORMATION TRANSPORT SYSTEMS INSTALLATION MANUAL, 6TH ED., BUILDING INDUSTRY CONSULTING SERVICES INTERNATIONAL (BICSI), 2010.

C. Governing Codes and Conflicts:

1. If the requirements of these specifications or the Project Drawings exceed those of the governing codes and regulations, then the requirements of these specifications and the Drawings shall govern. However, nothing in the Drawings or Specifications shall be construed to permit work not conforming to all governing codes and regulations.

1.5 ABBREVIATIONS

A. The following abbreviations are used in this document:

DC	Direct Current
IDF	Intermediate Distribution Frame
MDF	Main Distribution Frame
PBX	Private Branch Exchange
UTP	Unshielded Twisted Pair

SCS	Structured Cabling System
SCSI	Structured Cabling System Installer

1.6 SUBMITTALS

- A. Project Initiation:
1. Awarded contractor provides 4 copies of submittal within 14 days of Notice to Proceed
 2. Cover Sheet with Information, Pricing and Materials
 3. Cover sheet
 - a. Company name and logo
 - b. Submittal Title
 - c. Client name
 - d. Business Address
 - e. Point of Contact
 - f. Contact information (phone number)
 4. Product Data
 - a. Manufacturer's catalog information showing (items must be clearly identified in the page (use a red arrow to point to the item)
 - b. All items listed in the "Product's" section of Part 2 and specification sheets for
 - i. All Connectors
 - ii. All termination components for each component type
 - iii. All ground and surge suppression equipment
 - c. Manufacturer's cut sheets for all products with each item clearly identified
 - d. Technical data sheets for showing full swept frequency range of Guaranteed Channel Performance
 - e. Technical data sheets to include physical as well as the following transmission and electrical characteristics
 - i. Wire map
 - ii. Length
 - iii. Insertion Loss
 - iv. Near End Crosstalk
 - v. Power Sum Near End Crosstalk
 - vi. Equal Level Far End Cross Talk
 - vii. Power Sum Equal Level Far End Crosstalk
 - viii. Return Loss
 - ix. Propagation Delay
 - x. Delay Skew
 5. Manufacturer's Instructions
 - a. Application conditions and limitations of use as stipulated by product testing agency's regulatory requirements
 - b. Storage, handling protection, examination, preparation, installation instructions
 6. Pre-Qualification Certificate
 - a. Documentation showing completion of pre-qualification requirements
 - b. Manufacturer's letter indicating successful completion of pre-qualification requirements
 - c. Certificates for design, engineering, and installation
 7. Factory Test
 - a. Factory test information submitted prior to installation
 - b. Any substituted products must be verified and justified to be equivalent
 - c. Any and all substitutions will be approved in writing by the Owner.

8. Material Guarantee
 - a. Data Cabling System Installer guarantees Category 6 and fiber optic cabling and components meet or exceed ANSI/TIA-568-B.1, 568-B.2, 568-B.3 and 589 at time of bid.
9. Warranty Documentation
 - a. Warranty: life of installed product
 - b. Warranty documentation clearly explains manufacturer's warranty and is included in proposal. A sample warranty is provided with the procedure for processing support requests.
 - c. Application assurance manual which documents the vendor supported applications guidelines will be included in the submittal.
10. Test Equipment
 - a. Copper UPT Test Equipment
 - i. Make and Model Number
 - ii. Software version
 - iii. Quantity
 - b. Fiber Optic Test Equipment
 - i. Make and Model Number
 - ii. Software version
 - iii. Quantity
 - c. Submit a current test sample (one per test set)
 - d. Quality Assurance/Control Submittals
 - i. Quality Assurance/Control Submittals
 - ii. Make and Number
 - iii. Software revision
 - iv. Quantity

B. Shop Drawings:

1. Submit the following items, for Owner review and approval, within twenty-eight (28) days of notice to proceed:
 - a. Submitted drawings shall indicate the following:
 1. Submitted drawings shall indicate the following:
 2. SCSI will verify station cabling and MDF-to-IDF routings
 3. Location of all wall penetrations (all penetrations shall be sleeved and have protective bushings at both ends)
 4. Location of sleeved wall pass-thru
 5. Sleeve size at each installed location
 6. Cable quantity passing through each sleeve
 7. Location of drop in each room. Room labeling will be according to IDF number, patch panel number, port number
 8. Identify cable routing , size, quantity, and stub-up locations for all floor mounted outlets
 - b. Drawing Compliance: A letter shall be provided stating that the SCS installer complies with the ENTIRE project drawing, including all general, keyed, and notes to contractor. If the installer intends to deviate from any portion of the specifications, a detailed explanation of reason in which the installer would like to deviate shall be provided in addition to the specification compliance letter.

- C. Close-out Procedures:
1. Two (2) copies of the following documents shall be delivered to the building owner's representative at the time of system acceptance. The close out submittals shall include:
 - a. Inspection and Test Reports: During the course of the Project, the Contractor shall maintain an adequate inspection system to ensure that the materials supplied and the work performed, conform to contract requirements. The Contractor shall provide written documentation that indicates that materials acceptance testing was conducted as specified. The Contractor shall also provide documentation, which indicates that all cable termination testing was completed and that all irregularities were corrected prior to job completion. Manufacturer's representative shall inspect and certify all work to validate the manufacturer's warranty.
 - b. Provide complete test reports for all cabling and devices that comprise system as outlined in this document. Test results will be electronic in both native and PDF formats. The software for the native format must be included at no additional cost to the owner.
 - c. Include the Name, address and telephone of the authorized factory representative with a 24-hour emergency service number.
 - d. The manual shall also include Manufacturer's data sheets and installation manuals/instructions for all equipment installed, and a list of recommended spare parts. Spare parts will be included.
 - e. Generic or typical owner's instruction and operation manual shall not be acceptable to fulfill this requirement.
 - f. An up-to-date record ("as-built") set of approved shop drawing prints that have been revised to show each and every change made to the structure cabling system from the original approved shop drawings. Drawings shall consist of a scaled plan of each building showing the placement of each individual item of the technical cabling system equipment as well as raceway size and routing, junction boxes, and conductor size, quantity in each raceway. Only blue cabling will be used on this project.
 - g. As-built Drawings shall include cable pathways, circuit termination locations with correct labeling and MDF/IDF locations. The as-built drawings shall be prepared using AutoCad 2002 or later. Provide the Owner with electronic versions of the as-builts on CD media in AutoCAD, Visio and PDF format. Also the as-built drawings are to be posted on laminated sheets in the each MDF/IDF closet for owner's reference.
 - h. A hard copy as well as an electronic copy of the manufacturer's warranty shall be included in the close-out documents.
 - i. Any keys to cabinets and/or equipment and special maintenance tools required to repair, maintain, or service the system.
 - j. Operating and Maintenance Instructions for all devices within the system. These instructions shall reflect any changes made during the course of construction, and shall be provided to the Owner, for their use, in a three-ring binder labeled with the project name and description. This shall include 3 hard and electronic copies in color.
 - k. Upon completion of the work and at a time designated by the Architect or owner, provide formal training sessions for the Owner's operating personnel to include location, operation, and maintenance of all included systems and equipment. Minimum amount of training time shall be at least 4 hours of training and shall include phone support as needed.
 - l. One (1) 30" X 42" laminated floor plan sheets illustrating fiber, copper, technology drops with correct number scheme, and cable designations. Contractor will provide one complete floor plan of each IDF room (to be mounted in each IDDF room). The laminated floor plan of the MDF fiber and copper will be an addendum sheet only.

1.7 SPECIFICATIONS

- A. Only Data Cable System Installers certified in the approved manufacturer's solutions are invited to submit bid.
- B. Documentation required for bid response:
 - 1. Certification by manufacturer
 - 2. Certification must be current with eligibility date.
 - 3. Provide a list of current projects that Data Cable System Installer will be working during the same time period as this project and the workforce needed at each installation.
 - 4. Data Cable System Installer must submit 3 or more references of projects of similar scope with the following information:
 - a. Size of Project
 - b. Drop count
 - c. Number of wiring closets (MDF/IDFs)
 - d. Total cost of Project
 - e. Services provided
 - f. References must be similar in size and scope
 - g. Document will be submitted within 15 days of Data Cable System Installer selection
 - 5. Provide list of all projects within the last 3 years
 - a. Project location
 - b. Contact information
 - c. Project size
 - d. Approximate budget
 - e. Document will be submitted within 15 days of Data Cable System Installer selection
 - 6. Provide system installation certification covering manufacturer's link/channel specifications for a minimum of 20 years.
 - 7. Provide a sample warranty applicable to the completed project.
 - 8. Provide warranty support processing documentation
 - 9. Provide proof of qualifications with the proposal:
 - a. Technical experience of Project Manager's experience and online supervisor assigned to the project.
 - b. Project Manager will have 5 years experience on projects of similar size and scope
 - c. Project Foreman will have 3 years minimum project experience working crews of 4 or more.
 - d. List of product-related training attended by Data Cable System Installer staff.
- C. Workers on site are employees of the Data Cabling System Installer. Every employee will be properly trained by the manufacturers of the installed products.

1.8 CABLING REQUIREMENTS

- A. A. Cable Pathway
 - 1. All network cabling that is concealed in walls and exposed above ceiling grid level in plenum spaces:
 - a. Shall be in conduit installed by the electrical contractor with nylon bushings.
 - b. Cable tray and J-Hook method of delivery system, which is provided and installed by the Data Cabling System Installer.

2. Conduits are to be free of dirt and debris prior to cable installation.
 - a. Failure to clean out debris results in replacing cabling at Data Cabling Installer's sole expense.
 3. Velcro straps are not a suitable method to change the direction of a cable bundle.
 4. Cable trays shall exit the cable trays vertically using cable drop assemblies or "waterfalls" at all times. Cables that are not properly dressed which turn vertically over right angles or wire baskets will be in violation of bend radius requirements.
 5. Cabling that violates the bend radius rule will be replaced at Data Cabling System Installer's expense.
 6. *No plastic tie wraps are allowed* for use in structured pathway cabling.
 7. All cabling found bundled by plastic tie wraps will be replaced at Data Cabling System Installer's expense.
- B. Hardware
1. A complete and functioning system requires hardware including (but not limited) to UTP cabling, fiber backbone, patch panels, fiber termination sleeves, equipment racks, cable trays, ladder racks, vertical wire management, termination blocks, data and voice outlets, connectors, fiber and copper patch cables, and all other accessories needed to provide a complete and functioning system.
 2. All outlets (both copper and fiber) must be protected from construction related dust. Outlets not protected will be replaced at Data Cabling System Installer's expense.
 3. Dust proof barriers will remain in place after the final testing phase is complete.

1.9 GROUNDING AND BONDING

- A. All grounding and bonding will be according to National Electrical Code and any local codes pertaining to grounding and bonding requirements.
- B. Bonding and Grounding
 1. Bonding and Grounding will adhere to 607-A Standards.
 2. Communication bonding and grounding will be according to the National Electrical Code and the National Fire Protection Association.
 3. Horizontal Cabling will be according to ANSI/NFPA 70 as well as any local requirements and practices.
 4. Horizontal equipment includes cross connect frames, patch panels, racks, active telecommunication equipment and test apparatus and equipment.
 5. Where directed by local code, provide a Telecommunication Bonding Backbone utilizing a #6-AWG or larger bonding conductor that provides direct bonding between equipment rooms and telecommunications rooms.
 6. Note: this is part of the grounding and bonding infrastructure (telecommunications pathways and spaces within the building structure) and is independent of any equipment or cable.

1.10 SPECIAL REQUIREMENTS FOR CABLING ROUTING AND INSTALLATION

- A. Cabling
 1. All communications cabling used shall comply with the NEC Articles 725, 760, 770, 800 as well as the relative local codes
 2. All copper cabling has the applicable markings for the installed environment.
 3. All fiber optic cabling has the applicable markings for the installed environment.
- B. Cable Pathways
 1. Data Cable Systems Installer coordinates cable placement with the General Contractor during the painting phase of the construction in order to avoid paint on the cabling. Note: If Data Cable System Installer fails to coordinate with the General Contractor, any cables that get coated with paint will be replaced at Data Cable System Installer's sole expense.

2. Required cable bundle placement in shared pathways is noted on the drawings.
 3. In suspended ceilings and other areas where duct, cable trays or conduit are not available, Contractor will bundle (maximum of 48) station wiring using Velcro straps snug so as not to deform the cable geometry.
 4. Cables will be supported by "J" hooks and/or saddles/slides securely attached to existing building structure and framework no greater than five (5) foot intervals.
 5. Bundle cables in pathways with Velcro only. Cable ties are not permitted on any cable at any time. This includes both installation and post-installation phase.
 6. Data Cable System Installer will strictly follow Manufacturer's bend radius as well as cable pulling tension requirements.
 7. No cabling should be attached to lift out ceiling grid supports or laid directly on ceiling grid or tiles.
 8. No cabling to be attached to or supported by the fire sprinkler system including the heads or delivery system.
 9. No cabling to be attached to or supported by any environmental sensors in ceiling air space or duct work.
 10. Cables found violating the above requirement will be removed, pathway corrected, and then cable reinstalled at Data Cable System Installer's sole expense.
- C. All data ports and outlets must be protected from contaminants such as dust and debris at all times. Fire Stopping
1. Equipment and practices must comply with applicable national and local codes.
 2. Data Cabling Systems Installer responsible for sealing all cable pass throughs in walls rated fire rated and smoke, and any openings created between floors.
 3. Proper sealing is required. Sealing material and material application must be acceptable to local fire and building authorities as well as authorities having the highest jurisdiction.
 4. Data Cabling System Installer is responsible for creating only those openings as is necessary for cable passage between locations shown on the drawings.
 5. Any and all openings created by Data Cabling System Installer must be sealed.
- D. Data Cable System Installer Responsibility (Sole Expense)
1. Data Cable System Installer is responsible for damage to any surface or work disruption caused by him. (Any repairs including but not limited to surface repair or painting will be included as deemed necessary.)
 2. Data Cable System Installer will make restitution for any and all damages caused by his work.

1.11 SPECIAL REQUIREMENTS FOR CABLING ROUTING AND INSTALLATION

- A. Horizontal Cabling
1. Data Cable System Installer supplies the cabling to connect outlet to the backbone subsystem on same floor.
 2. The type horizontal cabling used for each work location will be 4-pair UTP unless otherwise noted.
 3. The length of each individual run will not exceed 290 feet.
 4. Cable to be installed according to manufacture instructions as well as Category 6 industry standards.
 5. Any cabling found in violation of any standards listed in this document will be replaced at Data Cable System Installer's sole expense.
 6. Contractor will coordinate with electrical contractor for final pathways.
 7. All cable routes to be approved by the Architect and the County prior to cable installation.
 8. During initial cable installation (rough-in), cable shall be protected at all times.
 - a. Cable will not be left on the floor.
 - b. Cable will be protected in open boxes, slings that are properly used, and approved barricades.

- c. Cable shall NOT be suspended by tie wraps or any other method that can compromise the integrity of the cable.
 - d. Wide-base support systems must be used (according to bundle size) to support cable during the rough-in.
 - e. Any cable not handled properly or protected and deemed damaged will be replaced at Data Cable System Installer's sole expense.
9. Data Cable System Installer shall not install cable in any conduit prior to the installation of conduit bushings.
- a. Electrical contractor will furnish and install conduit bushings on all low voltage conduits.
 - b. Anticipated cable installation delays caused by conduit bushings that installed will should be immediately brought to the attention of the General Contractor and Architect.
 - c. Cable that is installed in conduits without bushings will be replaced at the Structured Cabling System Installer's expense.
 - d. No installation of conduit bushings after the cable is pulled through the conduit is acceptable.
10. Recommended radius bend and pulling strength requirements for 4-pair UTP will be observed at all times during handling and installation.
- a. Avoid bending bends that deform cable jacket
 - b. Push slack cable above the ceiling level to avoid radius violations in the in back box.
 - c. Cables leaving J-Hooks to conduit stubs requires a gradual sweep and not have sharp turns.
11. Each cable run from the patch panel to the room outlet will be continuous without any joints or splices.
12. Cable runs should not be run in electrical rooms.
13. Cable runs shall not run parallel to electrical pathways without proper separation.
14. In areas where cable trays or conduit is not available, station cables will be bundled with Velcro straps at appropriate distances (no sagging).
- a. Cable will be supported by J-Hooks attached to the existing building structure and framework.
 - b. Do not mix different types of transmission media in the same J-Hook. For example, Fiber optic cable and Category 6 may not be mixed.
15. Cables are not supported by duct work.
16. Building support system are not acceptable supports. Cables should not wrap around the building structure.
17. Horizontal cabling will be concealed in interior walls. If obstructions exist, approval must be obtained from the Architect prior to the use of an alternate method.
18. Any damage to the ceiling grid or tiles caused by the cabling contractor will be paid for by the cabling contractor.
19. All 4-pair UTP cabling will be UL rated.
20. Conduit installed by Data Cabling Installation contractor will not exceed 100 feet or have more than two 90° (90 degree) bends without the use of pull boxes. The Architect must approve the configuration.
21. All station cables and tie cables will be run at right angles to electrical power circuits.

PART 2 - PRODUCTS

PART 2 - PRODUCTS

2.1 GENERAL

- A. The Structured Cabling System (SCS) solution shall be of one manufacturer or approved partnership. Approved manufacturers/partnerships are:
 - 1. Belden
 - 2. Equivalent solution as approved by the owner and their technology consultant.
- B. Installation: Products specified in this document are to be bid and installed according to manufacturer's specifications and must meet all applicable TIA/BICSI Standards. Data Cable System Installer is responsible for providing all incidental and/or miscellaneous hardware not explicitly listed as required or a complete and 100% operational system.
- C. Data Cable System Installer must report to the Architect any deleted product or one that is superseded by the manufacturer.
 - a. Part number with details or deleted or superseded product.
 - b. Proposed replacement part data sheet.
 - c. Cost differential (complete, thorough, comprehensive) between proposed replacement and original product.
 - d. Obtain written approval prior to purchase and installation of proposed replacement.
- D. Testing: All installed cabling shall be tested, 100% shall pass all required test.
- E. Ratings: All products will be new and brought to the job site in original packaging. Electrical components (including innerduct) shall bear the Underwriter's Laboratories Label. All communication cable shall bear flammability testing ratings as follows:
 - CM Communications Cable
 - CMP Plenum Rated Communications Cable
 - CMR Riser-Rated Communications Cable
- F. Initial Cable Inspection: The Contractor shall inspect all cable prior to installation to verify that it is identified properly on the reel identification label, that it is of the proper gauge, containing the correct number of pairs, etc. Note any buckling of the jacket that would indicate possible problems. Damaged cable or any other components failing to meet specifications shall not be used in the installation.
- G. Cable Lubricants: Lubricants specifically designed for installing communications cable may be used to reduce pulling tension as necessary when pulling cable into conduit.
 - 1. Approved Products:
 - a. Twisted-pair cable: Dyna-Blue
American Polywater
- H. Fire Wall Sealant: Any penetration through firewalls (including those in sleeves) will be resealed with an Underwriter Laboratories (UL) approved sealant.
 - 1. Approved Products:
 - a. 3M or
 - b. Pre-approved equal

2.2 CABLE ROUTING/PATHWAY

- A. Non-Continuous Cable Supports
 - 1. Description:
 - a. Non-continuous cable supports provide a bearing surface with sufficient width to satisfy the required bend radii or high-performance cables

- b. Maximum of 48 cables per bundle (multiple bundles cannot share J-Hook).
 - c. J-Hooks to have flared edges to prevent cable damage
 - d. J-Hooks sized 1 5/16" and larger will have a cable retainer strap to contain cables on hanger. Straps must be suitable for use in air handling spaces, both removable and reusable.
 - e. J-Hook shall have electro-galvanized or G60 finish and be rated for indoor use in non-corrosive conditions.
 - f. Stainless steel J-Hook supports are use in both indoors and outdoors in non-corrosive environments or in mildly corrosive conditions.
 - g. No support may be secured to the drop ceiling grid support wire. Cabling found connected in this manner will replace the assembly at the Data Cabling System Installer's sole expense.
- B. Cable Innerduct

If any cabling requires the use of innerduct, then outside plant textile innerduct will be used.

