PROJECT MANUAL

FOR

Las Positas Temporary Faculty Village Modular Offices

Livermore, California

LPAS Project No: 863-0005

For Constructon

08.28.2020

IDENTIFICATION STAMP
DIV. OF THE STATE ARCHITECT
APP: 01-119031 INC:
REVIEWED FOR
SS ☑ FLS ☑ ACS ☑
DATE: 10/22/2020

LPAS
Architecture + Design

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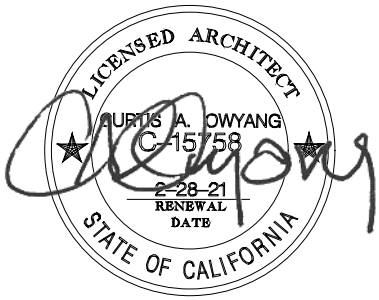
DOCUMENT 000107.10

SEALS PAGE - ARCHITECT

PART 1 - GENERAL

1.1 DESIGN PROFESSIONALS OF RECORD

Architect:



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DOCUMENT 000107.30

SEALS PAGE - STRUCTURAL ENGINEER

PART 1 - GENERAL

1.1 DESIGN PROFESSIONALS OF RECORD

Structural Engineer:

END OF DOCUMENT 000107.30

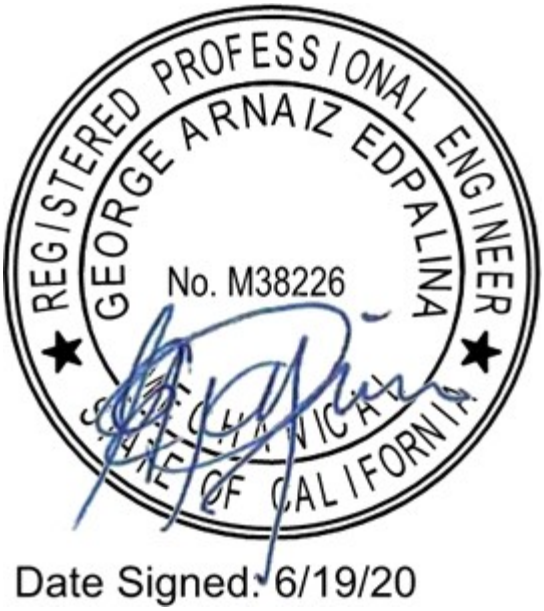
DOCUMENT 000107.50

SEALS PAGE - MECHANICAL ENGINEER

PART 1 - GENERAL

1.1 DESIGN PROFESSIONALS OF RECORD

Mechanical Engineer:



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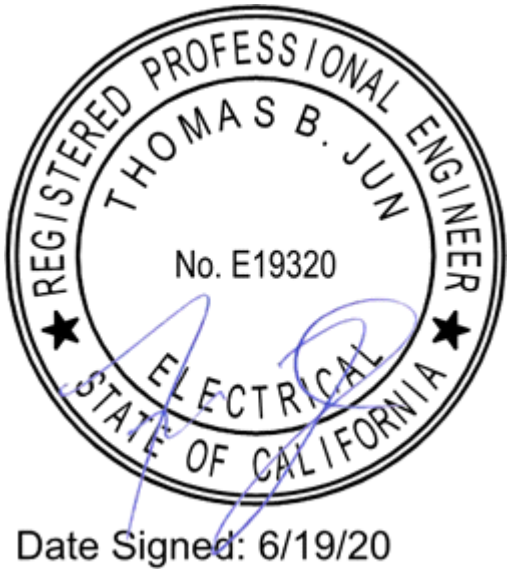
SEALS PAGE - ELECTRICAL ENGINEER

PART 1 - GENERAL

1.1 DESIGN PROFESSIONALS OF RECORD

Electrical Engineer:



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DOCUMENT 000107.80

SEALS PAGE - LANDSCAPE ARCHITECT

PART 1 - GENERAL

1.1 DESIGN PROFESSIONALS OF RECORD

Landscape Architect:

END OF DOCUMENT 000107.80

SECTION 00 0110

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NOT USED

DIVISION 22 - PLUMBING

DIVISION 23 - HEATING, VENTILATING, AND AIR CONDITIONING (HVAC)