 - 1. Acceptable Manufacturer:
 - a. Maxcell 3-chamber, 4; Innerduct
 - b. Standard Outdoor Textile Innerduct: Micro (33mm), 2-inch, 30=-inch, and 4-inch, single or multi-cell polyester/nylon textile innerduct containing 1250lb. polyester flat woven pull tape.
- C. Contractor shall provide (2) 2" conduits routed from a new in-ground pull box at the nearest serving terminal stubbed up to a new NEMA4 16x12x4 junction box installed at above interior ceiling elevation. Properly seal all building penetrations. Paint box and conduits to match existing surface.
- D. Contractor shall provide a Cable Tech Solutions suspended ceiling penetration (Model CPP-4-H) in the MDF Room above the CUBE-iT Wall-Mount Cabinet. Refer to plans for placement.

2.3 STATION WIRING

- A. Category 6 UTP, 4 Pair
 - 1. The Category 6 UTP cable shall be blue for all applications.
 - 2. The Category 6 UTP cable shall be plenum for all applications.
 - 3. Service loops will be installed at the work area outlet above the conduit stub up in a J-Hook
 - a. Service loop will be 36" of cable and configured according to industry standards at all locations
 - b. Service loops will be supported and not secured to conduit
 - c. Loops shall not violate bend radius standards
 - 2. Cat 6 UTP cables will extend between the station location and its associated MDF/IDF and consist of 4 pair, 24 gauge, UTP and will terminate on 8-pin modular jacks provided at each outlet. Data Cabling System Installer is responsible for terminating outlets in the proper IDF. Refer to the T drawings
- A. Testing: Each 1000' spool must be tested with test results affixed to the spool.
 - 1. Only complete 1000' spools accepted.
 - 2. "SHORTS" WILL NOT BE ALLOWED AND IF DISCOVERED, DATA CABLING SYSTEM INSTALLER WILL BE REQUIRE TO REMOVE ALL CABLE AND REINSTALL AT NO ADDIOTINAL COST TO OWNER.
- B. Rating: Cable installed shall be rated non-plenum. Cable not installed in conduit shall be plenum if installed in plenum ceiling space, non-plenum rated otherwise. Verify whether all cabling can be non-plenum.

2.4 STATION JACKS

- A. A. Flush Mount Jacks

2.5 ABOVE CEILING DATA DROPS FOR WIRELESS ACCESS POINTS

- A. Data drops for wireless access points and cameras mounted above ceiling level will be the same jack and faceplate as a data outlet below ceiling level.
- B. Data outlets will be mounted in surface mounted back boxes with conduit stubbed out to ensure the proper radius bend.

2.6 DATA CLOSET (MDF/IDF)

Public Health Building:

- A. Equipment Racks:

Provide and install equipment racks in locations indicated on the drawings for the following areas.

Chambers County Public Health Donna Street

Contractor shall provide and install new wall mounted rack systems as indicated on drawings.

- 1. CUBE-iT Wall-Mount Cabinet 19U – Chatsworth PN: 11900-736
- 2. 2 qty. Vertical Lashings – Chatsworth PN: 40971-736

- B. Distribution Rack/Cabinet Grounding:

All Racks and/or Cabinets shall be grounded using stranded #6 AWG insulated copper conductor. Connect to service entrance grounding electrode. Provide all required bonding materials and hardware and bond to building grounding electrode subsystem at building electrical service entrance.

- 1. Approved Products –Grounding Compression Lugs
NSi #L6N-14
- 2. Approved Products – Wall Mount Bus Bar (one per MDF/IDF location)
Hamaco #WMBB12

- C. Category 6 Patch Panels: The Category 6 data station cable shall be terminated on Category 6 RJ45 patch panels with circuit board construction, T568B terminations. Patch panels shall be 19-inch rack mountable. Workstation patch panels shall terminate all workstation communications outlets. Furnish units that adhere to the performance requirements TIA/EIA-568A standards.

- a. Approved Products: Belden Cat6 KeyConnect Patch panels

- 1. Belden 1RU Category 6 Patch Panels 24 Port, (provide cable support bars at the back of all patch panels to provide additional support at rear of rack and panels)
ALL VOICE PATCH PANELS SHALL BE TERMINATED TO THE USOC COLOR CODE.
- 2. Belden 2RU Category 6 Patch Panels 48 Port, (provide cable support bars at the back of all patch panels to provide additional support at rear of rack and panels)
ALL VOICE PATCH PANELS SHALL BE TERMINATED TO THE USOC COLOR CODE.

Provide Velcro straps for cable dressing in MDF/IDF rooms.

D. Fiber Optic Patch Panels

The enclosures shall provide termination panels for SC type connectors and be of sufficient size and capacity to terminate 110% of the fiber count of the inside of outside fiber optic cables. Patch panels must be 19" rack mountable. Provide all termination accessories, fiber patch cords, enclosures, and test for a complete fiber optic distribution system.

1. Approved Products (for MDF/IDF locations):
 - a. CommScope 1U Fiber Shelf 760249997 I EPX-1U-PNL-ENC
 - b. CommScope 2U Fiber Shelf 760231464 I SD-4U
 - c. CommScope 12 Fiber Inserts SC Single-Mode 760027714 I PNL-BK-912-SFA-SC02-BL
 - d. CommScope Wall Mounted Single Sided Single Door Fiber Enclosure 760147496-WBE-EMT-BK-2P-PNL
 - e. Provide cable grommets AMP#559496-2 or equivalent cable grommet.

E. Network Rack Patch Cables: Cabling Contractor shall provide owner with (1) – 5' Category 6 patch cable for each data drop on entire project. These cables will provide connectivity from the front of the network patch panels to the network equipment provided by owner upon move-in. The patch cables are to be terminated properly with RJ-45 connections on each end with the proper pin-out assignments per project configuration.

1. Approved Products:

BerkTek

F. Provide each MDF/IDF rack with a rack mounted UPS located at the bottom of each rack.

a. Approved Products:

- i. Eaton 5px2200RT UPS 2U provided with rack mount kit, 20A optional plug adapter configuration. Provide extended battery cabinet, #BP48V24-2U with rack mount kit and SNMP web card for each UPS installed. Proposer shall include Envirosense module and software license for each headend closet location. Provide 3 year extended warranty, for all UPS equipment installed. Proposer shall install new patch cable from web card to network switch for network connectivity. Proposer shall configure web card with correct network and notification settings.

G. Provide one 66m150 wall mounted wiring block for category 3 terminations at SWB demarcation point. Install blocks on painted white 3/4"x2"x18" fire rated plywood backboards in rear of rack.

H. A power distribution strip shall be installed in each Press Box rack.

Approved Products

- a. (2) Chatsworth 12848-706 66" Vertical power strips
- b. No substitutions.

PART 3 - EXECUTION

3.1 GENERAL

- A. Workmanship
 - 1. Standards and Requirements Violations
 - a. Field testing is not allowed as a solution, remedy or workaround for practices and procedures that violate industry standards and requirements listed herein.
 - b. All components will be installed neatly in a professional manner.
 - c. Terminations will be uniform throughout the system with wiring codes strictly enforced.
 - d. Identification markings and labeling will be uniform according to TIA and BICSI standards
 - e. Wiring code ANSI/TIA 568B is the standard Structured Cabling System.
 - f. Plastic cable tie wraps ARE NOT allowed on site.
 - g. This scope of work will not allow plastic cable tie wraps on any cabling, especially Category 6.
 - h. Any tie wraps found on Category cabling will be removed immediately.
 - i. Cables bundled with tie wraps during any phase of the installation will be removed and replaced with new product at the Data Cabling System Installer's sole expense.
 - j. Cables that appear affected by the cable ties will be removed and replaced at the Data Cabling System Installer's sole expense.
 - k. Any use of tie wraps for any purpose requires written authorization from Architect.
 - l. All data outlets must be protected from dirt and debris during the construction phase. Dust proof barriers must be used. Outlets (patch panels or in faceplates) not protected will be replaced at the Data Cable System Installer's sole expense.
- B. Fire Wall Penetrations: The contractor shall avoid penetration of fire-rated walls and floors wherever possible. Where penetrations are necessary, they shall be sleeved with metallic conduit and resealed with an Underwriter Laboratories (UL) approved sealant. Contractor shall also seal all floor, ceiling and wall penetrations in fire or smoke barriers and in the wiring closet.
- C. All penetrations through walls shall be sleeved with conduit.
- D. Allowable Cable Bend Radius and Pull Tension: In general, communications cable cannot tolerate sharp bends or excessive pull tension during installation. Refer to the cable manufacturers allowable bend radius and pull tension data for the maximum allowable limits.
- E. Cable Lubricants: After installation, exposed cable and other surfaces must be cleaned free of lubricant residue.
- F. Pull Strings: Provide pull strings in all new conduits, including all conduits with cable installed as part of this contract. Pull test is not to exceed 200 pounds. Data and video cables can be pulled together with pull strings.
- G. Conduit Fill: Conduit fill shall not exceed 40%.

- H. Damage:
1. The Contractor shall replace or rework cables showing evidence of improper handling including stretches, kinks, short radius bends, over-tightened bindings, loosely twisted and over-twisted pairs at terminals and cable sheath removed too far (over 1-1/2 inches). No cables and fiber will be allowed to lay on the floor prior to terminations in the patch panel or wall outlets all fiber and cabling runs not terminated will be placed in clean container or properly supported above the floor in the MDF/IDF.
 2. The Contractor shall replace any damaged ceiling tiles that are broken during cable installation.
- I. Clean Up:
- All clean up activity related to work performed will be the responsibility of the Contractor and must be completed daily before leaving the facility.

3.2 DOCUMENTATION

- A. General Description
1. Wiring system components shall comply with all product specifications contained in Part 2.
 2. Structured cabling system consists of the Work Area, Horizontal, and Campus Backbone, Riser Backbone, MDF, IDF, Entrance Facility and Administration elements.
- B. Labels
- The Contractor will label all outlets using permanent/legible machine printed labels approved by the Technology Representative.

The patch panels will be labeled according to the labeling scheme. Labels not according to specifications will be replaced at contractor's sole expense.

Labeling Work area Locations

1. All labeling scheme to be approved by a Technology Representative prior to installation.
2. All labels are to be machine printed for all cables and cords, distribution frames and outlet locations.
 - a. This includes all horizontal cable locations.
 - b. The standards require the following information on 2 lines (be visible at each work area outlet:
 - c. All locations will use this nomenclature unless directed to do so otherwise in writing by a Technology Representative. This includes, but not limited to, all camera and wireless access point locations.
 - d. Each cable will be labeled at both ends within 2 inches of the termination. (Locations are behind the faceplates and the back of the patch panel.) ALL labels will be machine generated.
 - e. Handwritten labels will be rejected.
3. Labeling Faceplates
 - a. Label face plates on top and bottom per Horizontal Work Area Standards.
4. Labeling Patch Panels
 - a. Ports will be labeled the same format as the data outlets (see sample above).
5. Labeling Hallways
 - a. All locations will be identified by the hall number as designated by a Technology Representative.

- b. Numbering will start at the end of the hall that is closest to the main office, main entry, or main hallway.
 - 6. Numbering Exterior Outlets
 - a. Number system for exterior locations will be ordered sequentially in order starting at the North side, East side, South Side, and West side.
 - 7. All locations will use this nomenclature unless otherwise directed in writing by the Technology Representative.
 - 8. Cables shall be terminated sequentially on the MDF/IDF patch panels.
 - 9. All cables are data cables.
 - 10. Labeling for Tie Cables
 - a. Tie cables are run between the MDF and each IDF.
 - b. Labels will have the MDF number on top line. The second line is the patch panel port number in the IDF.
 - c. Follow the same nomenclature for patch panels. (Room Number, Patch Panel number, port number.)
- C. Floor Plan

A floor plan clearly labeled with all outlet jack numbers shall be included in the as-built plans. Contractor shall provide complete floor plan drawing laminated, with outlet locations, cable routing, and proper labeling assignments.

Cables: All cables shall be labeled at both ends. This includes but not limited to horizontal voice and data cabling, copper backbone tie cables, and fiber optic cables.
- D. Fiber Optics: Fiber optic strands shall be labeled at both ends on the fiber distribution panel.
 - 1. Labeling Fiber Optic Panels
 - a. The label is on the inside of the fiber enclosure door.
- E. Equipment racks: Equipment racks shall bear at least one indicating label indicated MDF or IDF. If rack is installed in IDF, label shall include IDF #. The County will designate IDF numbers.
- F. All room identifications, whether on as-built drawings or site labeling, will use county's room number scheme. (Architect's room numbers are not acceptable.)

3.3 EQUIPMENT RACK CONFIGURATION

- A. Cable Placement: Cable installation in the Wiring Closet must conform to the Project Drawings. All cabling shall be routed so as to avoid interference with any other service or system, operation, or maintenance location. Avoid crossing area horizontally just above or below any riser conduit. Lay and dress cables to allow other cables to enter the conduit/riser without difficulty at a later time by maintaining a working distance from these openings.
- B. Cable Routing: Cable shall be routed as close as possible to the ceiling, floor or corners to ensure that adequate wall or backboard space is available for current and future equipment. All cable runs within the Wiring Closet shall be horizontal or vertical within the constraints of minimum cable bending radii. Minimum bend radius shall be observed. Cables shall not be tie-wrapped to electrical conduit or other equipment. It shall not be routed through the building steel webbing. All cable must be self-supported in all locations. It is the responsibility of the electrical contractor to supply the insulated bushings. The insulated bushings must be approved by the Architect. Bushings will be installed prior to running cables in conduits. No cutting of bushings installed after cable has been ran will not be accepted.

- C. Installation: All incoming cables shall be routed on the cable tray and neatly dressed down to the patch panels.
- D. Hardware: Provide rack and jack panel hardware as required for all data station wiring.

3.4 STATION WIRING INSTALLATION

- A. General:
 - 1. Installation shall follow ANSI/TIA 568-B.1 standards, federal and local standards and manufacturer's guidelines.
 - a. Contractor will ensure maximum pulling tensions of the specified distribution cables are not exceeded and cable bends are within limits.
 - b. Cabling between the IDF and workstation locations will be individual home runs. No intermediate punch down blocks or splices may be installed or utilized between the IDF and the network outlet at the workstation location.
 - 2. All cable must be handled with care during installation so as not to change performance specifications. Factory twists of each individual pair must be maintained up to the connection points at both ends of the cable. There shall never be more than one-half (1/2) inch of unsheathed enhanced Category 6 UTP cable at either the wiring closet or the workstation termination locations.
 - 3. All cable shall route to the center of the room in which it is serving and then to the outlet location.
 - 4. Provide minimum of 3 feet of service loop at all workstation drops.
 - 5. Provide minimum of 10 feet of service loop at all headend locations.
 - 6. All workstation service loops shall be configured in figure eights and properly supported and tied at each location.
- B. Exposed Cable:
 - 1. All cabling shall be installed inside walls or ceiling spaces whenever possible. Exposed station cable will only be run where indicated on the Drawings.
 - 2. Additional exposed cable runs will require Owner approval, and will only be allowed when no other options exist. Owner approval must be in writing.
- C. Placement: All cabling and associated hardware shall be placed so as to make efficient use of available space. All cabling and associated hardware shall be placed so as not to impair the Owner's efficient use of their full capacity.
- D. Cable Routes
 - 1. All cabling placed in ceiling areas must be in conduit, cable trays or J-Hooks. Cable supports shall be permanently anchored to building structure or substrates. Provide attachment hardware or anchors designed for the structure to which attached and that are suitably sized to carry the weight of the cables to be supported. Do not route cable through webbing of structural steel. Cabling must be supported in dedicated supports intended to support cabling as described in this section. Contractor shall adhere to the manufacturer's suggested fill ratio for each size cable support installed. All cable routes will be identified and marked on the walls. Coordinate the cable paths with other trades such as intercom, fire alarm, security, electrical, etc. through the General Contractor.

2. Attaching cable to pipes or other mechanical items is not permitted. Communications cable shall be rerouted so as to provide a minimum of 18 inches spacing from light fixtures, sources of heat, power feeder conduits and EMI sources. Cabling shall not be attached to ceiling grid support wires. Cable runs shall be routed down the corridors; parallel or perpendicular to building structure. Multiple cables to be bundled together at and between each cable support installed.
3. Contractor shall be responsible for coordinating with other trades on the project so that the installed cable pathway does not interfere with the installation of other systems to insure that mechanical ducts, pipes, conduits, or any other above ceiling systems are not putting unnecessary stress on any portion of the install SCS. General Contractor will assist with the coordination of all pathways.

3.5 STATION HARDWARE

- A. Flush Mount Jacks: Flush mount jacks shall be mounted in a faceplate with back box. Back boxes shall be flush with the wall surface.
- B. Placement: Where possible, the communications outlet shall be located so that its centerline is 18 inches above floor level or 12 inches above permanent bench surfaces. Outlets shall not be mounted on temporary, movable, or removable surfaces, doors, or access hatches.
- C. RJ-45 Jack Pin Assignments:
 1. Pin connections for data station cable outlets and patch panels shall match TIA 568 modular jack wiring recommendation T568B.
 2. Pin connections at data jack panels shall match pin connections at outlets (straight through wiring).

3.6 CABLE TESTING REQUIREMENTS

- A. Notification: The Owner and Engineer shall be notified one week prior to any testing so that the testing may be witnessed.
- B. Inspection: Before requesting a final inspection, the Contractor shall perform a series of end-to-end installation performance tests. The Contractor shall submit for approval a proposal describing the test procedures, test result forms and timetable for all copper and fiber optic cabling.
- C. Procedures: Trained personnel shall perform all testing. Acceptance of the test procedures discussed below is predicated on the Contractor's use of the recommended products and adherence to the inspection requirements and practices set forth. Acceptance of the completed installation will be evaluated in the context of each of these factors.
- D. Errors: When errors are found, the source of each shall be determined, corrected and the cable retested. All defective components shall be replaced and retested. Re-test results must be provided on Owner approved forms and witnessed by Owner. All test results will be recorded. A failure list with the re-test will be submitted to the County before final acceptance.
- E. Twisted Pair Cable Testing:
 1. At a minimum, the Contractor shall test all station drop cable pairs from Data Closet termination patch panels to outlet device RJ45 jacks. Category 6 products shall be tested for compliance to ANSI/TIA 568A and ISO/IES 11801 for a Category 6 rated installation. Test equipment used shall meet TIA TSB-67, Level II accuracy. Further, the contractor shall have a copy of TSB-67 in their possession and be familiar with its contents.