NOT USED

DIVISION 25 - INTEGRATED AUTOMATION

NOT USED

DIVISION 26 - ELECTRICAL

DIVISION 27 - COMMUNICATIONS

DIVISION 41 - MATERIAL PROCESSING AND HANDLING EQUIPMENT
NOT USED

DIVISION 42 - PROCESS HEATING, COOLING, AND DRYING EQUIPMENT
NOT USED

DIVISION 43 - PROCESS GAS AND LIQUID HANDLING, PURIFICATION, AND STORAGE EQUIPMENT
NOT USED

DIVISION 44 - POLLUTION AND WASTE CONTROL EQUIPMENT
NOT USED

DIVISION 45 - INDUSTRY-SPECIFIC MANUFACTURING EQUIPMENT
NOT USED

DIVISION 46 - WATER AND WASTEWATER EQUIPMENT
NOT USED

DIVISION 48 - ELECTRICAL POWER GENERATION
NOT USED

APPENDIX
A0 Georgia Pacific - Plytanium T1-11

END OF SECTION 00 0110

SECTION 01 1000

SUMMARY

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. Section Includes:

1. Project information.
2. Work covered by Contract Documents.
3. Owner-furnished products.
4. Contractor-furnished, Owner-installed products.
5. Access to site.
6. Coordination with occupants.
7. Work restrictions.
8. Tobacco and other controlled substances restrictions.
9. Security.

1.3 PROJECT INFORMATION

A. Project Identification: Las Positas Temporary Faculty Village Modular Offices.

1. Project Location: Las Positas College, Livermore, California.

B. Owner: Chabot-Las Positas Community College District.

1. Owner's Representative: Ann Kroll.

C. Architect: LPAS Architecture + Design.

D. Construction Manager: Critical Solutions.

1. Contact: Diane Hardy.
2. Construction Manager has been engaged for this Project to serve as an advisor to Owner and to provide assistance in administering the Contract for construction between Owner and Contractor, according to a separate contract between Owner and Construction Manager.

E. Web-Based Project Software: Project software administered by Contractor will be used for purposes of managing communication and documents during the construction stage.

1.4 WORK COVERED BY CONTRACT DOCUMENTS

A. The Work of Project is defined by the Contract Documents and consists of the following:

1.

B. Type of Contract:

1. Project will be constructed under a single prime contract.

1.5 OWNER-FURNISHED PRODUCTS

A. Owner reserves the right to furnish products for the Project. Owner and Contractor will coordinate responsible party for receiving, unloading, handling, storing, protecting, and installing Owner-furnished products and making building services connections.

1.6 CONTRACTOR-FURNISHED, OWNER-INSTALLED PRODUCTS

A. Owner reserves the right to install products furnished by the Contractor. Owner and Contractor will coordinate responsible party for unloading, handling, storing, and protecting Contractor-furnished products as directed and turning them over to Owner.

1.7 ACCESS TO SITE

A. General: Contractor shall have limited use of Project site for construction operations as indicated on Drawings by the Contract limits and as indicated by requirements of this Section.

B. Use of Site: Limit use of Project site to Work in areas indicated. Do not disturb portions of Project site beyond areas in which the Work is indicated.

1. Driveways, Walkways and Entrances: Keep driveways loading areas, and entrances serving premises clear and available to Owner, Owner's employees, and emergency vehicles at all times. Do not use these areas for parking or for storage of materials.

a. Schedule deliveries to minimize use of driveways and entrances by construction operations.
b. Schedule deliveries to minimize space and time requirements for storage of materials and equipment on-site.

C. Condition of Existing Building: Maintain portions of existing building affected by construction operations in a weathertight condition throughout construction period. Repair damage caused by construction operations.

D. Condition of Existing Grounds: Maintain portions of existing grounds, landscaping, and hardscaping affected by construction operations throughout construction period. Repair damage caused by construction operations.

1.8 COORDINATION WITH OCCUPANTS

A. Partial Owner Occupancy: Owner will occupy the premises during entire construction period, with the exception of areas under construction. Cooperate with Owner during construction operations to minimize conflicts and facilitate Owner usage. Perform the Work so as not to interfere with Owner's operations. Maintain existing exits unless otherwise indicated.

1. Maintain access to existing walkways, corridors, and other adjacent occupied or used facilities. Do not close or obstruct walkways, corridors, or other occupied or used facilities without written permission from Owner and authorities having jurisdiction.
2. Provide not less than 72 hours' notice to Owner of activities that will affect Owner's operations.

B. Owner Limited Occupancy of Completed Areas of Construction: Owner reserves the right to occupy and to place and install equipment in completed portions of the Work, prior to Substantial Completion of the Work, provided such occupancy does not interfere with completion of the Work. Such placement of equipment and limited occupancy shall not constitute acceptance of the total Work.

1. Architect will prepare a Certificate of Substantial Completion for each specific portion of the Work to be occupied prior to Owner acceptance of the completed Work.
2. Obtain a Certificate of Occupancy from authorities having jurisdiction before limited Owner occupancy.
3. Before limited 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 Work.
4. On occupancy, Owner will assume responsibility for maintenance and custodial service for occupied portions of Work.

1.9 WORK RESTRICTIONS

A. Work Restrictions, General: Comply with restrictions on construction operations.

1. Comply with limitations on use of public streets and with other requirements of authorities having jurisdiction.

B. On-Site Work Hours: Limit work in the existing building to normal business working hours of 7:00 a.m. to 5:00 p.m., Monday through Friday, unless otherwise indicated.

1. Confirm alternate hours with Owner, and if necessary, authorities having jurisdiction.

C. Existing Utility Interruptions: Do not interrupt utilities serving facilities occupied by Owner or others unless permitted under the following conditions and then only after providing temporary utility services according to requirements indicated:

1. Notify Construction Manager not less than two days in advance of proposed utility interruptions.
2. Obtain Construction Manager's written permission before proceeding with utility interruptions.

D. Noise, Vibration, and Odors: Coordinate operations that may result in high levels of noise and vibration, odors, or other disruption to Owner occupancy with Owner.

1. Notify Construction Manager not less than two days in advance of proposed disruptive operations.
2. Obtain Construction Manager's written permission before proceeding with disruptive operations.

1.10 TOBACCO AND OTHER CONTROLLED SUBSTANCES RESTRICTIONS

A. Comply with the requirements of CALGreen 5.504.7, or local code, whichever is more stringent.

1. Smoking is prohibited within the building, and within 25 feet of:

a. Building entries.
b. Outdoor air intakes.
c. Operable windows.

B. Smoking is prohibited on campus.

C. Other Controlled Substances: Use of other controlled substances within the Project site is not permitted.

1.11 SECURITY

A. Employee Identification: Provide identification tags for Contractor personnel working on Project site. Require personnel to use identification tags at all times.

B. Employee Screening: Comply with Owner's requirements for drug and background screening of Contractor personnel working on Project site.

1. Maintain list of approved screened personnel with Owner's representative.

PART 2 - PRODUCTS

NOT USED

PART 3 - EXECUTION

NOT USED

END OF SECTION 01 1000

SECTION 01 1000

SUMMARY OF WORK

PART 1 - GENERAL

1.1 SUMMARY

A. This section includes summary of work including:

1. Work covered by Contract Documents
2. Bid items, Allowances and Alternates
3. Work under other contracts
4. Future work
5. Work sequence
6. Cooperation of contractor and coordination with other work
7. Maintenance
8. Occupancy requirements
9. Reference Standards
10. Products ordered in advance
11. CLPCCD furnished products

1.2 WORK COVERED BY CONTRACT DOCUMENTS

A. THE PROJECT WORK WILL BE PERFORMED BY TWO CONTRACTORS. THERE WILL BE A SITE CONTRACTOR AND A MODULAR CONTRACTOR. THE PROJECT IS NOT BEING SUBMITTED IN INCREMENTS.