2. Each wire/pair shall be tested at both ends for the following:
 - a. Wire map (pin to pin connectivity)
 - b. Length (in feet)
 - c. Attenuation
 - d. Near end cross talk (NEXT)
 - e. Far end cross talk (FEXT)
 - f. Power Sum
 - g. Power Sum Near end cross talk (PSNEXT)
 - h. Power Sum Far end cross talk (PSFEXT)
 3. Test equipment shall provide an electronic and printed record of these tests.
 4. Test results for each Category 6 four-pair UTP cable must be submitted with identification to match labels on all patch panel ports and RJ45 jacks and must match as-builts associated with that cable.
 5. All testing of Category 6 twisted pair cable testing shall be performed as described above and comply with all current Category 6 testing parameters and standards. All test results will be recorded. A failure list with the re-test will be submitted to the County before final acceptance.
- F. Testing: Once installed the cabling will be tested for continuity, shorts and grounds.
1. Cabling:
 - a. Continuity – 100% continuity testing is required and will be tested from the MDF/IDF location to each classroom drop. A checklist of each cable and test performed on that cable will be submitted once the testing has been completed.
 - b. Shorts – No cable shorts will be permitted on the system. If a short is detected, the connector or cable will be repaired or replaced.
 2. System:
 - a. Continuity – As tested in the above testing requirements.
 - b. Power Readings – A power reading will be required at each drop of each of the cabling systems. A +3 dB to a +7 dB is required at each drop with a common feed signal of + 15 dB into the head end amplifier. These measurements to be taken with an approved field strength meter of known calibration. Test measurements to be performed at low channel, mid-band channel, and high channel to determine cable slope.
 - c. Signal Quality – A standard receiver, typical of those used in the system, shall randomly be connected to 10% of the outlets across the system and tuned to a reference channel of known quality. No visible indication of co-channel interference, noise, ghosting, or beat interference may be observed.
 - d. Carrier to Noise – Carrier to Noise shall be measured at random outlets representing an average cross section of the drops with an approved field strength meter by the following process. With normal operating levels the field set shall be tuned to each channel's visual carrier and the level recorded. The input signal to the head end amplifier shall be removed and the input of the amplifier terminated with a short. Each channel shall be re-measured and the noise levels recorded. The Carrier to Noise measurement is the difference of the two figures.
 - e. Documentation of Results – All recorded measurements are to be tabulated and included in the systems documentation manual for reference during maintenance of the system.
 3. All testing of Category testing and systems shall be performed as described above and comply with all current Category 6 testing parameters and standards. Final payment will be withheld until all testing documentation is complete.

3.7 INSPECTION

- A. General: Conformance to the installation practices covered above are to be verified when completed. In some cases, the Owner/Designer may inspect before acceptance.

END OF SECTION 27 10 00

SECTION 27 51 23

INTEGRATED ELECTRONIC COMMUNICATIONS AND CLOCK NETWORK

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. The drawings and general provisions of the Contract Documents apply to this Section.
- B. Section 27 00 00 – BASIC MATERIALS AND METHODS

1.2 SUMMARY

- A. Provide a complete communications system capable of providing two-way speech communication between selected speaker stations or intercom handsets and main console. System shall also be capable of distributing sound and voice signals to all system speakers simultaneously or in user programmed groups of speaker stations.
 - 1. High School and Middle School classrooms shall have a speaker and a call button. Elementary School classrooms shall have an intercom speaker only.
 - 2. All portable classrooms (A and B sides) shall be updated with IP speakers, call buttons.
 - 3. Reception desk and designated offices shall have Console Phones.
- B. Provide Algo master time system as part of the communications system as required to facilitate the generation of audible signals through the communications system speakers (e.g., class change tones) based on input from master time system. Provide means of muting local program material of all public address systems.
- C. Lock Down Buttons
 - 1. Buttons provided and installed by the Intrusion Detection system contractor (28 16 00).
 - 2. The cabling is home run to the Intercom system for each button or a given group in a particular area can be connected for one home run and one description for the area at the headend. Cabling for this scope is provided by the Intercom system contractor.
 - 3. The secondary contact on the button is for the burglar/security system to be taken to the nearest poppit for a description on the security system. Cabling for this scope is provided by the Intrusion Detection system contractor.
 - 4. Additionally, a cable is run from the Intercom headend to the Burglar/Security headend to send notification to our Central Station. This allows the Central Station to also be notified in an instance where the school has activated the system through the software and not by the button. Cabling for this scope is provided by the Intercom system contractor.
 - 5. When the button is activated, the Intercom system sends a distinct tone throughout the building. The tone is the same for all campuses, letting everyone know what they should be doing without having to make an announcement. NOTE: It is not the burglar system sending the tone.
 - 6. Coordinate with other trades to provide a fully functional system.

- D. Lock Down Button Wiring Methods
1. Inside Buildings: Run a home run wire from each button to the Intercom head end. The wire shall be plenum rated and either 18 gauge single pair or 22 gauge two pair. The wire shall be connected to an Aux Module (TCC2033) to trigger a Lock Down. The Module shall be programmed to identify the circuit and button. For portable buildings, this wire shall be jumped to each portable and run through an aerial hang to the main building, then run to the head end.
 2. Portable Buildings: Run a wire circuit to an existing IP speaker from each Lock Down Button. The wire shall be plenum rated 18 gauge single pair or 22 gauge two pair. Each IP speaker module (TCC2011A) has an RJ45 jack on it for inputs. The Lock Down wire shall be connected to the green/white pair of this RJ45 connector. The speaker module shall be programmed (see special programming below) to trigger a Lock Down when a button is pressed.
 3. Special Programming: For middle schools and high schools with call buttons in portables, special programming can be created for Lock Down Buttons to work independently or with another call button. A 220 ohm resistor is needed on the Lock Down Button circuit if it is used with a call button.
- E. Fire Alarm System Interconnection: APPLICABLE IN HIGH SCHOOLS AND IN MIDDLE SCHOOLS - Main communications and local sound reinforcement systems in the Gymnasiums, Cafeteria, Natatorium, Black Box and Large Group Instruction shall be automatically muted during fire alarm system activation (NFPA Life Safety Code 101, 7-6.3.10 and National Fire Alarm Code 72, 3-8.13.5). However, school communication system shall remain capable of manual override so that school staff can deliver voice instructions over the school communications system, such as directing students to return after a fire drill.
- F. The system shall be supplied by the manufacturer's authorized contractor, Rauland, Certification shall be submitted verifying that the contractor is the manufacturer's authorized contractor. Included shall be certificates of attendance in manufacturer's installation / maintenance training by the contractors directly employed personnel. The communications contracting company shall have been in business for a minimum of 5 years, continuously furnishing the specified manufacturers' product lines and systems.
- G. The system assemblies shall be completely factory built and tested by manufacturers of established reputation, who have and can refer to similar systems which are currently installed and functioning properly. The factory pre-assembled cabinets, consoles, and power supplies shall be UL approved and listed.
- H. The system shall be guaranteed for a period of five years from the date of acceptance or first beneficial use, whichever is first, against defects in materials, workmanship, design and improper adjustment. Any defects in the system shall be corrected at no expense to the Owner, provided the system does not show signs of abuse. During the guarantee period any work found not to be in conformance with the plans, specifications and addenda shall be brought into conformity with same at no additional cost to the owner.
- I. The equipment furnished shall be supplied by one communications contractor. The contractor shall hold the necessary License for this type of work. Contractor is required to submit current certification from manufacturer with submittals.
- J. Provide local wall mounted volume control in all offices, work rooms, conference rooms, teaching theaters, large teaching areas, special needs classrooms, band, orchestra and choir and all practice rooms. Provide volume control at intercom/P.A. rack for auditorium all dressing rooms and corridors around auditorium, cafeteria, and corridor circuits for Middle and High Schools.
- K. Provide IP speaker module, dual level call in switch on wall closest to door leading to hallway.

- L. Provide IP admin phone and microphone at receptionist, principal's office, AP secretary, all AP's and any admin suite.
- M. ADDITIONS/RENOVATIONS (Existing buildings w/analog recording).
 - 1. Maintain a fully functioning system in unaffected areas.
 - 2. Remove all abandoned equipment and return to owner, remove all abandoned wiring and patch surfaces at wall and floor penetrations.
 - 3. Maintain access to all existing equipment.
 - 4. Prior to construction, a system test will be required of the contractor to demonstrate the current state of the system. Any non-functioning item at this time shall be noted and addressed by CFISD maintenance. If system is proven to be 100% functional, the contractor is responsible to any repair necessary to return it to its previous state.
 - 5. At Substantial Completion or when system is ready to be tested, a demonstration is required by the contractor to demonstrate the system mirrors the system condition prior to construction. If system is not functioning the same prior to construction, the contractor shall make necessary repairs to bring the system back up to the pre-construction condition.
- N. This section includes a fully operational IP platform for a district-wide internal and school Critical Communications Solution, school safety notifications and general communications including but not limited to the following:
 - 1. The platform shall provide complete internal communications and employ state of the art IP Technology including the minimum functions listed.
 - a. Two-way internal intercommunications between staff locations and classrooms.
 - b. Scheduled bell events.
 - c. Emergency announcements that will override any pre-programmed audio, assuring that all Emergency/Lockdown etc., are heard at each and every speaker location.
 - d. Capability of prerecording emergency announcements that can be activated by a Soft Key on an administrative console, panic button, dial string, or web browser.
 - e. Atomic Time Synchronization with Class Change Tones utilizing multiple, programmable schedules for each zone.
 - f. District-wide, Emergency, Group, All School and Zone live voice paging.
 - g. District-wide, Emergency, Group, All School and Zone paging for pre-recorded audio – tones, music and voice.
 - h. Web-based user interface.
 - 2. The system shall support a minimum of 1000 level priorities which shall be user-definable, allowing each end point to place a minimum of 5 different priority calls at the same time.
 - 3. Any authorized administrator shall be able to call from outside the school into any classroom, zone, or entire school directly via the School District supplied SIP enabled Telephone Network. This shall allow remote monitoring, call-in annunciation, and two-way conversation from outside the facility as well as paging into the system. (Compliance with NEMA Standard SB-40 for emergency communications in K-12 Schools).
 - 4. Authorized system users shall be able to create a minimum of 100 automated sequences with voice instructions, tones, emails, program distribution, and relay activations and replay them.
 - 5. Automated message strings shall be manually initiated from a single-button access on the console, on a SIP connected telephone, a panic button, from the web-based user interface or via interface with third party systems.
 - 6. Paging and two-way intercom features shall be accessible from any system console or SIP connected telephone for each campus.
 - 7. The platform shall synchronize its system time to the network timeserver or a web-based time server.
 - 8. Each single campus installation shall be locally survivable for intercom, paging, bells, and emergencies such as lockdown, even when the district connection is unavailable.

9. This specification establishes a minimum level of quality, features, and performance for individual components as well as the integrated system.
10. All cabling shall comply with Division 27 cabling specifications.
11. Systems that do not comply with the feature-sets highlighted in this Specification will not be considered.

1.3 DEFINITION OF TERMS

- A. Installer(s): Shall refer to the person, persons, or company who or which actually contracts to perform the work specified herein.

1.4 SUBMITTALS

- A. Product data for each component showing electrical characteristics and connection requirements.
- B. Shop Drawings: Prior to proceeding with the work: Provide detailed equipment assemblies and indicate dimensions, weights, required clearances, method of field assembly, components, location of each field connection, and a complete schedule of all equipment and materials with associated manufacturer's cuts sheets which are to be used.
 - a. Wiring Diagrams: Detail wiring for power, signal, and control systems and differentiate between manufacturer-installed and field-installed wiring. Identify terminals to facilitate installation, operation, and maintenance. Include a single-line diagram showing cabling interconnection of components and levels throughout system and impedances.
 - b. Artwork drawings and lists indicating proposed nameplate nomenclature and arrangements for control panels and plug panels prior to fabrication reflecting equipment used.
 - c. Each drawing shall have a descriptive title and all sub-parts of each drawing shall be labeled. All drawings shall have the name and locations of the project, Systems Contractor's name in the title block.
 - d. Details and descriptions of any other aspect of the system, which must differ from the contract documents due to field conditions or equipment, furnished.
- C. FCC Approval: The system shall be approved for direct interconnection to the telephone utility under Part 68 of FCC rules and regulations. Systems, which are not FCC approved or utilize an intermediary device for connection, will not be considered. Provide the FCC registration number of the system being proposed as part of the submittal process.
- D. Product Certificates: Signed by manufacturers certifying that products furnished comply with specified requirements.
- E. Installer Certificates: Signed by manufacturers certifying that Installers comply with specified requirements.
- F. Manufacturer Certificates: Signed by manufacturers certifying that they comply with specified requirements.
- G. Field Test Reports: Indicate and interpret test results for compliance with performance requirements. Include record of final matching transformer-tap settings, and signal ground-resistance measurement certified by Installer.

- H. Operation and Maintenance Data: For equipment to be included in maintenance manuals specified in Division 1.
 - a. Record of Owners equipment-programming option decisions.
 - b. All instructions necessary for proper operation and manufacturer's instructions.
 - c. "Proof of Performance" information.
 - d. Manufacturer's maintenance information.
 - e. Copies of non-proprietary computer programs and system set up disks documenting all programmable features of the installed system.
- I. Record As Built Drawings: Prior to final acceptance, provide three (3) complete sets of As Built drawings (Arch E – 32x40) with a floorplan diagram of the system installation details indicating actual wiring layout and locations of field devices and all cable numbers and construction details in accordance with the actual system installation. Revise all shop drawings to represent actual installation conditions. These Record Drawings will be used during "Final Acceptance Testing".
 - 1. Provide AutoCAD drawing files of the As Built Drawings on an 8MB thumb drive. AutoCAD 2017 or later.
- J. System Training: Submit the following information describing the training programs and system trainers as outlined in paragraph 1.6 of this specification and in accordance with Division 1 specifications.
 - a. Include with the submittal a preliminary staff development training program in outline form for review and approval by the owner's representative.
 - b. Include with the submittal a current copy of the trainer's certification from the manufacturer that certifies and identifies the trainer(s) who are eligible to provide training and support for the project.
 - c. Include with the submittal a current copy of trainer's needs assessment form which will be reviewed with the owner's designated representative for the system's preliminary system programming and configuration.
 - d. Include with the submittal copies of all documentation used to identify for the owner those participants attending and completing the training programs.
 - e. Provide a minimum of eight hours of instruction in proper operation and routine maintenance of the system. Instruction shall cover all materials indicated in the Owner's operations manual.
 - f. Operational guidelines shall be given in written form in sufficient numbers so that all key personnel have operational instructions of programming, station use and special features. Copies of these instructions shall be provided for permanent record in the operations and maintenance manuals.
- K. A copy of the manufacturer's standard statement of warranty proving all equipment provided for the school communications network is covered with the required **five-year** warranty shall be included with the project submittal. This statement of warranty shall be provided on the manufacturer's stationary.

1.5 QUALITY ASSURANCE

- A. Installer Qualifications: An experienced Installer who is an authorized representative of equipment manufacturer for both installation and maintenance of equipment required for this Section. Provide the following within thirty (30) days after notification to proceed:
 - 1. Provide a list of installations that the Installer has specifically installed for verification by the Owner. Random installations from other vendors and/or Installers shall not be accepted. The Installer, not its employees, must meet these qualifications.
 - 2. The Installer shall be bondable.
 - 3. The Installer shall demonstrate to the satisfaction of the Owner or his representative that he has:
 - a. Adequate plant and equipment to pursue the work properly and expeditiously.

- b. Adequate staff and technical experience to implement the work.
 - c. Suitable financial status to meet the obligations of the work.
 - d. Technically capable and factory trained service personnel at a local service facility to provide routine and emergency service for all products used in this project.
- B. Any Contractor, who intends to bid on this work and does not meet the requirements of the "Quality Assurance" paragraph(s), shall employ the services of an "Installer" who does meet the requirements and who shall provide the equipment, make all connections and continuously supervise the installation. A subcontractor so employed as the "Installer" must be acceptable to the Architect/Engineer. The "Installer" shall be identified within thirty (30) days of notification to proceed for acceptance by the Architect/Engineer.
- C. Because the life expectancy of this type of communications structure normally exceeds 10 years, the owner expects continuity from the service provider. If the installing/servicing company has not been an authorized provider of the manufacturer's product for it least (10) years, the following is required:
 - 1. A list of (2) systems manufacturers of which they currently are authorized service providers where the relationship exceeds (10) years.
 - 2. A letter from the manufacturer outlining the details of changes in service providers over the last (10) years and what actions they will take to ensure continuity of service to the customer.
- D. Each major component of equipment shall have the manufacturers name, address and model number on a plate securely affixed in a conspicuous place. NEMA code ratings, UL Label, or other data that is die-stamped into the surface of the equipment shall be easily visible.
- E. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction.
- F. Comply with NFPA 70
- G. Comply with NEMA Standard SB-40 for Emergency Communications in K-12 schools.
- H. Comply with UL 60950.

1.6 IN-SERVICE TRAINING

- A. The contractor shall provide and implement a complete and comprehensive staff training program for all administrators, facility staff members, and teachers. This mandatory training program will provide school staff a complete understanding of how to utilize and properly operate all functions.
- B. The training program shall be implemented by a staff member/trainer employed by the contractor. The trainer must be factory certified to provide training on their product.
- C. All staff development training is to be coordinated through the owner's designated representative. As training sessions are completed, the trainer will provide the school's administrative staff and school district's staff a document listing all of the staff and faculty members who attended, received, and completed the training program.

1.7 WARRANTY

- A. Provide a **manufacturer's five-year warranty** of the school communications network equipment against defects in material and workmanship. This warranty will cover all electronic system components. Additional warranties cover clocks, speakers, and call in switches. If any defects are found within the warranty period, the defective equipment shall be replaced at no cost (equipment only); a one year warranty shall be provided for labor.
- B. A copy of the manufacturer's standard statement of warranty proving all equipment provided for the school communications network is covered with the required five-year warranty shall be included with the project submittal. This statement of warranty shall be provided on the manufacturer's stationary. The standard five-year warranty is an important element in establishing a standard in quality. Manufacturers who circumvent the five-year warranty by offering special "extended warranties" that are not part of their normal published warranty will not be accepted.
- C. Contractor shall respond, excluding weekends and holidays, within 24 hours to any warranty service calls. If equipment cannot be repaired within 24 hours of service visit, the contractor shall provide "loaner" equipment to the facility at no charge.
- D. Make available a service contract offering continuing factory authorized service of the system after the initial warranty period.