B. SITE WORK:

C. AN EXISTING PARKING LOT IS BEING CONVERTED INTO A VILLAGE TO HOUSE TEMPORARY FACULTY FACILITIES. SITE WORK INCLUDES DEMOLITION TO SUPPORT NEW CONSTRUCTION OF UTILTIES. A RAISED COVERED WALKWAY WILL CONNECT ENTRY DOORS FOR ALL MODULAR BUILDINGS. FIRE SPRINKLERS ARE NOT REQUIRED. NEW ASPHALT IS PROVIDED IN SPECIFIC AREAS TO ACCOMPLISH AN ACCESSIBLE PATHWAY, AND TO PROVIDE LEVEL SETTING FOR MODULAR BUILDINGS. LANDSCAPE IS LIMITED TO TREES LOCATED ABOVE-GRADE IN BOXES AND EXTENSION OF IRRIGATION. EXISTING UTILITIES TO REMAIN SHALL BE PROTECTED IN-PLACE INCLUDING ELECTRICAL POLE LIGHTS AND PARKING TICKET DISPENSERS. LIMITED WORK INSIDE MODULARS INCLUDES PULLING WIRING AND INSTALLATION OF FACE PLATE/DEVICES FOR LOW VOLTAGE DATA AND FIRE ALARM. PLUMBING AND ELECTRICAL CONNECTIONS TO THE MODULAR BUILDING WILL BE PROVIDED BY THE SITE CONTRACTOR. THESE DRAWINGS ARE FOUND IN VOLUME 1.

D. MODULAR CONSTRUCTION WORK:

E. 8 MODULAR BUILDINGS WILL BE LEASED BY LAS POSITAS COLLEGE FOR NO MORE THAN THREE YEARS. THESE MODULARS WILL PROVIDE TEMPORARY FACULTY FACILITIES DURING THE DEMOLITION AND CONSTRUCTION OF NEW FACILITIES. MODULAR SCOPE OF WORK INCLUDES FACULTY OFFICES, MEETING ROOMS, BREAK ROOM AND RESTROOMS. MODULAR MANUFACTURER TO PROVIDE WALKWAYS FROM EXITS AT THE BACK OF THE MODULAR BUILDINGS. THESE DRAWINGS ARE FOUND IN VOLUME 2.The work shall include all work shown and specified except for work indicated "N.I.C" or "Not in Contract".

F. During construction, all existing buildings will remain in service and be occupied during normal campus hours as this campus will remain active throughout the entire project. The contractor may perform up to 60% of work during "off-hours" in order to avoid interfering with instruction. No work is to take place in any classrooms while they are in use.

G. The Contractor must maintain access to the existing buildings at all times during the project. The contractor is to provide secure fencing and/or barricades to keep the general public from entering exterior work areas. Fencing is required to have a privacy screen. Work hours for this project shall be 60% off-hours. While work can take place in unoccupied rooms during the day, many classrooms remain in use until 10:00 p.m.

H. Unless provided otherwise in the Contract Documents, all risk of loss of Work covered by the Contract Documents shall rest with the Contractor until Final Completion and Acceptance of the Work.

1.3 BID ITEMS

A. Base Bid- Furnish and install all work shown on Drawings and described in Specifications and all other Contract Documents, including connections to existing systems for a complete and operation product. Dispose and replace existing horn/strobes with new evacuation speaker/strobe system.

B. Allowance- An Owner's unspecified allowance is as noted in Paragraph 1.1 of the Bid Proposal.

1.4 WORK UNDER OTHER CONTRACTS

Not Applicable

1.5 FUTURE WORK

Not Applicable.

1.6 WORK SEQUENCE

A. The contractor shall coordinate their work with the Construction Manager. Work will be performed on an active college campus. Campus buildings are generally in use from 7:30AM to 10:00PM Monday through Friday. Contractor shall presume interior work in classrooms must be performed at times other than when a campus building is in use. Exterior work can occur during normal working hours.

1.7 COOPERATION OF CONTRACTOR AND COORDINATION WITH OTHER WORK.

A. Should construction work, or work of any other nature, be underway by other forces or by other contractors within or adjacent to the limits of the Work at the time the Work was advertised for bids, the Contractor shall cooperate with all such other contractors or forces to the end that any delay or hindrance to their work will be avoided. The cost of such cooperation will be considered as included in the prices bid and no direct or additional payment will be made therefore. Contractor shall coordinate with such other contractors and forces as required by General Conditions.

B. CLPCCD reserves the right to perform other or additional work, within or adjacent to the limits of the work specified, at any time by the use of other forces. Contractor shall coordinate with CLPCCD and any CLPCCD forces, or other forces, engaged by CLPCCD, as required by General Conditions. In the event that the performance of such other or additional work materially increases or decreases Contractor's costs, the work and the amount to be paid therefore will be appropriately adjusted as determined by the Construction Manager.