1.8 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide the following system:
 - 1. New campuses - Telecenter U IP manufactured by Rauland. No substitutions.
 - 2. Existing campuses are equipped with Telecenter U. During renovations, IP modules can be added. Coordinate with Intercom consultant and CFISD.
 - a. Authorized Rauland Distributor contact:
Name: Firetron Inc
Address 10101a Stafford Center Drive
Contact: Richard Phillips
Email: rphillips@firetron.com

PART 2 - PRODUCTS

2.1 SYSTEM REQUIREMENTS

- A. The platform shall utilize state of the art IP Technology for Call-in Notification, School Safety Paging and Evacuation tones, Atomic Time Synchronization, Class Change Tones utilizing multiple, programmable schedules for each zone, Two-way hands-free Internal Communications and Paging, and Program Distribution. The system shall be easy to learn and operate. All standard programming shall be web-based and user friendly to allow the system administrator the ability to easily program system features.

- B. Provide complete and satisfactorily operating district/school communications and district/school safety as described herein, using materials and equipment of types, sizes, ratings, and performances as indicated. Use materials and equipment that comply with referenced standards and manufacturers' standard design and construction, in accordance with published product information. Coordinate the features of all materials and equipment so they form an integrated system, with components and interconnections matched for optimum performance of specified functions.
- C. The platform shall be a single electronic system consisting of a minimum of 10 audio channels for each campus, (classroom) IP Speaker Modules and call switches, IP Zone Modules connecting corridor speakers, inside and outside horns, IP Administrative Consoles, SIP enabled PBX integration and district-wide integration for paging, emergency notifications, calendar scheduling and configuration.
- D. Each Classroom shall be provided with a Speaker Module interface and a minimum of 5 different call switches, each with their own annunciation path and priority.
- E. Call-ins may automatically annunciate (display of priority and location) to administrative consoles, SIP enabled phones, and outside phones.
- F. Call-ins shall be programmed to automatically change priority and annunciation route based on age of call-in and original priority.
- G. Call-ins may have priority (and annunciation route) changed by user action from a console or SIP enabled phone.
- H. Call-in annunciation route shall include playing pre-recorded audio over speakers, sending a pre-configured email, and activating relays.
- I. The platform shall lend itself to expansion by simple addition of hardware modules.
- J. The platform shall connect directly to an existing, standard protocol WAN/LAN network, without the need for a separate server at each school location. Configuration, including bell schedules, calendars, and emergency sequences can be remotely created, changed, stored and downloaded to the system by an authorized user from a web-based user interface.
- K. The platform shall provide the ability to initiate school safety paging announcements, evacuation tones and take cover tones from any telephone or connected web browser within the facility or outside the facility to any other location within the facility or district.
- L. The platform shall provide the ability to selectively communicate or monitor individual classrooms in emergency situations from any telephone within the facility or outside the facility to any other location within the facility; all communication within the classroom shall be hands-free and will not require any interaction by the classroom user.

- M. The platform shall provide classroom users the ability to confirm that they have safely secured their classrooms during an emergency with a single button press. The front office administrator will receive confirmation that the classroom is safely secured via an administrative console and web-based user interface. The front office administrator can view classrooms that are not safely secured via the administrative console. The front office administrator can view classrooms that are not safely secured via the web-based user interface. The front office administrator shall be able to initiate two-way communication, without a pre-announcement tone, to the classroom during an emergency via the administrative console. Web-based user interface will still identify that a school is in an emergency, even if all classrooms are safely secured. Individual classroom check-in and school emergency status shall be viewed from the web-based user interface, both on-site and remotely.
- N. IP Addressable and POE powered Speaker Modules for individual rooms shall be system programmable and may be assigned any two, three, four, five or six digit number as well as name and description. Any extension may be reassigned at any time.
- O. IP-enabled two-way voice communication shall be available from any provided telephone or administrative console through any speaker in a campus. This shall allow hands-free communication to any classroom or any individual loudspeaker unit. A programmable pre-announce tone shall sound immediately before the intercom path is opened and a supervisory tone shall continue to sound at regular intervals when speaker monitoring is active, complying fully with all privacy legislation. Pre announce tone and supervisory tones shall be disabled during designated emergencies automatically.
- P. The platform shall allow users to configure multiple schedules per school, with a minimum of 500 unique events per schedule, and automatic Daylight Savings time correction. Schedules can be programmed to occur once, daily, weekly, monthly, or in any combination of the preceding recurrences. Each school may have a minimum of 20 unique bell schedules, with a minimum of 5 active schedules on any given day for each campus. User shall be able to select from 25 standard included tones as well additional user created and uploaded audio files for class change signaling and messaging. In addition, scheduled events shall include relay actions, email notifications, and paging exclusions as system configuration changes. The platform shall allow control of the bell schedules via the district WAN/LAN without the need for a separate server at each school location. Bell schedules can be remotely created, changed, stored and assigned to calendar days for the local school by an authorized user from a web-based user interface.
- Q. The platform shall be able to integrate with an existing PA system or operate as a fully independent IP solution. The platform shall be able to function in combination of said configurations, and allow for seamless communication within a school or district-wide, regardless of the type of configuration used. The platform shall be scalable, with the ability to easily add, install, and configure additional equipment to a system.
- R. The platform allows for customization of preprogrammed sequences, used for emergencies, events, and everyday communications. Preprogrammed sequences can be activated from the push of a relay button, soft key of an administrative console, a dial string of a SIP phone, or a web browser configured to the district network. Sequences can be initiated automatically as part of a schedule or on the fly. Preprogrammed sequences can be customized to utilize any combination of audio tones, emails, relays, tone exclusions, swings, delays, duples, SIP phone notifications, and program distribution. Audio tones can include customized audio files and voice messages, recorded in any language. Uploaded audio tones and messages can be preprogrammed to annunciate repeatedly or individually, as part of a scheduled sequence or on the fly. Each school in a district can have its own customized sequences, and can be activated individually, in groups, or district-wide.

- S. Exterior speakers shall be zoned in groups, with a separate signal feed routed to each individual zone. Audio signal routed to each zone shall be controlled by the Owner (MUTE / UN-MUTE). Reference drawings for speaker zones groups. Provide the Owner a simple interface to successfully and easily operate this function.

2.2 EQUIPMENT AND MATERIAL

A. Server Software

1. Provides district-wide paging, bell event scheduling, emergency notification and configuration for entire district.
2. Ability to configure system and initiate system features, per school and district-wide via web-based user interface.
3. The software has the ability to sync system time to the Altas Clock Signal or to the school's or district's network time server.
4. The software will provide a web browser to deliver district-wide emergency paging, pre-recorded messages and tones from any authorized computer in the facility or the district. The software must be capable of automatically notifying district personnel via the WAN/LAN of an alarm condition.
5. The software can automatically broadcast emergency instructions via associated system hardware throughout an entire district when an alarm (e.g. lockdown, lockout, security, fire) is initiated via the web-based user interface. The emergency instructions are preprogrammed and require no user intervention. Bell tones are able to be halted during an emergency. The system provides redundant alarm annunciation over intercom/paging speakers and is not meant to replace primary fire alarm or security systems.
6. The software allows for user-uploaded pre-recorded messages and tones. Software supports the upload of MP3 and WAV file types. User-uploaded pre-recorded messages and tones can be part of emergencies, sequences, and bell schedules.
7. The software can be installed in cloud, virtual or physical server environments.
8. The web-based user interface supports secure HTTP browsing.
9. The software supports encryption to ensure secure access.
10. The system shall monitor itself if devices go offline and system actions are not received. Specified users shall receive email notifications when devices go offline. The software shall be able to keep a log and report on system activity within a school or all schools district-wide for a minimum of one year. These reports can be exported to excel spreadsheets.
11. The software will support a minimum of 20 bell schedules per school, with 5 schedules assignable to a specific school day. Bell schedules can be programmed to annunciate tones, activate relays, send emails, activate program distribution, and notify SIP phones.
12. The system allows programmable end points to be automatically included or excluded for live paging, bell tones, or prerecorded audio, depending on the time or day or day of the week. These inclusions/exclusions can be applied manually or automatically depending on their schedule.
13. The software can automatically send an email, as part of a programmed sequence of events, to district administrators alerting them of an emergency within the district.
14. The software provides the ability to view schools that are in an emergency status, using any web browser on the district's network. The software shall identify the name of the school in an emergency as well the type of emergency that school is in.
15. The software provides the ability to view individual classrooms that are not checked-in during an emergency, using any web browser on the district's network. The software shall identify the name, extension, and description of the classroom that is not checked-in during the emergency.

16. The system has a minimum of 5 customizable emergencies, one of them being an All-Clear – with the ability to return the system from an emergency to normal status. Each emergency shall have a minimum of 500 unique events.
17. As a district-wide communications solution, the system shall be able to provide simultaneous communications to all schools or groups of schools within a district. The system shall allow a user to initiate district-wide communications to individual schools, all schools or groups of schools, from a web-based user interface. The system shall allow a user to initiate prerecorded audio, live paging, or programmed sequences to individual schools, all schools or groups of schools, from the web-based user interface. Programmed sequences shall be customizable per school, and the system shall be able to activate them simultaneously to individual schools, all schools or groups of schools, from the web-based user interface.
18. The communications software must allow upgrade from an individual school system to multiple schools, or an entire school district, using the same web-based user interface. The communications software from an individual school system must be identical in typical user operation to the multiple schools or entire school district communications system software.

B. Campus Controller

1. Shall integrate with existing District-wide Cisco IP telephones. Coordinate with Intercom Consultant and CFISD.
2. Provides call routing for paging and intercom for a single facility.
3. System shall connect to the district provided Telephone Network via a SIP connection.
4. Support a flexible numbering plan allowing two, three, four, five, or six digit extensions.
5. SIP interface to a district provided Telephone Network shall be capable of allowing connected phones to display classroom call-ins, answer internal intercom call-ins, make pages and change priorities of call-ins in progress.
6. Direct dialing, two-way amplified voice intercom between any provided telephone or admin console and speaker without the use of a press-to-talk or talk-listen switch.
7. Ability to upgrade priority level from individual call switch.
8. The ability to answer intercom call-ins registered at administrative consoles and pre-selected telephones.
9. The ability to automatically escalate incoming call-ins to an alternate telephone or group of telephones if they remain unanswered for a predetermined amount of time.
10. The ability to manually upgrade an intercom call-in to an alternate telephone or group of telephones.
11. The ability for classrooms to “check-in” via push button when they have successfully secured their location during emergency.
12. Administrative console shall display locations that have not checked in to confirm their secured location and provide hands-free audio monitoring and communication to unsecured locations.
13. The controller shall not need direct connection to any classroom via home run or distributed wiring. It shall communicate solely through the IP network.
14. Single button access from any console on the system to distribute emergency announcements within the facility to all or select locations equipped with speakers. Emergency announcements originating from any assigned administrative console shall have priority over all regular system functions.
15. Ability for administrative consoles and connected phones to selectively monitor audio at any two way speaker during an emergency.
16. Stores a minimum of 48 hours’ worth of Bell Event Schedules, all emergency notification sequences as well as facility wide configuration.
17. System has the ability to sync system time to the Atomic Clock Signal or to the school’s or districts network time server.

18. System's SIP Interface shall provide:
 - a. Audio paging access from any telephone to any single intercom speaker, zone (group) of intercom/paging speakers, or all speakers/paging horns throughout the entire facility.
 - b. Ability to answer a call-in directed to that SIP extension.
 - c. Ability to upgrade a call-in directed to that SIP extension.
 - d. Single button access from any telephone on the system to initiate alarm signals within the facility to all or select locations equipped with speakers. A minimum of 25 separate distinct alarm signals shall be provided. Alarm signals originating from any assigned administrative telephone shall have priority over all regular system functions.
 - e. Ability to initiate a school-wide emergency including lockdown and evacuate sequences.
 - f. SIP device shall display call-in information from call in switch. Information will include a minimum of Classroom Name, Number, and Priority Level.
19. The system will have the ability to utilize a web browser and a USB microphone connected to the PC to deliver district-wide live emergency paging, pre-recorded messages and tones from any authorized computer in the facility or the district. The system must be capable of automatically notifying district personnel via the WAN of an alarm condition.
20. The system can automatically broadcast emergency instructions throughout an entire campus when an alarm (e.g. lockdown, lockout, security, fire) is tripped or manually activated. The emergency instructions are preprogrammed and require no user intervention. Bell tones are able to be halted during an emergency. The system provides redundant alarm annunciation over intercom/paging speakers and is not meant to replace primary fire alarm or security systems.

C. IP Addressable Modules:

1. System shall provide multiple IP Addressable Modules for intercom, paging and relay activation.
 - a. All Modules are POE 802.3af compliant
 - b. All Modules support DHCP.
 - c. All Modules connect to network with a single RJ45 connector
2. IP Addressable Speaker Module
 - a. Shall interface to school's data network, a classroom speaker, and multiple call switches.
 - b. A minimum of 5 levels of call-in can be placed from an IP Speaker Module. The call-ins are routed to administrative consoles and select SIP connected telephones and can only be cleared from the system once answered. If a call-in is not answered within a preprogrammed time the call-in may reroute to other telephones, consoles, and speakers.
 - c. An option for Privacy call in switches is supported. When the Privacy switch is activated it prevents administrative or classroom telephones from monitoring the specific classroom/location intercom speaker.
 - d. The ability to belong to one or more of a minimum of 100 independent zones for zone paging, program/music distribution zones and class change tone zones; this assignment is a programmable function, changeable by time of day. Each IP Speaker Module's location shall be programmed in software to belong to any combination of software zones. IP Speaker Modules shall be designed to mount near ceiling and wall speakers and in the plenum space.
 - e. Intercom and paging volume adjustable from Software interface.
3. IP Addressable Zone Paging Module
 - a. Zone Paging Module shall connect multiple speakers for district all page, all page, zone paging, bells, audio events and, emergency notification.
 - b. Zone Paging Modules shall be rack and wall mountable.

- c. Zone Paging Modules shall be able to belong to one or more of 100 independent zones for live paging, bells, pre-recorded audio and emergency notification.
 - 4. IP Addressable Aux I/O Module
 - a. Aux I/O Module shall have two input contacts and two output contacts.
 - b. Input and output contacts are individually addressable.
 - c. Aux I/O Module shall be wall and rack mountable.
 - d. User can program relays to be activated manually, through an event/bell schedule, or during emergency notification.
 - e. Aux I/O Module can perform school lockdown from a single press of a panic button.
 - 5. IP Addressable Program Line Input Module
 - a. Program Line Input Module shall provide line level audio program distribution into system.
 - b. Program Line Input Module shall have a 3.5mm cable jack.
 - c. Program Line Input Module shall be configured via web-based user interface.
 - d. User can configure program distribution to be activated manually or automatically through an event/bell schedule.
 - e. Program Line Input Module will have a system priority level such that emergency communications override program distribution.
- D. IP Addressable Analog Gateway
- 1. IP Addressable Gateway provides integration with existing analog wiring infrastructure – consisting of shielded two-pair classroom field wiring. The Gateway provides the ability to reuse speaker wiring, speakers, and punch blocks to integrate analog infrastructure with IP platform.
 - 2. Each Gateway will have 5 watts of power per port and 25 watts total per device.
 - 3. Supports 24 classrooms that utilize 25 Volt speakers and all current Telecenter call switches for front office notification.
 - 4. Supports minimum of 5 call switch priorities per classroom, capable of lockdown check-in functionality, while reusing existing shielded two-pair classroom field wiring.
 - 5. Classroom intercom volume adjustable from Software interface.
 - 6. Classroom paging volume adjustable from Software interface.
 - 7. Configured to the school network and can be used in conjunction with IP Addressable Modules.
- E. IP Addressable Administrative Console
- 1. A full color screen with 64 soft keys, 3 line select, volume control, push to talk, speakerphone mode and left/right and up/down scrolling.
 - 2. Audio paging access from any Console to any single intercom speaker, zone (group) of intercom/paging speakers, or all speakers/paging horns throughout the entire school.
 - 3. Programmable soft key access from any console on the system to initiate alarm signals within the school to all or select locations equipped with speakers. A minimum of 25 separate distinct alarm signals shall be provided. Alarm signals originating from any assigned administrative console shall have priority over all regular system functions.
 - 4. Programmable soft key access from any console to automatically broadcast page emergency instructions throughout an entire school when an alarm (e.g. lockdown, lockout, security, fire) is tripped or manually activated. The emergency instructions are preprogrammed and require no user intervention. The system provides redundant alarm annunciation over intercom/paging speakers and is not meant to replace primary fire alarm or security systems.
 - 5. Ability to perform intercom to any single IP Addressable Speaker Module.
 - 6. Ability to display 3 call-ins at a time on the screen while other call-ins are annunciating and the ability to scroll to view all call-ins.
 - 7. Ability to upgrade a call-in via soft key.
 - 8. Programmable soft key access from any console for activating relays, campus wide.

9. Ability to maintain, along with controller and other IP Modules system functions, including intercom, bells and paging for the local campus in the event of district-wide connection loss.
 10. Classrooms that have not 'checked-in' during an emergency are listed on the Administrative Console's screen.
 11. The time duration of an emergency is shown on the screen of the administrative console. The check-in timer is shown on the screen of the administrative console.
- F. Audio Paging/Program Amplifiers
1. Power amplifier(s) shall be provided to provide a minimum of 2 watts of power to all paging speakers, and 15 watts of power to all paging horns.
 2. The maximum load on the paging/program amplifiers shall be 80% of the rated maximum output of the amplifiers.
- G. Normal/Emergency Call Switch – Rauland Dual Level Call In Switch
1. Normal/Emergency Call Switches indicated on the drawings shall provide the following functions and features:
 - a. One (1) "Normal" call switch that shall activate a distinctive "NORMAL" level call from single button activation. The button shall be clearly marked "NORMAL" and will route the call-in to any one or more Administrative Consoles and/or Marquee Displays for quick and easy response from an Administrative Console.
 - b. One (1) "Emergency" call switch that shall activate a distinctive "EMERGENCY" level call from single button activation. The button shall be red in color and shall be clearly marked "EMERGENCY" and will route the call-in to any one or more Administrative Consoles and/or Displays for quick and easy response from an Administrative Consoles.
- H. Emergency/Check-In Call Switch – Rauland Check-In Call In Switch
1. Emergency/Check-In Call Switched indicated on the drawings shall provide the following functions and features:
 - a. One (1) "Emergency" call switch that shall activate a distinctive "EMERGENCY" level call from single button activation. The button shall be red in color and shall be clearly marked "EMERGENCY" and will route the call-in to any one or more Administrative Consoles and/or Displays for quick and easy response from an Administrative Consoles.
 - b. One (1) "CHECK-IN" call switch that shall activate a distinctive "CHECK-IN" level call from single button activation. The button shall be blue in color and shall be clearly marked "CHECK-IN" and will route the call-in to any one or more Administrative Consoles. This button will be used for emergency check-ins during school emergencies, notifying the front office of the classroom occupants' safety during an emergency.
- I. Equipment Racks
1. All equipment racks shall provide 35 spaces (61") minimum for mounted system equipment.
 2. All equipment racks shall be multi-rack format ("gangable") style, bolted together, and open cavity.
 3. All equipment racks will be provided with lockable rear doors.
 4. Equipment rack(s) shall be located in climate-controlled areas/rooms as shown on drawings.
 5. All head-end, distribution, and source equipment, including data and power, shall be located in racks configured as approved by the Engineer.
 6. Rack mounted equipment shall be accessible from front and rear.
 7. All unused rack spaces will be covered with appropriate blank/vent panels.