C. Limit use of the Site for Work and for construction operations to allow for:

1. CLPCCD operation
2. Work by other contractors and tenants

D. Coordinate use of the Site and access to site with other contractors, utilities, and CLPCCD forces, as required by General Conditions. Construction Manager has final authority over coordination, use of the Site, and access to site.

E. Cooperate with CLPCCD and others who may occupy and begin work on site and inside building prior to completion of Work of this Contract.

F. Cooperate with contractors for other area work, not included in Contract, but which may take place during construction period.

1.8 MAINTENANCE

A. Cost of maintenance of systems and equipment prior to Final Acceptance will be considered as included in prices bid and no direct or additional payment will be made therefore.

1.9 OCCUPANCY REQUIREMENTS

A. Whenever, in the opinion of Construction Manager, Work or any part thereof is in a condition suitable for use, and the best interest of CLPCCD requires such use, CLPCCD may take beneficial occupancy of and connect to, open for public use, or use the Work or such part thereof. In such case, CLPCCD will request Architect/Engineer to inspect the Work or part thereof, and issue a Certificate of Substantial Completion for that part of Work.

B. Prior to date of Final Acceptance of the Work by CLPCCD, all necessary repairs or renewals in Work or part thereof so used, not due to ordinary wear and tear, but due to defective materials or workmanship or to operations of Contractor, shall be made at expense of Contractor, as required in General Conditions.

C. Use by CLPCCD of Work or part thereof as contemplated by this section shall in no case be construed as constituting acceptance of Work or any part thereof. Such use shall neither relieve Contractor of any responsibilities under Contract, nor act as waiver by CLPCCD of any of the conditions thereof.

D. CLPCCD may specify in the Contract Documents that portions of the Work, including electrical and mechanical systems or separate structures, shall be substantially completed on milestone dates prior to substantial completion of all of the Work. Contractor shall notify Architect/Engineer in writing when Contractor considers any such part of the Work ready for its intended use and substantially complete and request Architect/Engineer to issue a Certificate of Substantial Completion for that part of the Work.

PART 2 - PRODUCTS

2.1 REFERENCE STANDARDS

A. For products specified by association or trade standards, comply with requirements of standard, except where more rigid requirements are specified or are required by applicable codes.

2.2 PRODUCTS ORDERED IN ADVANCE

Not applicable.

2.3 CLPCCD FURNISHED PRODUCTS

A. For CLPCCD furnished products as specified, if any, shall be indicated on Construction Documents.

PART 3 - –EXECUTION

Not applicable.

END OF SECTION

SECTION 01 2500

PRODUCT OPTIONS AND SUBSTITUTIONS

PART 1 - GENERAL

1.1 SUMMARY

A. Procedures are described for selecting products and requesting substitutions of unlisted materials in lieu of materials named in the specifications or approved for use in addenda.

B. Related Sections

1. Section 01 2600: Contract Modification Procedures
2. Section 01 3300: Submittals

1.2 CONTRACTOR'S OPTIONS

A. For products specified only by reference standard: Select any product meeting that standard.

B. For products specified by naming one or more products or manufacturers:

1. Select products of any named manufacturer meeting specifications.
2. For any product or manufacturer, which is not specifically named, submit Request for Substitution (RFS).

C. For products indicated or specified by naming only one product and manufacturer, followed by the words “no substitution allowed”, there is no option.

1.3 SUBSTITUTIONS

A. No substitutions shall be allowed for systems, products, and/or materials unless approved in writing from the Architect’s office five (5) days prior to bid.

B. Within a period of thirty-five (35) days after Award of Contract, Construction Manager and Architect/Engineer will consider RFS from Contractor. After that period, requests will be considered only when product becomes unavailable due to no fault of Contractor. Requests for review of proposed substitute items will not be accepted from anyone other than Contractor. The RFS will state the extent, if any, to which the evaluation and acceptance of the proposed substitute will prejudice Contractor's achievement of substantial completion on time, whether or not acceptance of the substitute for use in the Work will require a change in any of the Contract Documents (or in the provisions of any other direct contract with CLPCCD for work on the Project).