J. Terminal Cabinets

1. A terminal cabinet with a sufficient number of bushed openings shall be installed in the wall behind the intercom control console equipment rack. Cabling between the equipment rack and the main junction box shall be provided with telephone type 50 pin connectors to allow ease in console connections, disconnections and service. Satellite terminal junction boxes shall be provided as needed to allow for station terminations in each building.

K. Backboards

1. Provide 4 foot x 8 foot plywood backboards for mounting of system cross connect field. Mount as shown on the plans. Provide Modular Termination backboards with 110 type terminal blocks as required to terminate all cables. Provide distribution and cross connect backboards equal to AT&T 110 Series for all cross-connect wiring.

L. Jacks

1. All station device terminations (except speakers) shall be terminated on USOC standard modular jacks. Jacks for wall mounted telephones shall have lugs for securely attaching the instrument to the wall.

M. Interior Ceiling Speakers

1. IP Speaker - Provide Ceiling Speaker Assembly consisting of 8 Ohm, 8" speaker mounted in a 2 foot by 2 foot, or 2 foot by 1 foot, lay-in baffle, with an integrated back box that covers the full area of the baffle.
 - a. The speaker shall be connected by inserting an 8-pin RJ45 terminated CAT6 cable.
 - b. The speaker shall include provisions to allow attachment of a safety cable if required.
2. 70V/25V speaker – Provide round steel speaker baffle in white finish. Speaker support bridge and speaker backbox or one piece speaker – Rauland #ACC-1400.
3. Provide Atlas SBMS speakers in shop areas.
4. For all 25/70V applications, ie corridors / exterior horns, provide and install 24-port hybrid controllers.

N. Wall Mounted Exterior / Interior Horns, Flush Mount

1. Provide double re-entrant type horn loudspeakers with integral driver. The horn loudspeaker shall be impervious to weather and vandalism. Horn shall be constructed of heavy-duty ABS plastic. Horn loudspeaker drivers shall be rated at 15 watts with a frequency response of 480 Hz to 14 KHz. Sensitivity shall be 106 dB 1 watt, 1 meter. Transformer assembly shall be dual voltage multi-tap type suitable for 25 or 70-volt installations. Dispersion pattern shall be 180 degrees conical. The horn loudspeaker shall be constructed of treated heavy gauge aluminum, with all exposed parts potted and a sealed driver. Wiring terminal shall be fully enclosed. The speaker flange and mounting surface shall have a cork-rubber gasket. The horn loudspeakers finish shall be gray baked on enamel.
2. The recessed back box shall be of heavy gauge cold-rolled steel, spot welded for stability with a rust-retardant gray primer finish. Acoustically treat the interior to eliminate mechanical resonance. The back box shall be 10-3/4"x10-3/4"x6" deep.
3. The baffle shall be vandal proof, the faceplate constructed of 14-gauge carbon steel with a minimum tensile strength of 55,000 PSI. A lattice grid sub-plate shall deny access to the horn but be acoustically transparent for sound projection. Provide tamper proof, stainless steel mounting hardware. The baffle shall a mar/scratch baked epoxy rust inhibitive finish.

4. Flush mount with vandal-resistant metal baffle similar to Atlas/Soundolier Model VP161-APF. Baffle shall be square and designed for flush mounting. Provide backbox designed for flush mounting. Backbox shall be metal with all-welded seams and undercoated to eliminate mechanical resonances. Box shall have rust-resistant coating. Backbox shall be Atlas/Soundolier Model 193 Series deep box for specified speaker and baffle, or approved equal. Install gaskets to seal enclosure to speaker. Backboxes and conduit shall be sealed and secured to the building.
 5. For all 25/70V applications, ie corridors / exterior horns, provide and install 24-port hybrid controllers.
- O. Uninterruptible Power Supplies (UPS)
1. UPS equipment provided for this system will include Power Conditioning to smooth current and voltage fluctuations and shall comply with Division 27 specifications.
 2. UPS equipment will be sized in accordance with the system manufacturer's recommendations.
 3. Provide an individual UPS for EACH SYSTEM CONTROLLER (Gateway) furnished with the system.
 4. Provide additional UPS(s) for protection of all other equipment furnished with the system and housed in the equipment racks.
 5. All UPS equipment shall be rack mounted.
 6. Tripp Lite IsoBar.
- P. Clock System
1. For new construction, provide Master Clock by Lathem, with daylight savings time pre-programmed via connection to intercom controller. Clocks are to be installed in the following locations only:
 - a. Cafeteria / Commons
 - b. Library
 - c. Clinic
 - d. Gymnasiums
 - e. Receptionist Area
 2. For renovations, keep the Master Clock and the field clocks at the following locations:
 - a. Cafeteria / Commons
 - b. Library
 - c. Clinic
 - d. Gymnasiums
 - e. All other clocks on this system shall be removed and the wall patched and painted to match existing surface.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine conditions, with the Installer present, for compliance with requirements and other conditions affecting the performance of the School Communications and School Safety Network.
- B. Do not proceed until unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. General: Install system in accordance with NFPA 70 and other applicable codes. Install equipment in accordance with manufacturer's written instructions.

- B. Furnish and install all material, devices, components and equipment for a complete operational system.
- C. Impedance and Level Matching: Carefully match input and output impedance's and signal levels at signal interfaces. Provide matching networks where required.
- D. Control Circuit Wiring: Install control circuits in accordance with NFPA 70 and as indicated. Provide number of conductors as recommended by system manufacturer to provide control functions indicated or specified.
- E. All housings are to be located as indicated.
- F. The contractor shall provide necessary transient protection on the AC power feed, all copper station lines leaving or entering the building, and all central office trunks. All protection shall be as recommended by the equipment supplier and referenced to earth ground.
- G. Wiring within Enclosures: Provide adequate length of conductors. Bundle, lace, and train the conductors to terminal points with no excess. Provide and use lacing bars.
- H. Provide physical isolation from speaker-microphone, telephone, line-level wiring, and power wiring. Run in separate raceways, or where exposed or in same enclosure, provide 12 inch minimum separation between conductors to speaker-microphones, telephone wiring and adjacent parallel power. Provide physical separation as recommended by equipment manufacturer for other system conductors.
- I. Identification of Conductors and Cables: Use color coding of conductors and apply wire and cable marking tape to designate wires and cables so all media are identified in coordination with system wiring diagrams.
- J. Weatherproofing: Provide weatherproof enclosures for items to be mounted outdoors or exposed to weather.

3.3 GROUNDING

- A. Provide equipment grounding connections for Integrated Electronic Communications Network systems as indicated. Tighten connections to comply with tightening torques specified in UL Standard 486A to assure permanent and effective grounds.
- B. Ground equipment, conductor, and cable shields to eliminate shock hazard and to minimize to the greatest extent possible, ground loops, common mode returns, noise pickup, cross talk, and other impairments. Provide 5-ohm ground at main equipment location. Measure, record, and report ground resistance.
- C. Provide all necessary transient protection on the AC power feed and on all copper station lines leaving or entering the building. Note in system drawings, the type and location of these protection devices as well as all wiring information.

3.4 FIELD QUALITY CONTROL

- A. Manufacturer's Field Services: Provide services of a duly factory authorized service representative for this project location to supervise the field assembly and connection of components and the pre-testing, testing, and adjustment of the system.

- B. Inspection: Make observations to verify that units and controls are properly labeled and interconnecting wires and terminals are identified. Provide a list of final tap settings of paging speaker line matching transformers.
- C. Testing: Rectify deficiencies indicated by tests and completely re-test work affected by such deficiencies at Contractor's expense. Verify by the system test that the total system meets the Specifications and complies with applicable standards.

3.5 FINAL ACCEPTANCE TESTING

- A. The Final Acceptance Testing shall be provided to the Owner or the Owners designated representative only. Final acceptance testing to any other trade or service provider for the project will not comply with the requirements of this section.
- B. The contractor will provide a Final Acceptance Test record document signed by both the contractor and the Owner or designated Owner's Representative establishing the "In Warranty" date. The warranty period will not commence until the Final Acceptance Test is completed.
- C. Be prepared to verify the performance of any portion of the installation by demonstration, listening and viewing test, and instrumented measurements. Make additional adjustments within the scope of work and which are deemed necessary by the Owner because of the acceptance test.

3.6 COMMISSIONING

- A. The contractor shall train the Owner's maintenance personnel in the procedures and schedules involved in operating, troubleshooting, servicing, and preventative maintenance of the system. This training will be in accordance with the training as outlined in Section 1.6 of these specifications. In addition to the Training Materials provided, the contractor will also furnish Operators Manuals and Users Guides at the time of this training.
- B. Schedule training with Owner through the owners representative, with at least seven days advance notice.

3.7 OCCUPANCY ADJUSTMENTS

- A. The contractor shall provide Occupancy Adjustments in accordance with Section 1.6 of these specifications. A response scenario amenable to both the owner and the contractor will be established and followed for the first year of service.

3.8 CLEANING AND PROTECTION

- A. Prior to final acceptance, the contractor shall vacuum and clean all system components and protect them from damage and deterioration. All blank spaces in equipment cabinets will be covered with blank panels. Top and side panels, and all cabinet doors will be installed. All general areas within and around all equipment rack/cabinets in the facility will be swept, vacuumed, and cleaned up. No cabinets will be left unlocked and all cabinet keys will be turned over to the owner or designated owner's representative.

END OF SECTION

SECTION 28 31 00
FIRE DETECTION AND ALARM

PART 1 GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. This Section Includes:
1. Provide a complete, fully addressable, power limited, fire detection evacuation system for this project. The system shall be connected, tested, verified by AHJ to be acceptable and left in first class operating condition. All equipment herein specified shall be engineer-approved and California State Fire Marshal (CSFM) listed. The entire installation shall conform to the National Fire Protection Association (NFPA) Standard 72, 2016 90A & CEC Article 760 and authorities having jurisdiction as applicable. The system specified and depicted on the plan is a complete and approved system. The entire fire alarm system has been submitted and approved by the Division of the State Architect as a complete submittal. Any routing of the system wiring that is significantly different than shown on the approved drawings shall have the approval of the engineer and must be obtained prior to construction.
 2. Provide all work and material as shown and / or required to provide a fully functional and adequate system as described hereon and as required by the California State Fire Marshal.
 3. Supervision: The fire alarm system shall monitor the integrity of all alarm initiating and indicating appliance circuits and provide local and remote status of all connected systems. The system shall be provided with automatically charged standby batteries to maintain system operation for 24 HRS in the normal supervisory mode and 15 minutes of alarm. Batteries shall be supervised for connection to the system and low voltage threshold. The automatic battery charger shall be capable of charging fully discharged system batteries to 100% in 8 hours.
 4. The system wiring and installation shall be as stated in drawings and as required by the manufacturer. All wiring shall be color coded, tagged and verified to assure that it is free from shorts and grounds and shall be rated for the appropriate environmental conditions such as well locations.
 5. Testing: The completed system shall be tested in accordance with NFPA Standard 72 7.6.6 and 7.8.2.
 6. All Fire Alarm wiring shown in drawings shall be installed in conduit.
 7. System Operation shall include:
 - a. Separate zone signaling and device status indication for all initiating devices.
 - b. Audible to sound the California uniform fire alarm signal in temporal mode. Devices shall be at least 15dBA above average ambient sound level, but not less than 75dBA at 10' or more than 120dBA.
 - c. Visual devices shall not exceed 2 flashes per second and shall not be slower than 1 flash per second. Visual devices shall be synchronized when 3 or more devices are within the same field of view.
 - d. Supervision of all circuits to indicate any abnormal wiring condition.
 - e. N.O./N.C. integral relays for external device interface or as indicated on drawings.
 - f. Central station connection capable of indicating (3) distinct separate signals as being tamper, trouble and alarm with point reporting capabilities.

8. All work shall be completed as shown on the plans and or as specified within this specification and shall include the following (but is not limited to):
 - a. Life safety fire alarm detection and signaling system.
 - b. Furnishing and installation of equipment and devices.
 - c. Conductors, connections and interconnections where specified and all in conduit system.
 - d. Conduit, wire and connections for control of heating and ventilation motors, smoke dampers and smoke exhaust.
 - e. Testing, cleaning and adjusting of completed work.
 - f. Wiring diagrams, as-built drawings and three (3) sets of equipment operations and maintenance instructions for Owner.
 - g. Complete maintenance for two years.
 - h. Proposal for subsequent maintenance contract.
 - i. All work and material for complete and operable systems as indicated or specified.
 - j. Permits, inspections and fees.
 - k. Identification and instruction to Owner Representative. Training shall consist of a minimum of two (2) 6-hour sessions.
9. Coordination with Section 26 05 33: Raceway and Boxes for Electrical Systems.
10. Furnishing of special back boxes where required for installation of fire alarm devices.
11. All conductors to be installed in conduit pursuant to Specification Section 26 05 33: Raceway and Boxes for Electrical Systems.
12. Qualifications: Contractor shall receive written approval and verified test results which shall be submitted to the owner for system from manufacturers recognized representative prior to completion and acceptance.
13. All initiating devices shall be separately addressed for individual identification at control panel.
14. As-Built Drawings: A complete set of reproducible "as-built" drawings showing installed wiring, color coding, wire tag notations exact locations of all installed equipment, specific interconnections between all equipment and internal wiring of the equipment shall be delivered to the owner upon completion of the system.
15. Maintenance Instructions: Three (3) submittals of maintenance instructions shall be provided and shall be complete, easy to read, understandable and shall provide the following information:
 - a. Instructions for replacing any components of the system, including internal parts.
 - b. Instructions for periodic cleaning and adjustments of equipment with a schedule of these functions.
 - c. A complete list of all equipment and components with information as to the address and telephone number of both the manufacturer and local supplier of each item.
 - d. User operating instructions shall be prominently displayed on a separate sheet located next to the control unit in accordance with UL Standard 864. The contractor shall warrant all equipment and wiring free from inherent mechanical and electrical defects for two years from the date of final acceptance.
16. The FACP shall integrate with the to prevent bells from activating during a fire alarm.
17. The FACP shall meet the requirements of UL ANSI 864 Ninth Edition. Systems listed to UL ANSI 864 Eighth Edition or earlier revisions are not acceptable.
18. Per DSA IRA-1 chapter of approval for temporary school use of DSA approved relocatable buildings, Approval of fire alarm and/or fire sprinkler systems for temporary use buildings shall be in accordance with the Chapter 9, CCR, Title 24, Part 2.
 - a. Fire Alarm: Section 3.4.4.4 For buildings sited less than three years and used for educational purposes (instruction), provide an approved manual fire alarm system consisting of manual pull-stations, visual notification appliances and audible device(s) (with a minimum rating of 95 dBA at 10 feet). Buildings more than 25 feet apart are to be provided with additional audible devices to ensure the fire alarm signal can be heard within adjacent buildings.

- b. Communications: Section 3.4.4.5 Buildings more than 25 feet from other buildings, including other temporary buildings, with a stand-alone fire alarm system must be provided with approved "two-way communication" with the main administration offices consisting of an intercom system, permanently mounted telephone or "walkie-talkie" devices or other similar systems. Buildings that are less than 25 feet from existing permanent buildings on the site shall be interconnected with the campus fire alarm system.

B. Substitutions

1. Substitution of system components or manufacturer will require the contractor to separately obtain approval with DSA at Contractor's expense and shall meet all requirements of the system as designed and pre-approved.
2. All proposed substitutions shall be listed with the California State Fire Marshal.

1.3 SUBMITTALS

A. Comply with applicable provisions of Section 26 05 00: Common Work Results for Electrical.

B. General:

1. Two (2) copies of all submittals shall be submitted to the Architect/Engineer for review and approval.
2. All references to manufacturers model numbers and other pertinent information herein is intended to establish minimum standards of performance, function, and quality.
3. For equipment other than that specified, the contractor shall provide proof that the proposed substitute equipment equals or exceeds the form, feature, function, performance, and quality of the specified equipment.

C. Product Data:

1. A complete list of all supplied equipment including model numbers with catalog data sheets on each component.
2. Data sheets show California State Fire Marshal Listing, U.L. listing, equipment ratings, dimensions and finishes.
3. Highlight actual devices to be used and their amp draw in stand-by and alarm modes.

D. Shop Drawings:

1. Provide schematic layout, floor plan, drawings indicating location of all components and equipment, required size and location of conduit and outlets and type and quantity of system conductors. Include voltage drop calculations and battery calculations based on actual number of devices to be installed.
2. Include riser and wiring diagrams for overall system and components including control panels, annunciators, power supplies, initiating circuits, notification appliances, control devices and FATC. Address numbers shall be noted on all appliances.
3. Include physical and electrical characteristics of equipment to indicate conformance with the Specifications.
4. Describe system characteristics and function as well as device wiring diagrams.
5. Voltage drop and battery calculations for each control panel and power supply and initiating circuits at 24 hour stand-by and 15 mins alarm.
6. System operational matrix.

E. Operating and Maintenance Instruction Manual:

1. Manual shall include the following tailored to this specific project:
 - a. Operational description.
 - b. Coded cabling plan.
 - c. Two wire circuit diagrams.
 - d. Wiring destination schedule.
 - e. Schematic component diagrams and PC board layouts.

- f. Maintenance and alignment procedures.
- g. Voltage drop and battery calculations.

F. Other documentation

1. In addition to the shop drawings, the following information shall also be included with the submittal.

- a. Manufacturer's technical data sheets for each piece of equipment that will be installed.
- b. Standby battery calculations for the FACP and any remote power supply or other panels that include their own standby batteries.
- c. Voltage drop calculations showing the worst-case end of line voltage for all notification appliance circuits
- d. Detailed description of the overall operation of the system or a sequence of operation matrix.
- e. Proof of factory training and certification of the supervising technician assigned to the project.
- f. Proof of factory training and certification of a service technician employed by the installation company that can be onsite to troubleshoot and repair any service-related problems with the system, within 4 hours of being notified of the problem.

1.4 PERFORMANCE REQUIREMENTS

- A. Alarm, trouble and supervisory signals from all intelligent reporting devices shall be encoded on NFPA Style 4 (Class B) Signaling Line Circuits (SLC).
- B. Device Circuits (IDC) shall be wired Class A (NFPA Style D) as part of an addressable device connected by the SLC Circuit.
- C. Notification Appliance Circuits (NAC) shall be wired Class A (NFPA Style Z) as part of an addressable device connected by the SLC Circuit.
- D. On Style 6 or 7 (Class A) configurations a single ground fault or open circuit on the system Signaling Line Circuit shall not cause system malfunction, loss of operating power or the ability to report an alarm.
- E. Alarm signals arriving at the FACP shall not be lost following a primary power failure (or outage) until the alarm signal is processed and recorded.
- F. NAC circuits and control equipment shall be arranged such that loss of any one (1) NAC circuit will not cause the loss of any other NAC circuit in the system.
- G. Two-way emergency telephone communication circuits shall be supervised for open and short circuit conditions.
- H. The secondary power source of the fire alarm control panel shall be capable of providing at least 24 hours of backup power with the ability to power the system for an additional 15 minutes in an alarm condition, at the end of the 24-hour backup period.