C. Submit separate RFS for each product and support each request with:

1. Product identification
2. Manufacturer's literature
3. Samples, as applicable
4. Name and address of similar projects on which product has been used, and date of installation
5. Name, address and telephone number of manufacturer's representative or sales engineer
6. Where DSA approval is required, product shall be reviewed and approved by DSA

D. Itemize a comparison of the proposed substitution with product specified and list significant variations. If variation from product specified is not pointed out in submittal, variation will be rejected even though submittal was favorably reviewed.

E. State whether the substitute will require a change in any of the Contract documents (or provisions of any other direct contract with CLPCCD for work on the Project) to adapt the design of the proposed substitute, and whether or not incorporation or use of the substitute in connection with Work is subject to payment of any license fee or royalty. Submit data relating to changes in construction schedule.

F. All variations of the proposed substitute from that specified will be identified in the RFS and available maintenance, repair and replacement service will be indicated.

G. Include accurate cost data comparing proposed substitution with product and amount of net change in Contract price, including but not limited to, an itemized estimate of all costs or credits that will result directly or indirectly from acceptance of such substitute, including costs of redesign and claims of other contractors effected by the resulting change, all of which will be considered by Construction Manager and Architect/Engineer in evaluating the proposed substitute. Construction Manager and Architect/Engineer may require Contractor to furnish additional data about the proposed substitute.

H. Substitutions will not be considered for acceptance when:

1. They will result in delay meeting construction milestones or completion dates.
2. They are indicated or implied on submittals without formal request from Contractor.
3. They are requested directly by subcontractor or supplier.
4. Acceptance will require substantial revision of Contract Documents.
5. They disrupt Contractor's job rhythm or ability to perform efficiently.

I. Substitute products shall not be ordered without written acceptance of Construction Manager and Architect/Engineer.

J. Construction Manager and Architect/Engineer will determine acceptability of proposed substitutions and reserve right to reject proposals due to insufficient information.

K. Accepted substitutions will be evidenced by a change order or Supplemental Instruction. All Contract requirements apply to Work involving substitutions.

1.4 CONTRACTOR'S REPRESENTATION AND WARRANTY

A. Requests constitute a representation and warranty that Contractor:

1. Has investigated proposed product and determined that it meets or exceeds, in all respects, specified product
2. Will provide the same warranty for substitution as for specified product
3. Will coordinate installation and make other changes, which may be required for Work to be complete in all respects
4. Waives claims for additional costs, which may subsequently become apparent
5. Will compensate CLPCCD for additional redesign costs associated with substitution, if required
6. Will be responsible for Construction Schedule slippage due to substitution
7. Will be responsible for Construction Schedule delay due to late ordering of available specified products caused by requests for substitution, which is subsequently rejected by Construction Manager
8. Will compensate CLPCCD for all costs; including extra costs of Contract, extra cost to other contractors, and any claims brought against CLPCCD, caused by late requests for substitutions or late ordering of products.

1.5 CONSTRUCTION MANAGER'S AND ARCHITECT/ENGINEER'S DUTIES

A. Review Contractor's RFS within seven (7) working days.

B. Notify Contractor in writing of decision to accept or reject requested substitution within seven (7) working days.

1.6 COST OF REVIEW

A. Construction Manager and Engineer will record time required in evaluating substitutes proposed or submitted by Contractor. Whether or not Construction Manager or Architect/Engineer accepts the substitute item so proposed or submitted by Contractor, Contractor shall reimburse CLPCCD for the charges of Architect/Engineer and Construction Manager for evaluating each such proposed substitute item.

B. The CLPCCD reserves the right to waive the requirement of paragraph A above.

PART 2 - PRODUCTS
Not used.

PART 3 - EXECUTION
Not used.

END OF SECTION

SECTION 01 2600

CONTRACT MODIFICATION PROCEDURES

PART 1 - –GENERAL

1.1 SUMMARY

A. This section describes general procedural requirements for alterations, modifications and extras.

B. Related Sections:

1. Section 01 1100: Summary of Work

1.2 GENERAL

A. Any change in scope of work or deviation from Drawings or Specifications shall be accomplished only when authorized in writing by Construction Manager. As appropriate, change orders are subject to approval by the Division of the State Architect. Refer to section 4-338, Part 1, Title 24, California Code of Regulations.