I. Basic System Operation

1. When an off normal condition occurs (Alarm, Supervisory, or Trouble) the respective LED on the FACP shall illuminate.
2. A piezo sounder shall activate at the FACP during any off normal condition until the SILENCE button is pressed by an authorized user.
3. A Red LED shall illuminate when an alarm or pre-alarm condition exists.
4. An Amber (yellow) LED shall illuminate when a Supervisory or Trouble condition exists.
5. A backlit 4-line 40-character LCD screen shall display all messages that refer to an off-normal condition.
6. An Alarm condition shall have priority over all other signals.
7. The FACP shall include an event buffer that maintains the last 4,000 system events including a date and time stamp for each.
8. In response to a fire alarm condition, the systems notification appliances and relay-controlled output circuits that are associated through programming with the device initiating the alarm, shall automatically activate. Additionally, the system shall notify an approved central station via dial-up, IP, or cellular means as deemed acceptable by the local Authority Having Jurisdiction (AHJ).

1.5 QUALITY ASSURANCE

- A. Loads of Equipment and Components
 - a. Follow IEEE Standard where applicable.
 - b. Provide fuse protection for equipment and spare fuses.
 - c. Design systems for operation at 120 volts, normal or emergency power as indicated, 60 Hz nominal input.
 - d. Operating voltage dissipated by resistors shall not exceed 25% of ratings.
 - e. Operating voltage of capacitors shall not exceed 80% of rated voltage.
 - f. Operating loads and voltages on transistors and solid-state devices shall not exceed manufacturer's recommendation for normal full load operation.
 - g. Use electronic components of types and rating commonly available from stock of established commercial distribution.
- B. Regulatory Requirements
 1. The specifications and standards shall fully comply with the latest issue of the current code and standards.
 2. All requirements of the Authority Having Jurisdiction (AHJ).

The FACP and associated field devices system shall comply with the following Underwriters Laboratories Inc. (UL) USA listing standards as applicable.

1. No. 38 Manually Actuated Signaling Boxes
2. No. 50 Cabinets and Boxes
3. No. 864 Control Units for Fire Protective Signaling Systems
4. No. 268 Smoke Detectors for Fire Protective Signaling Systems
5. No. 268A Smoke Detectors for Duct Applications
6. No. 346 Waterflow Indicators for Fire Protective Signaling Systems
7. No. 464 Audible Signaling Appliances
8. No. 521 Heat Detectors for Fire Protective Signaling Systems

- 9. No. 1638 Private Mode Emergency and General Utility Signaling
- 10. No. 1971 Visual Notification Appliances

1.6 WARRANTY

- A. For a period of two years from date of final acceptance, the system shall be under full guarantee for materials and labor at no cost to the Owner. The system shall be under a service contract with a technician authorized by the manufacturer. Replacement parts and labor shall be readily available during normal business hours while the service contract is in effect. A complete system inspection and test shall be performed at five months and again at eleven months after final acceptance. Tests shall include all smoke detector sensitivity settings.
- B. Conform to applicable provisions of the General Requirements.
- C. Service technicians and replacement components for the system shall be available locally from a service representative of the manufacturer who is able to provide evidence of technical training and authorization by the manufacturer.
- D. All component failures shall be remedied to the satisfaction of the Owner.
- E. A continuing service contract shall be offered at time of bid to commence at the expiration of warranty included with the system.

1.7 ACCEPTABLE MANUFACTURER

- A. All fire alarm system devices and equipment shall be manufactured with the one indicated on the drawing or approved equivalent. no other manufacturers will be accepted.
- B. All equipment, materials, accessories, devices, etc. covered by the specifications and/or noted on the contract drawings shall be new and unused and be UL. listed for their intended use.
- C. All equipment provided shall be available for purchase from at least two authorized distributors within the service area.

1.8 MAINTENANCE:

Maintenance and testing shall be on a semi-annual basis or as required by the AHJ. A preventative maintenance schedule shall be provided by the contractor describing the protocol for preventative maintenance. The schedule shall include:

Systematic testing and complete inspection of the entire fire alarm system including control panels, field devices, and wiring terminations including smoke sensors, heat sensors, manual pull stations, sprinkler system switches, remote panels, power supplies, and terminal boxes, and all other fire alarm accessories, in accordance with NFPA 72. Cleaning and adjusting of these devices shall be conducted at this time.

An inspection and test of system power supplies, batteries, circuit breakers, and fuses as well as a load test of the batteries shall be conducted in accordance with NFPA 72.

Placing the system into an alarm condition and checking each notification device for proper operation.

Removing devices from the FACP SLC circuit to ensure a trouble condition occurs.

Input and output mapping shall be tested to ensure proper sequence of operation.

Signal transmission shall be tested to the Monitoring Station.

A report showing the calibrated sensitivity of each of the systems smoke detectors shall be generated from the fire alarm control panel and verified to ensure all smoke detectors are within UL tolerance.

Following each periodic maintenance and test, the owner shall be provided with a detailed report of the test results including any deficiencies found.

PART 2 PRODUCT

2.1 MANUFACTURERS

- A. Fire Alarm Power Supply: Gamewell
- B. Area Smoke Detectors and Heat Detectors: Gamewell
- C. Strobes, Combination Horn/strobe and Weatherproof Horn: System sensor

2.2 MATERIALS

- A. Main FACP or network node shall contain a microprocessor based Central Processing Unit (CPU) and power supply in an economical space saving single board design. The CPU shall communicate with and control the following types of equipment used to make up the system: intelligent addressable smoke and thermal (heat) detectors, addressable modules, printer, annunciators, and other system-controlled devices.
- B. System Devices and components shall be provided as specified on the fire alarm equipment legend and as shown on associated electrical drawing.

2.3 COMPONENTS

EXISTING FIRE ALARM CONTROL PANEL (FACP)

- A. FACP shall be as indicated model on the drawing or approved equivalent.

2.1 System description

- A. The fire alarm system as outlined on the drawings, shall be a fire life safety system as manufactured by the panel indicated on the drawing. It shall be complete with all necessary hardware, software and memory specifically tailored for this project.
- B. All equipment needed for a complete operable system, (whether specifically indicated or not) shall be included in this section. It shall be the installing contractor's responsibility for a complete and operable system upon completion of this project.

2.2 Automatic alarm operations

A. The fire alarm system operation subsequent to the alarm initiation via pull station, smoke detector, heat detector, sprinkler flow switch, etc., shall be as follows:

1. All audible alarm indicating devices shall sound the temporal signal code in synchronization with each other, until silenced at the control panel or at the remote annunciator.
2. All visual alarm indicating devices shall flash per NFPA requirements in synchronization with each other, until reset at the control panel or at the remote annunciator.
3. Alarm audible devices and alarm visual devices shall operate on the same circuit
4. The alarm signals shall be inhibited from being silenced for a period of at least 1 minute after commencing operation. this rate is to be field programmable for actual AHJ requirements.
5. Display type and location of alarm per point on the main control panel lcd display.
6. Display type and location of alarm per point on remote lcd annunciator.
7. List on printer the time, date, type, and user defined message for each event printed.
8. Graphically display on the fireworks station, school diagram showing whole school, with graphic scrolling thru system prompts, down to point of alarm activation.
9. Subsequent alarms are to report to the main control panel and fireworks, shall indicate to the operator that a subsequent alarm is present, and also indicate the number of subsequent alarms.
10. Shut down all associated air handlers in alarm zone.

2.3 Automatic supervisory operation

A. All data, initiating, indicating and supervisory lines shall be constantly monitored for integrity. indicate opens, shorts, grounds, at main control panel and remote annunciator.

2.4 operation

- A. During the normal state, the normal led (green) shall flash. the first line of the lcd shall display the time in (hh: mm: ss) as well as the number of active points (ap) and the number of disabled points (dp) in the system.
- B. When the control panel goes into alarm condition, the normal led (green) extinguishes and the alarm led (red) shall light, the buzzer pulsates, and the lcd indicates the time, the number of messages waiting, the type of alarm, the point id number of devices, and the time that the alarm occurred. the second line is dedicated to the user specified message.
- C. To silence the panel buzzer, the operator shall press the local silence button and the buzzer will silence.
- D. To silence the audible devices, the operator shall press the alarm silence button. a new alarm shall cause the audibles to resound.

E. During the trouble condition, the amber trouble led shall light, the normal led shall go out, and the buzzer shall pulsate. the display shall indicate the point id number of the device, the time the event occurred and up to a 40-character custom user description.

F. During the monitor or supervisory condition, the appropriate led shall light, the normal led shall go out, and the buzzer shall pulsate. the display shall indicate the point id number of the device, the time the event occurred and up to a 40-character custom user description.

The intelligent fire alarm amplifier shall be as indicated model on the drawing or approved equivalent. The intelligent 50 or 70-watt amplifier is used to amplify the audio message for distribution throughout the facility. Since it is designed as a self-contained distributed amplifier it can be conveniently located near the area of protection to reduce wiring demands.

Each amplifier can produce 50 or 70 -watts of audio power. Up to four amplifiers can be used on the evacuation system. The amplifier has its own power supply with battery backup and four speaker circuits which can be expanded to eight speaker circuits. The amplifier is fully supervised by the main panel for trouble conditions.

B. Fire Alarm Power Module:

1. The intelligent fire alarm power module shall be as indicated model on the drawing or approved equivalent. It delivers 6 amps of notification appliance circuit power and built-in synchronization. Its switch mode power supply design is up to 50% more efficient than competitive linear mode power supplies.
2. The power supply is a 6-amp notification power expander that provides its own AC power connection, battery charging circuit, and backup battery for use with the same manufacturer series fire alarm control panels (FACPs). The power supply is the cost-effective solution for powering notification appliances required by the Americans with Disabilities Act (ADA). It has built-in ANSI cadence pattern. The output circuits can be programmed as notification appliance circuits, or as auxiliary power (configurable for constant, resettable, or door holder power).

C. Intelligent Photoelectric Smoke Detector

1. The intelligent photoelectric smoke detector shall be as indicated model on the drawing or approved equivalent and shall use the photoelectric (light-scattering) principal to measure smoke density and shall, on command from the control panel, send data to the panel representing the analog level of smoke density.

D. Intelligent Thermal Detectors

1. The intelligent thermal detectors be as indicated model on the drawing or approved equivalent addressable devices rated at 135 degrees Fahrenheit (58 degrees Celsius) and have a rate-of-rise element rated at 15 degrees F (9.4 degrees C) per minute. A high heat thermal detector rated at 190 degrees Fahrenheit shall also be available. The thermal detectors shall connect via two wires to the fire alarm control panel signaling line circuit.

E. Control Relay Module:

1. The Control Relay is intended for use in intelligent, two-wire systems where the individual address of each module is selected using the built-in rotary switches. It allows a compatible control panel to switch discrete contacts by code command. The relay contains two isolated sets of Form-C contacts, which operate as a DPDT switch and are rated in accordance with the table in the manual. Circuit connections to the relay contacts are not supervised by the module. The module also has a panel-controlled LED indicator.

F. Intelligent Monitor Module:

1. The monitor module indicated on the drawing is an addressable monitor module for use with Honeywell Silent Knight Series fire alarm control panels (FACPs). The monitor module is intended for use in intelligent, two-wire systems, where individual address of each module is selected using the built-in rotary switches.
2. It supports Class A supervised or Class B supervised wiring to the load device. Conventional 4-wire smoke detectors can be monitored for alarm and trouble conditions.

G. Ceiling Mounted Strobe

1. The notification appliances shall be as indicated model or approved equivalent model as Visual Strobe appliances for ceiling-mount applications with a low-profile design or approved equals. The Strobes shall be listed for UL Standard 1971 (Emergency Devices for the Hearing-Impaired) for Indoor Fire Protection Service.
2. The Series shall be Restriction of Hazardous Substances (RoHS) compliant and contain no mercury or other hazardous substances.
3. All Series shall meet the requirements of FCC Part 15 and ICES-003.
4. All inputs shall be compatible with standard reverse polarity supervision of circuit wiring by a Fire Alarm Control Panel (FACP) with the ability to operate from 16 to 33 VDC.
5. The Strobe appliances shall produce a flash rate of one (1) flash per second over the Regulated Voltage Range and shall incorporate a Light Emitting Diode (LED) as the light source with a rugged Lexan® lens. The appliances shall be of low current design. The LED strobe flash duration shall be 20 ms. Where multi-candela appliances are specified, the strobe intensity shall have 4 field selectable settings at 15, 30, 75, 95 candela for ceiling-mount applications. The selector switch for selecting the candela shall be tamper resistant. Appliances with candela settings shall show the candela selection in a visible location at all times when installed.
6. The Strobe mounting options shall include Ceiling backboxes, 4" square, 1 1/2" or 2 1/8" deep and 4" Octagonal, 1 1/2" or 2 1/8" deep. Two wire appliance wiring shall be capable of directly connecting to the mounting base. Removal of an appliance shall result in a supervision fault condition by the Fire Alarm Control Panel (FACP).
7. All notification appliances shall be backwards compatible.
8. The ceiling models shall have a low-profile measuring.
9. When synchronization is required, the appliance shall be compatible with Sync Modules, PS Power Supplies, or other manufacturer's panels with built-in manufacturer Patented Sync Protocol. The strobes shall not drift out of synchronization at any time during operation. If the sync protocol fails to operate, the strobe shall revert to a non-synchronized flash-rate and still maintain (1) flash per second over its Regulated Voltage Range. The appliance shall also be designed so that the audible signal may be silenced while maintaining strobe activation when used with patented sync protocol.

H. Combination Horn Strobes

1. The Horn Strobes are designed for high efficiency sound output for indoor applications. The product line features intelligible communications with crisp, clear messages and tone signaling, ideal for mass notification.
2. Providing a sleek aesthetic appearance, the wall and ceiling appliances feature dual voltage (25/70 VRMS) capability and field-selectable taps from 1/8 to 2 watts. For faster and easier installation, the low-profile design incorporates a speaker mounting plate, and each model has a built-in level adjustment feature and Snap-On cover with no visible mounting screws.
3. For visible signaling to meet the hearing impaired, the E horn Strobe models incorporate the low current draw of the Strobes.

4. Ceiling mount models are available in multi-candela ceiling strobe with field selectable intensities of 15/30/75/95/110/115cd or the high intensity strobe with field selectable 135/150/177/185cd.
5. The strobe portion of all Horn Strobes may be synchronized when used in conjunction with the Sync Modules, Power Supplies or other manufacturers panels incorporating the manufacturer Patented Sync Protocol.
Synchronized strobes offer an easy way to comply with ADA recommendations \ concerning photosensitive epilepsy.
6. Horn Strobes are UL Listed for indoor use under Standard 1971 (Signaling Devices for the Hearing-Impaired) and Standard 1480 (Speaker Appliances). All inputs employ IN/OUT wiring terminals for fast installation using #12 to #18 AWG wiring.
7. All models shall have listed sound output of up to 87 dB at 10 feet and a listed frequency response of 400 to 4000 Hz. The speaker shall also incorporate a sealed back construction.
8. The horn and horn strobe appliances shall be designed for indoor flush mounting. The speaker and speaker strobe shall incorporate a speaker mounting plate with a Snap-On grille cover with no visible screws for a level, aesthetic finish and shall mount to standard electrical hardware. The finish of the Speakers and Speaker Strobes shall be red. All speaker and speaker strobe appliances shall be backward compatible.
9. When synchronization is required, the strobe portion of the appliance shall be compatible with sync modules or the Power Supplies with built-in Patented Sync Protocol. The strobes shall not drift out of synchronization at any time during operation. If the sync module or Power Supply fails to operate, (i.e., contacts remain closed), the strobe shall revert to a non-synchronized flash rate.

I. Weatherproof Horn

1. Weatherproof notification appliances shall be UL listed for outdoor use. The appliances shall be available for optional wall mounting or ceiling mounting to weatherproof backboxes using either exposed conduit, concealed conduit, or semi-flush mounting to a recessed electrical box in walls or ceilings using indicated manufacturer mounting accessories.
2. Wall-mount outdoor notification appliances can be used indoors or outdoors in wet or dry applications, and can provide reliable operation from -40°F to 151°F. These speakers provide a broad frequency response range, low harmonic distortion and maintain a high sound pressure level at all tap settings to provide accurate and intelligible broadcast of evacuation messages.
3. Field-selectable settings, including candela, speaker voltage and power settings, and automatic selection of 12- or 24-volt operation enable installers to easily adapt devices to meet requirements.
4. Weatherproof audibles shall be System sensor models or approved equals. The speaker devices shall be able to produce a continuous output or a temporal code-3 output that can be synchronized.
5. WP notification appliances shall be listed to Underwriters Laboratories Standard S4048 for outdoor fire protective signaling systems. Devices shall have a frequency range of 400 to 4,000 Hz and shall have an operating temperature from -40°F to 150.8°F and shall have power taps and wattage settings that are selected by rotary switches. The WP notification appliances must be installed with its weatherproof back box in order to remain outdoor approved per UL listing S4048 and shall be suitable for use in air handling spaces and wet environments.

J. Battery

1. The battery shall have sufficient capacity to power the fire alarm system for no less than twenty-four hours plus 15 minutes of alarm upon a normal AC power failure.
2. The batteries are to be completely maintenance free. No liquids are required. Fluid level checks for refilling, spills, and leakage shall not be required.

3. If necessary, to meet standby requirements, external battery and charger systems may be used.
- K. Addressable Manual Fire Alarm Box (manual station)
1. Addressable manual fire alarm boxes shall, on command from the control panel, send data to the panel representing the state of the manual switch and the addressable communication module status. They shall use a key operated test-reset lock and shall be designed so that after actual emergency operation, they cannot be restored to normal use except by the use of a key.
 2. All operated stations shall have a positive, visual indication of operation and utilize a key type reset.
 3. Manual fire alarm boxes shall be constructed of Lexan with clearly visible operating instructions provided on the cover. The word FIRE shall appear on the front of the stations in raised letters, 1.75 inches (44 mm) or larger.

PART 3 EXECUTION

3.1 COORDINATION

- A. Refer to the electrical and mechanical drawings and specifications to determine quantities and location of devices and required scope of work and coordinate work with mechanical and electrical installers. Provide function described under mechanical section Sequence of Control, for fire and/or emergency conditions. Submit proposed interconnection to elevator supplier. Submit conduit and pathing requirements to electrical installer. For self-contained door release, coordinate with door supplier.

3.2 GENERAL

- A. Comply with all applicable paragraphs in Section 26 05 00: Common Work Results for Electrical, apply as though repeated herein
- B. Install system(s) in accordance with manufacturer's instructions.
- C. Include services of certified technicians to supervise installation, provide adjustments, provide final connections, system testing and system training to Owner Representative

3.3 INSTALLATION

The complete system shall be installed by one (1) contractor and the installing contractor must be a certified dealer of the specified system. No subcontractors, to the awarded proposing contractor, will be allowed to install any portion of this system Including, but not limited to:

1. Wiring
 2. Field device installation
 3. System programming
 4. FACP installation
 5. Remote power supply installation
- A. The installing contractor shall install the network fire alarm system in as instructed by the manufacturer's instructions.
- B. Installation shall be in accordance with the CEC, NFPA 72, local and state codes, as shown on the drawings, and as recommended by the major equipment manufacturer.

- C. All conduit, junction boxes, conduit supports, and hangers shall be concealed in finished areas and may be exposed in unfinished areas. Smoke detectors shall not be installed prior to the system programming and test period. If construction is ongoing during this period, measures shall be taken to protect smoke detectors from contamination and physical damage.
- D. All fire detection and alarm system devices, control panels shall be flush mounted when located in finished areas and may be surface mounted when located in unfinished areas.
- E. Manual fire alarm boxes shall be suitable for surface mounting or semi-flush mounting as shown on the plans and shall be installed not less than 42 inches (1067 mm), nor more than 48 inches (122 mm) above the finished floor.
- F. The fire alarm control panel shall be connected to a separate dedicated branch circuit, maximum 20 amperes. This circuit shall be labeled at the main power distribution panel as FIRE ALARM. Fire alarm control panel primary power wiring shall be 12 AWG. The control panel cabinet shall be grounded securely to either a cold-water pipe or grounding rod. The control panel enclosure shall feature a quick removal chassis to facilitate rapid replacement of the FACP electronics.

3.4 GROUNDING

- A. All equipment to be grounded by means of green ground wire to "U" contact of duplex receptacles and bonded to ground provided under 26 05 26: Grounding and Bonding of Electrical Systems.

3.5 INSPECTION

- A. Systems to meet all the requirements of the CSFM and IOR and AHJ and shall be approved thereby before installation and prior to final acceptance.
- B. Closeouts:
 - 1. It is the intent of these specifications and of the architect/engineer that a continued program of system maintenance be continued by the owner in compliance with NFPA Standard 72H. It is mandatory that the installing contractor provide such services and make available these services to the owner upon completion of the project.
 - 2. As part of the closeout documents, fire alarm contractor will provide owner with AutoCAD as built drawings indicating locations of devices, routing of wiring, and panel information. All room numbers indicated on final close out documents and all panel settings shall be listed by actual building room numbers and not by room number indicated on construction documents. CAD files shall be AutoCAD 2004 or later. Provide the owner with one Mylar plot of each drawing and two blue line prints of each drawing. Provide the owner with electronic versions of the as-built CD's.
 - 3. Locate next to building FACP and other fire alarm panels.
 - 4. A building graphic shall be provided mounted in aluminum-extruded frame with plexi-glass front. Graphic shall locate all fire alarm devices, power supplies, and FACP.
 - 5. State FML-005 certificate shall also be framed and mounted near the fire alarm panel. Fire alarm panel shall have white FM required installation sticker attached to it.
- C. Graphic shall include actual room numbers posted as part of the building graphics package, include as part of substantial completion requirement

3.6 LOCATION

- A. Before installation, verify exact location of control equipment and outlets. The Owner reserves the right to relocate system components within a radius of 10' at no increase in cost before rough-in work is started for the respective component.

3.7 WIRING

- A. All fire alarm wiring shall be new.
- B. Furnish all conductors, equipment, terminal strips, etc., and labor to install a complete and operable system. All cable conductors shall be color coded and numbered for identification at all terminals. Green shall be for grounding conductor only. Use red insulation and or red jacketing on all fire alarm cable.
- C. All wiring shall be in accordance with NFPA 72, the California Electrical Code, Local Codes, and article 760 of NFPA Standard 70. All wiring sizes shall conform to recommendations of the equipment manufacturer, and as indicated on the engineered shop drawings.
- D. All wire shall be U.L. Listed FPL for limited energy (300V) and fire alarm applications and shall be installed in conduit. Limited energy FPLP or MPP wire may be run open in return air ceiling plenums provided such wire is U.L. Listed for such applications and is of the low smoke producing fluorocarbon type and complies with CEC Article 760 if so, approved by the local authority having jurisdiction.
- E. No A.C. wiring or any other wiring shall be run in the same conduit as fire alarm wiring.
- F. Wiring used for the multiplex communication circuit (SLC) shall be twisted and support a minimum wiring distance of 10,000 feet when sized at 12 AWG. The design of the system shall permit use of IDC and NAC wiring in the same conduit with the SLC communication circuit. Shielded wire shall not be required.
- G. The fire alarm control panel shall be capable of T-tapping NFPA Style 4 (Class B) Signaling Line Circuits (SLCs). Systems which do not allow or have restrictions in, for example, the number of T-taps, length of T-taps etc., is not acceptable.
- H. Contractor shall provide a service loop located above each device installed on the entire project. The service loop shall be a minimum of 5'.
- I. Contractor shall provide a service loop located above each type of panel installed. The service loop shall be a minimum of 10', but shall have enough length to allow for the panel to be relocated to any wall within the room that panel is located in.
- J. All service loops shall be installed in the accessible ceiling that is nearest to each device and panel. No service loops shall be installed in open spaces or non-accessible spaces

3.8 TERMINAL BOXES, JUNCTION BOXES AND CABINETS:

- A. All boxes and cabinets shall be UL listed for their use and purpose.

3.9 CONDUIT / RACEWAY:

- A. All wire shall be installed in an approved conduit/raceway system (except where permitted by NEC and the local authority having jurisdiction). Maximum conduit "fill" shall not exceed 40% per CEC.

- B. Conduit and raceway system shall be installed as specified under the general electrical section of the specifications, and per CEC, local, and state requirements.
- C. Minimum conduit size shall be 3/4" (19.1 mm). Install conduit per engineered shop drawings.
- D. Systems utilizing open wiring techniques with low smoke plenum cable shall provide conduit in all inaccessible locations, inside concealed walls, all mechanical/electrical rooms, or other areas where wiring might be exposed or subject to damage.
- E. All vertical wiring and all main trunk/riser wiring shall be installed in a complete raceway/conduit system. All riser boxes shall be adequately sized for the number of conductors traversing the respective box as well as the number of terminations required.
- F. Cable must be separated from any open conductors of power, or Class 1 circuits, and shall not be placed in any conduit, junction box or raceway containing these conductors, per CEC Article 760-29.
- G. Wiring for 24-volt DC control, alarm notification, emergency communication and similar power-limited auxiliary functions may be run in the same conduit as initiating and signaling line circuits. All circuits shall be provided with transient suppression devices and the system shall be designed to permit simultaneous operation of all circuits without interference or loss of signals.
- H. Conduit shall not enter the fire alarm control panel or any other remotely mounted control panel equipment or back boxes, except where conduit entry is specified by the FACP manufacturer.
- I. All wiring associated with smoke control system shall be installed in conduit per current adopted codes regardless of voltages or ratings.

3.10 TESTING

- A. After all equipment specified herein for each system has been installed and is in operating condition, conduct performance tests to determine if the installation and components comply with these specifications. Furnish competent personnel, all test material and approved test instruments and conduct the tests under supervision of factory personnel, in the presence of the Engineer, the building and fire inspecting agencies:
 - 1. The contractor's job foreman, in the presence of a representative of the manufacturer, a representative of the owner, and the fire department shall operate every installed device to verify proper operation and correct annunciation at the control panel.
 - 2. At least on half of all tests shall be performed on battery standby power.
 - 3. Where application of heat would destroy any detector, it may be manually activated.
 - 4. The signaling line circuits and notification appliance circuits shall be opened in at least two (2) locations to verify the presence of supervision.
 - 5. When the testing has been completed to the satisfaction of the contractor representative IOR, representatives of the manufacturer and owner, a notarized letter co-signed by each attesting to the satisfactory completion of said testing shall be forwarded to the owner and the authority having jurisdiction.
 - 6. The contractor shall leave the fire alarm system in proper working order, and, without additional expense to the owner, shall replace any defective materials or equipment provided by him under this contract within two years from the date of final acceptance by the awarding authority.
 - 7. The local responding fire department must be notified prior to the final test in accordance with local requirements and when requested, participate in system testing and evaluation.

3.11 WALK TEST

- A. Notify Owner, Architect and Engineer when system is 100 percent operational. Schedule walk-through of the entire facility and verify that each initiating and each indicating device is operating properly.
- B. Provide report at conclusion of walk through certifying all fire alarm devices are working.
- C. Walk test shall include a representative from owner maintenance department.
- D. Walk test to show in a printed report all AHU shutdown, strobes/horns, heat and smoke detectors. Report shall list all devices by approximate location to rooms, and device number.

3.12 SOFTWARE

- A. Installer shall provide a backup copy of the installed program database (on CD) upon completion of the project. They shall also provide the current version of system software, for the panel provided, on CD.

3.13 REPORT

- A. Prepare written report of final test results, signed by witnessing parties. Submit to the Engineer in triplicate for final approval.

END OF SECTION 28 31 00

SECTION 31 20 00

EARTHWORK

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. This Section includes the following:
 - 1. Excavating soil and other material for surface improvements.
 - 2. Placing fill.
 - 3. Compaction of existing ground and fill.
 - 4. Preparation of subgrade for other improvements.
 - 5. Grading of soil.
- B. RELATED SECTIONS
 - 1. Contract General Conditions and Division 1, General Requirements

1.3 REFERENCES

- A. ANSI/ASTM D1557 - Test Methods for Moisture-Density Relations of Soils and Soil Aggregate Mixtures Using 10 lb. (4.54 Kg) Rammer and 18-inch (457 mm) Drop.
- B. Standard Specifications for Public Works Construction (GREENBOOK), latest edition

1.4 DEFINITIONS

- A. Utility: Any buried or above ground pipe, conduit, cable, associate device or appurtenances, or substructure pertaining thereto.

1.5 SUBMITTALS

- A. Product Data:
 - 1. Information indicating the source of all import material, the fill material type and where it is to be used, and approval of the District's Inspector of Record for incorporation of import material into the Work.
- B. Material Test Reports:
 - 1. Classification of Soils.
 - 2. Compaction Characteristics of Soils.
 - 3. Density and Unit Weight of Soils in Place.
 - 4. Imported fill shall be tested and approved by the Owner's Geotechnical Engineer prior to import to the site, including testing for compliance with Department of Toxic Substances Control (DTSC) guidelines. Said testing and certification documents shall be paid for by the Owner.

- C. Project Closeout: In accordance with Specification Section PROJECT CLOSEOUT.
 - 1. Drawings indicating the extent and depth of all engineered fill, and over-excavation and re-compaction. This information shall be a part of the Project "As-Built" and Project "Record" Documents in accordance with the Specification Section PROJECT DOCUMENTS.

1.6 QUALITY ASSURANCE

- A. Certificates:
 - 1. Contractor's certification (on Contractor's letterhead paper) that the Earthwork materials and installation meet or exceed the requirements of this specification.
 - 2. If Fill (Soil or Aggregates) are brought onto site, vendor shall supply a Materials Report or Sieve Analysis of soil composition.
- B. Construction:
 - 1. Ensure all Subgrade preparation, relative compaction and subgrade tolerances comply with GREENBOOK Section 301.

1.7 COORDINATION

- A. Provide required notification to the Owner and Geotechnical Engineer or the Engineer of Record so that a representative from the Owner's Geotechnical Engineering consultant can be present for all excavation, filling and grading operations to test and observe earthwork construction.
- B. Verify that the location of existing utilities has been indicated at work site by utility authorities, by Owner, and as specified on the Plans.

1.8 EXISTING CONDITIONS

- A. Existing Conditions:
 - 1. Examine the site and verify conditions with the Drawings and Specifications. Contractor shall familiarize himself with the existing site conditions and any changes that have occurred at the site since the preparation of the contract documents and shall be responsible to account for any such changes in the price bid for this work.
 - 2. Thoroughly investigate and verify conditions under which the Work is to be performed.
 - 3. Locate and identify utilities:
 - a. Call DIG Alert – (800) 422-4133 or at 811 for the task of locating any applicable off-site and on-site utilities in the area where the Project is located.
 - 4. No allowance for Extra Work will be granted resulting from negligence or failure to meet the requirements of this Section.
- B. Determine exact location of existing buried utilities by:
 - 1. Marking on ground or pavement surface the alignment and extent of the facilities and the probable location of existing utilities using construction plans and existing surface features.
 - 2. Provide DIG Alert a minimum of two (2) working days' notice of request for locations and notify Owner of said request concurrently.
 - 3. Confirm exact location of existing utilities by hand methods of excavation, or by use of vacuum equipment.

1.9 PROJECT RECORD DOCUMENTS

- A. Submit under provisions of GENERAL CONDITIONS and DIVISION 1, GENERAL REQUIREMENTS.
- B. Accurately record actual locations of utilities encountered including depth and horizontal location, as measured from permanent site features.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Subgrade Compacted Fill for New Ramp and Footing: All subgrade material for compacted fill shall be Crushed Aggregate Base (CAB) complying with Greenbook Section 200-2.2. Ensure that material is properly compacted to a minimum relative compaction of 95 percent.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Verify site conditions are consistent with conditions indicated in the contract documents.

3.2 EXCAVATION

- A. Following clearing and stripping operations, excavate planned construction areas as specified in this Section.
- B. Soil disturbed by prior construction activities, undocumented fill deemed to possess inadequate compaction or uniformity, debris, and abandoned underground structures must be excavated to expose undisturbed native soil or suitable fill.
- C. Within the area of the planned improvements plus at least 5 feet horizontally beyond the perimeter of these improvements, the subgrade must be over-excavated at least 24 inches below the stripped, undisturbed soils, or to 12" below the bottom of footings, whichever is lower.
- D. Following over-excavation, the exposed ground surface must be reviewed by the Geotechnical Engineer to evaluate if loose soils or soft zones are present that require additional excavation. The exposed subgrade shall be proof rolled under the observation of the Geotechnical Engineer to detect soft or pliant areas. Soft or pliant areas must be over-excavated to firm native soil. The exposed surface shall be scarified to a minimum depth of 8-inches, uniformly moisture conditioned to 2 percent above optimum moisture, and compacted to 90% relative compaction.

3.3 FILLING AND COMPACTING

- A. Once clearing, stripping and over-excavation operations are complete, scarify the surface to receive fill material or improvements to a depth of 8-inches, moisture condition to at least 2% above optimum moisture content, and compact to a minimum of 90% of maximum dry density (relative compaction) based on ASTM Test Method 1557.
- B. The upper 12 inches of engineered fill placed as backfill under pavement sections shall be compacted to at least 95% of the maximum dry density.

- C. Upon approval, on-site soils may be suitable for re-use as Engineered Fill, providing they are cleansed of excessive organics (less than 3 percent by weight, ASTM D2974), debris, and fragments larger than three (3) inches in maximum dimension and meet the requirements of soil Type S4, Division 31 Specification Section SOIL MATERIALS.
- D. Engineered Fill shall be moisture conditioned to within 2% of optimum moisture, placed in uncompacted layers not exceeding eight (8) inches in thickness, and compacted as specified, based on ASTM Test Method D1557.
 - 1. Non-vegetative surface improvement areas (structures and site concrete improvements) - To a minimum of 90% of maximum dry density (relative compaction).
 - 2. Vegetative surface improvement areas (turf and planters) - Below top twelve (12) inches - to a minimum of 90% of maximum dry density (relative compaction). Top twelve (12) inches - 85% of maximum dry density (relative compaction).
 - 3. Pavement areas: to a minimum 95% of maximum dry density (relative compaction) in top twelve (12) inches.
- E. which will not disturb or damage existing utilities and other improvements.

3.4 PREPARATION OF SUBGRADE FOR SURFACE IMPROVEMENTS

- A. Where concrete, asphalt-concrete, aggregate base, or other non-vegetative surface improvements, or a layer of said surface improvements, are to be constructed on the soil surface, prepare the subgrade for said improvements in accordance with this section.
- B. Scarify the soil as specified and remove and dispose of (off the project site) all rocks, hardpan chunks or otherwise unsuitable material over 3-inches in size.
- C. Thoroughly moisture condition and compact as described above.

3.5 FIELD QUALITY CONTROL

- A. Compaction testing will be performed in accordance with ANSI/ASTM D1557.
- B. If tests indicate work does not meet specified requirements, recompact, or remove and replace, and retest.
- C. All retesting required because of failure of initial test will be performed by Owner's testing agency, at the expense of the Contractor.

3.6 PROTECTION

- A. Protect graded areas from traffic, freezing, erosion, and all other sources of damage. Keep free of debris and trash.
- B. Repair and re-establish grades to specified tolerances where completed or partially completed work becomes eroded, rutted, settled, or where it is damaged by subsequent construction operations or weather.
- C. Where settlement occurs prior to acceptance of the work, remove and replace surface improvements, excavate, replace, and re-compact in accordance with these specifications, and restore the surface improvements.

3.7 CLEANING

- A. Remove all surplus or unsatisfactory soil material, trash, and debris, and legally dispose of off of the Owner's property.

END OF SECTION 31 20 00

SECTION 31 23 33

TRENCH EXCAVATION AND BACKFILL

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. Excavating trenches, holes and pits for constructing the Work.
 - 2. Backfill and compaction.
 - 3. Providing suitable bedding and backfill material, as specified herein.
- B. RELATED SECTIONS
 - 1. Contract General Conditions and Division 1, General Requirements.
 - 2. Section 31 11 00 - Site Clearing
 - 3. Section 31 20 00 - Earthwork: Excavation, Filling and Grading
 - 4. Section 31 22 00 - Grading

1.3 REFERENCES

- A. ANSI/ASTM D1557 - Test Methods for Moisture-Density Relations of Soils and Soil-Aggregate Mixtures Using 10 lb. (4.54 Kg) Rammer and 18-inch (457 mm) Drop.

1.4 DEFINITIONS

- A. Utility: Any buried or above ground pipe, conduit, cable, associate devices or appurtenances, or substructure pertaining hereto.

1.5 QUALITY ASSURANCE

- A. Qualifications
 - 1. Installer:
 - a. Engage an experienced Installer who has successfully completed three (3) projects of similar scope and size to that indicated for this project within the past 5 years.
- B. Regulatory Requirements:
 - 1. In accordance with Specification Section REGULATORY REQUIREMENTS and the following:
 - a. CARB Materials and equipment used for this Project shall comply with the current applicable regulations of the California Air Resources Board [CARB].
 - b. EPA Environmental Protection Agency

- c. CAL/OSHA Comply with all provisions of the Construction Safety Regulations, General Safety Orders of the California Division of Occupational Safety and Health, as well as all other applicable regulations as they pertain to the protection of workers from the hazard of caving ground excavations.
- C. Certificates:
 - 1. Installer's certification that all trench backfill installation meets or exceeds the requirements of this specification.
 - 2. Contractor's certification (on Contractor's letterhead paper) that the trench backfill materials and installation meet or exceed the requirements of this specification.
- D. Meetings:
 - 1. Pre-Installation: Schedule prior to the start of work.
 - a. Coordinate the work with other work being performed.
 - b. Identify any potential problems, which may impede planned progress and proper installation of work regarding quality of installation and warranty requirements.
 - 2. Progress: Scheduled by the Contractor during the performance of the work.
 - a. Review for proper installation of work progress.
 - b. Identify any installation problems and acceptable corrective measures.
 - c. Identify any measures to maintain or regain project schedule if necessary.
 - 3. Completion: Scheduled by the Contractor upon proper completion of the work.
 - a. Inspect and identify any problems which may impede the issuance of warranties or guaranties.
 - 4. Maintain installed work until the Notice of Substantial Completion has been filed.

1.6 COORDINATION

- A. Coordinate work with Owner's personnel.
- B. Verify that the locations of existing utilities have been indicated at work site by utility authorities.

1.7 EXISTING UTILITIES

- A. Where subsurface work involves more than the normal depth of excavation required for the removal and/or construction of surface improvements (surface improvements such as concrete work, paving, landscaping, signs, etc.), the Engineer will have made a diligent attempt to indicate on the plans the location of all main and trunkline utility facilities which may affect the Work. In many cases, however, the only available information relative to the existing location of said facilities may have been small scale unidimensional plats. The locations of said facilities, therefore, shall be considered approximate only, until exposed by the Contractor.
- B. Determine exact location of existing buried utilities by:
 - 1. Marking on ground or pavement surface the alignment and extent of the proposed facilities and the probable location of existing utilities using construction plans and existing surface features.
 - 2. Call DIG Alert – (800) 422-4133 or at 811 prior to any digging or trenching activities.
 - 3. Locate exact location of existing utilities by hand methods of excavation, or by use of vacuum equipment.

- C. At proposed work location, expose by hand methods (or vacuum equipment) all existing utilities along the route of the proposed work prior to using any mechanical equipment. If mechanical equipment is allowed at a particular location, it may only be used after the completion by the Contractor of a successful exhaustive search by hand (or vacuum equipment) methods to locate all existing facilities as indicated on the plans, and/or as indicated on the ground by USA or Owner's personnel.
- D. Provide Field Engineering by Contract General Conditions and Division 1 to record the location of all utilities encountered. Where locational conflicts exist between existing utilities and the planned location of facilities to be constructed under the Contract, submit detailed information to the Owner's Inspector and Engineer for review and direction.
- E. Maintain all existing utility mains and service lines in constant service during construction of the Work.
- F. Where service disruptions are allowed; minimize the length of such disruptions by proper scheduling and diligent pursuit of the work.

PART 2 - PRODUCTS

2.1 FILL MATERIALS

- A. Fill Type S1, S2, S4 and S5, as specified in Division 31 Specification Section SOIL MATERIALS.

2.2 WARNING TAPE

- A. 6" wide warning tape shall be installed over all the pipelines as shown on the details.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Protect plant life, lawns, trees, shrubs, and other features not authorized for removal.
- B. Protect existing structures, fences, sidewalks, curbs, and other improvements from excavation equipment and vehicular traffic.
- C. Maintain and protect above and below grade utilities which are to remain.
- D. Comply with all provisions of the Construction Safety Orders and General Safety Orders of the California Division of Industrial Safety, as well as all other applicable regulations as they pertain to the protection of workers from the hazard of caving ground in excavations.

3.2 EXCAVATION

- A. Excavating soil required to locate existing utilities and install the work.
- B. Use hand methods of excavation to locate existing utilities, and to excavate trenches, pits and holes in congested areas.

- C. Employ equipment and methods appropriate to the work site. Small mechanical excavators may be used only in areas where there is sufficient space so as not to damage adjacent improvements, and where the locations of all existing utilities have been determined by hand methods of excavating.
- D. Cut trenches just wide enough to enable installation and proper bedding and backfill, and to allow inspection.
- E. Do not interfere with 45 degree (1:1) bearing splay of foundations.
- F. Hand trim excavation. Hand trim for bell and spigot pipe joints. Remove loose material.
- G. Excavate trenches, pits or holes bottoming in hardpan to a minimum of 6 inches below the grade for the bottom of the pipe and any couplings, and then backfill to the pipe grade with Type S2 or S5 material, containing sufficient moisture to allow compaction to 90% maximum dry density (relative compaction). Soil Type S2 shall meet requirements of Type S5. No additional payment will be made for such over-excavation and refill.
- H. In all trenches or excavation sites where a firm foundation is not encountered, such as soft, spongy, or otherwise unsuitable material, remove the material to a minimum of 12 inches, or to a depth determined by the Engineer, below the bottom of the proposed pipe or structure, and backfill the space with Type S2 or S5 material containing sufficient moisture to allow compaction to 90% maximum dry density (relative compaction). Soil Type S2 shall meet requirements of Type S5. No additional payment will be made for such additional excavation or backfill.
- I. Excavate trenches to provide the design grade of the facility, or as directed by the Engineer.
- J. Stockpile excavated material to be returned to trench adjacent thereto in location which will not be detrimental to existing improvements, or pedestrian or vehicular traffic. Remove from site all unsuitable or excess material not to be used.
- K. When excavating through tree roots, perform work by hand and cut roots, where authorized, with a saw.
- L. Upon Owner's approval, stockpile excess soil not used for backfilling at an on-site location designated by the Owner. Obtain a disposal site off the Owner's property and legally dispose of said excess material, all at no additional cost to the Owner.
- M. If water is encountered during excavations, provide all dewatering measures necessary to construct improvements shown.
- N. Contractor shall make all provisions necessary, including but not limited to, shoring or sloping back trench walls as required to address sandy soils. The cost of these provisions shall be included in the lump sum amount bid for this work and no separate payment will be made therefore.

3.3 PROTECTION OF EXCAVATIONS

- A. Provide all shoring and bracing as required and those codified in local, state and federal safety regulations.
- B. Prevent water, caving or sloughing ground from entering excavations.
- C. Maintain excavations free of water.

3.4 BACKFILLING

- A. Provide type S2 or S5 pipe bedding as required by Plans and compact to 90% maximum dry density (relative compaction). Soil Type S2 shall meet requirements of Type S5.
- B. After installation of pipes and appurtenances and placement of pipe bedding material, backfill trenches and excavations to finished grade, or subgrade in areas to receive surface improvements.
- C. Backfill trenches above pipe bedding material and to within 24 inches of finish subgrade with Type S1, S2, S4, or S5 soils, except that that top 12 inches shall be type S2, S3, S4, or S5 soils.
- D. Employ a placement method that does not disturb or damage existing or proposed pipes or other Utilities or Improvements.
- E. Place and compact all soil backfill in continuous layers not exceeding 8 inches in loose uncompacted thickness, moisture condition to at least 2% above optimum moisture content.
- F. Maintain optimum moisture content of fill materials to attain required compaction.
- G. Backfill final 12-inch thickness to finish subgrade in areas to receive concrete, asphalt-concrete, aggregate base, or other non-vegetative surface improvement, with Type S2, S4, or S5 soils.
- H. Backfill final 12-inch thickness to finish subgrade in areas to receive sod, other vegetation, or bare soil, with Type S2 or S3 soils.
- I. Compact backfill below the top 12-inches to 90% maximum dry density (relative compaction).
- J. In areas to receive buildings, structures, or concrete flatwork, compact the top 12-inches to 90% maximum dry density (relative compaction).
- K. In areas to receive asphalt concrete pavement or concrete pavement subject to vehicular traffic, compact the top 12-inches to 95% maximum dry density (relative compaction).
- L. In planting areas, compact the top 12-inches to 85% maximum dry density (relative compaction).

3.5 TOLERANCES

- A. Top Surface of Backfill under Paved or Concrete Areas: Plus or minus 0.02 feet from required elevations.
- B. Top Surface of General Backfilling: As required for finish surface to match adjacent improvements or ground.

3.6 FIELD QUALITY CONTROL

- A. Field inspection and testing will be performed under provisions of General Conditions and/or Division 1.
- B. Compaction testing will be performed in accordance with ANSI/ASTM D1557.

- C. If tests indicate work does not meet specified requirements, recompact, and retest. Retests required due to failure of initial tests shall be paid for by the Contractor.

3.7 PROGRESS AND PROSECUTION

- A. Backfill any excavation opened in any day on that same day.

END OF SECTION 31 23 33

SECTION 32 11 23

AGGREGATE BASE

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Material requirements and construction methods for placing aggregate base.

1.2 RELATED REQUIREMENTS

- A. Section 31 20 00 - Earthwork
- B. Section 32 13 13 – Site Concrete Improvements

1.3 REFERENCE STANDARDS

- A. ASTM D1557 - Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/ft³ (2,700 kN-m/m³)); 2012 (Reapproved 2021).
- B. California Test Method 301 – Method of Test for Determining the Resistance R Value of Treated and Untreated Bases, Subbases, and Basement Soils by Stabilometer
- C. California Test Method 217 – Method of Test for Sand Equivalent
- D. ASTM C127 – Standard Test Method for Relative Density (Specific Gravity) and Absorption of Coarse Aggregate

1.4 SUBMITTALS

- A. Materials Test Report or Sieve Analysis of materials being delivered to site
- B. Samples: 10 lb. (4.5 kg) sample of each type of aggregate; submit in air-tight containers to testing laboratory.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. When necessary, store materials on site in advance of need.
- B. When aggregate materials need to be stored on site, locate where directed by Owner.
- C. Aggregate Storage, General:
 - 1. Separate differing materials with dividers or stockpile separately to prevent intermixing.
 - 2. Prevent contamination.

PART 2 PRODUCTS

2.1 MATERIALS

- A. Aggregate Base materials used for this project shall comply with Standard Specifications of Public Works Construction (GREENBOOK) Section 200-2.2 'Crushed Aggregate Base'

PART 3 EXECUTION

3.1 EXAMINATION

- A. Verify that survey benchmarks and intended elevations for the work are as indicated.
- B. Verify substrate has been inspected, gradients and elevations are correct and is dry.

3.2 PREPARATION

- A. Correct irregularities in substrate gradient and elevation by scarifying, reshaping, and re-compacting.
- B. Do not place aggregate on soft, muddy, or frozen surfaces.

3.3 INSTALLATION

- A. Spread aggregate over prepared substrate to a total compacted thickness of 4 inches.
- B. Under New Site concrete
 - 1. Place coarse aggregate to a total compacted thickness of 4 inches.
 - 2. Compact to 95 percent of maximum dry density.
- C. Place aggregate in maximum 4-inch (100 mm) layers and roller compact to specified density.
- D. Level and contour surfaces to elevations and gradients indicated.
- E. Add small quantities of fine aggregate to coarse aggregate as appropriate to assist compaction.

3.4 TOLERANCES

- A. Flatness: Maximum variation of 1/4 inch (6.4 mm) measured with 10 foot (3 m) straight edge.
- B. Scheduled Compacted Thickness: Within 1/4 inch (6.4 mm).

3.5 FIELD QUALITY CONTROL

- A. Compaction density testing will be performed on compacted aggregate base course in accordance with ASTM D1556, ASTM D2167, or ASTM D6938.
- B. Results will be evaluated in relation to compaction curve determined by testing uncompacted material in accordance with AASHTO T 180, ASTM D698 ("standard Proctor"), or ASTM D1557 ("modified Proctor").

SECTION 32 13 13

SITE CONCRETE IMPROVEMENTS

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. This Section includes the following:
 - 1. All material, labor, equipment and services necessary to completely install exterior Portland cement flatwork, cast-in-place concrete, and architectural flatwork concrete, accessories and other related items, slabs, ramps and sidewalks and walkways, curb and gutter, mow strips, and other miscellaneous concrete items of the form and dimensions shown on the plans and necessary to complete the project, and in accordance with the requirements of the Standard Specifications as modified and supplemented by these Special Provisions
 - 2. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division-1 Specifications sections, apply to the work of this section.
- B. RELATED SECTIONS:
 - 1. Section 312000 - Earthwork
 - 2. Section 321123 - Aggregate Base

1.3 REFERENCES

- A. Standard Specifications for Public Works Construction (GREENBOOK)
- B. ACI standards, including but not limited to #304, 305, 306, 308, 309 and 347.
- C. ASTM standards, including but not limited to #C-33, C-39, C-94, C-136, C-143, C-150, and C-309.

1.4 SUBMITTALS

- A. Submit under provisions of Specification Section SUBMITTALS.
 - 1. Concrete Mix Design
 - 2. Load tags for delivered material.
 - 3. Compressive strength testing as required by the approving agency.
 - 4. Application instructions for the architectural materials.
 - 5. Accessories and manufacturer's installation specifications.

1.5 QUALITY ASSURANCE

- A. Furnish concrete materials conforming with GREENBOOK Sections 200 and 201.
- B. Perform work in accordance with GREENBOOK Section 303.

PART 2 - PRODUCTS

2.1 MIXES

- A. Submit a mix design that conforms to GREENBOOK Section 201-1.3.2 Mix Design and identifies the concrete class as shown in Table 201-1.3.3.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Subgrade shall conform to the requirements of Division 31 Specification Section EARTHWORK: EXCAVATION, FILLING AND GRADING. The District may elect to verify compacted subgrade elevations by measurement made from adjacent existing improvements or by a template supported by forms.

3.2 GENERAL CONCRETE

- A. Concrete placement shall conform to the applicable requirements of Standard Specification Sections 51 and 90. Concrete shall not be placed when the air temperature in the shade at the project site exceeds 95° F or is below 45° F, or when the temperature of the concrete exceeds 85° F.
- B. After the concrete has been placed, it shall be struck off to proper section and compacted with a grid of parallel metal bars until a layer of mortar not less than 3/8 inch thick has been brought to the surface. All exposed concrete surfaces shall receive a medium broom finish applied transversely to the line of pedestrian traffic or to the longest dimension of the concrete, as applicable.
- C. General concrete surfaces shall be cured by the curing compound method and shall be protected in accordance with the provisions of Subsections 90-1 and 90-2 of the Standard Specifications.

3.3 PROTECTION OF CONCRETE

- A. The Contractor shall be responsible for the condition of all concrete work until such time as all work has been completed and is accepted by the District. The Contractor shall limit vehicular travel across concrete until such time as the concrete has achieved sufficient strength that it can support traffic without damage. In no case, however, will vehicles be allowed to travel across new concrete improvements until seven calendar days have passed since the concrete was placed.

3.4 CONCRETE JOINTS

- A. Expansion joints and weakened plane joints shall be constructed at the locations shown on the plans or as directed by the Engineer. Where joint locations are not specified on the plans, expansion joints shall be constructed at maximum intervals not exceeding 30 feet, and weakened plane joints shall be constructed at maximum intervals of 10 feet.
- B. Expansion joints shall be considered as weakened plane joints for the purpose of spacing weakened plane joints. Expansion joints shall be tooled with a 1/4-inch maximum radius edger, and shall be filled with 3/8 inch pre-formed expansion joint filler.

3.5 CONCRETE FINISHES

- A. Where concrete is being installed adjacent to or near existing concrete improvements, match the finish of similar concrete surfaces (i.e. new sidewalks shall match existing sidewalks, new curbs shall match existing curbs, etc.).

- B. Sidewalks and Mow strips: Medium sweat finish or medium broom finish perpendicular to the direction of travel.
- C. Curbs: Trowel smooth and finish with a light brush.
- D. Gutters: Medium broom finish parallel with curb or direction of flow.
- E. Drive approaches and wheelchair ramps: medium broom finish, perpendicular to the direction of travel.

3.6 INSTALLATION OF ACCESSORIES

- A. Strictly comply with the manufacturer's instructions and recommendations and approved details. Securely anchor work to substrate.

3.7 REPAIR AND CLEAN-UP

- A. Contractor shall legally remove all trash, debris, containers and excess materials from the site on a periodic basis and shall keep the work broom clean until Owner's acceptance.
- B. The Contractor shall be held responsible for the repair and/or replacement of new or existing improvements damaged as a result of this work to the satisfaction of the Owner.
- C. The Contractor shall provide roll-off bins for wash-out of ready-mix concrete trucks and pumper. Do not allow concrete debris or cement water onto soils scheduled for landscape planting.

END OF SECTION 32 13 13

SECTION 32 31 13

CHAIN LINK FENCES AND GATES

1. PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Fence framework, fabric, and accessories.
- B. Excavation for post bases.
- C. Concrete anchorage for posts and center drop for gates.
- D. 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.

B. Fences, Gates and Hardware:

1. Gates that are part of the accessible route shall meet all the requirements of an accessible door in compliance with CBC Section 11B-404.
2. The levers of lever actuated latches or locks for accessible gates shall be curved with a return to within ½" of the gate surfaces to prevent catching on the clothing or persons. California Referenced Standards Code. T-24 Part 12, Section 12-10-202, Item (F).
3. Swing doors and gate surfaces within 10" of the finish floor or ground shall have a smooth surface on the push side extending the full width of the door or gate. Parts creating horizontal or vertical joints in these surfaces shall be within 1/16" of the same plane as the other and be free of sharp or abrasive edges. Cavities created by added kick plates shall be capped. CBC Section 11B-404.2.10.

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 each 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 F668, Class 2b, PVC coated.

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:
 - (a) Mortise lock keyed 2 sides: Schlage Commercial Latch L9010, www.schlage.com or Sargent Lock No. 8126, www.sargentlock.com.
 - (b) Cylinder lock keyed 2 sides: Schlage Commercial Latch No. L9066, www.schlage.com.
 - (c) Paddle exit device: Adams Rite No. 4710 with paddle assembly No. 4590. www.adamsrite.com.
 - (d) Panic bar exit device: Von Duprin AX-PA-99L x 996-03 626, www.vonduprin.com. Rim cylinder 20-057-ICX 626 with permanent core 23-030-626, www.schlage.com.
 - (e) Kickplate: Commercial quality cold rolled steel conforming to ASTM A653 galvanized to G60 coating class according to ASTM A924 with minimized spangle, mill phosphatized, 0.067 inch thick, with all exposed edges hemmed. Finish to match fencing.
 - (f) Security Screen: Perforated commercial quality cold rolled steel conforming to ASTM A653 galvanized to G60 coating according to ASTM A924 with minimized spangle, mill phosphate, 0.067 inch thick, 1 / 4 inch diameter holes on 3 / 8 inch staggered centers, 40 percent open. All exposed edges hemmed. Finish to match fencing.
 - (g) Substitutions: Under provisions of Section 01 25 13.
- 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. Aluminum Coating: ASTM A428; 0.40 oz/sq ft.
- C. Vinyl Coating: ASTM F668, Class 2b PVC coating Black color on galvanized coating.
- D. 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.
- P. Install accessible gate hardware in accordance with Section 08 71 00] [at 3'-4" to centerline of hand activated operable gate opening hardware.
- Q. Install 10 inch high smooth metal kickplate on each side of accessible gate. Mount 2 inches above finished grade.
- R. Install security screening on accessible gate and on each side of accessible gate a minimum of 4 feet from both hinge and strike sides of gate. Attach screen to fence and gate posts with flat head self-tapping sheet metal screws at maximum 12 inches on center to match hole spacing.

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