B. Changes in scope of Work or deviation from Drawings or Specifications may be initiated only by the Contractor or the Construction Manager.

1. Contractor may initiate changes by submitting Requests for Information (RFI), Requests for Substitution (RFS), Notice of Concealed or Unknown Conditions, or Notice of Hazardous Waste Conditions.

a. RFI's shall be submitted to seek clarification of Contract Documents.
b. RFS's shall be submitted in accordance with paragraph 4.8.2 of General Conditions to request substitution of materials or methods of execution.
c. Notices of Changes shall be submitted in accordance with paragraph 9.6 of General Conditions.
d. Notices of Hazardous Waste Conditions shall be submitted in accordance with paragraph 4.17 of General Conditions.
e. Notices of concealed or unknown conditions shall be submitted to make Owner aware of a potential change in scope of the work.

2. Contractor shall be responsible for its costs to implement and administer RFI's and RFS's throughout the Contract duration. Regardless of the number of RFI's submitted, Contractor will not be entitled to additional compensation. Contractor shall be responsible for both CLPCCD's and Architect's administrative costs for answering its RFI's where the answer could reasonably be found by reviewing the Contract Documents, as determined by CLPCCD; such costs will be deducted from progress payments.

3. Architect/Engineer may initiate changes by issuing a Supplemental Instruction (which shall require written approval of the Construction Manager).
4. Construction Manager may initiate changes by issuing Requests for Proposal (RFP) or a Field Change Notice (FCN) to Contractor. Such RFP's or FCN's will detail all proposed changes in the Work and request a quotation of changes in Contract Sum and Contract Times from Contractor. A RFP or FCN may require Contractor to expedite the work and proceed on a time and material (force account) basis.

1.3 PROCEDURE

A. Contractor shall submit RFI to Construction manager. Contractor shall reference each RFI to an activity on its Progress Schedule and note the time criticality of the RFI, indicating the time in which the response is required. Architect/Engineer shall respond by issuing a Clarification.

1. If Contractor is satisfied with the Clarification and does not request change in Contract Sum or Contract Times, then the Clarification shall be executed without a change.
2. If Contractor believes that the Clarification results in change in Contract Sum or Contract Times, Contractor shall notify Construction Manager who may then deny request for change or issue RFP.

B. Contractor shall submit RFS to Construction Manager who may then deny request or issue RFP.

C. Contractor shall submit Notices of Changes to resolve unanticipated conditions incurred in the execution of the Work. Procedures in Paragraph 9.6 of General Conditions shall be followed. If Construction Manager determines that a change in Contract Sum or contract Times is justified, Construction Manager shall issue RFP.

D. Contractor shall submit Notices of Hazardous Waste Conditions to resolve problems regarding hazardous materials encountered in the execution of the Work. Procedures in Paragraph 4.17 of General Conditions shall be followed. If Construction Manager determines that a change in Contract Sum or contract Times is justified, Construction Manager shall issue RFP.

E. Architect/Engineer shall issue Supplemental Instruction to the Construction Manager who shall forward onto Contractor. Contractor shall not proceed with Supplemental Instruction until Construction Manager approves it in writing.

1. If Contractor is satisfied with Supplemental Instruction and does not request change in Contract Sum or Contract Times, then Supplemental Instruction shall be executed without a Change Order.
2. If Contractor believes that Supplemental Instruction results in change in Contract Sum or Contract Times, Contractor shall notify Construction Manager. Construction Manager may then deny request for change, cancel Clarification or issue RFP.

F. Responses by recipients shall be within a reasonable time.

G. Contractor shall respond to Construction Manager's RFP within fifteen (15) working days by furnishing a complete breakdown of costs of both credits and extras; itemizing materials, labor, taxes, overhead and profit. Subcontract work shall be so indicated.

H. Upon approval of RFP, Construction Manager will issue a Change Order directing Contractor to proceed with extra work.

I. Payment shall be made as follows:

1. Change Orders which increase Contract Sum or Contract Times shall be included in next Contract Modification Form, signed by Construction Manager, accepted by Contractor.
2. Payment shall be made for Change Order work along with other work in progress payment following completion of Change Order work. Partial completion of Change Order work shall be paid for that part completed during the period covered by the monthly payment request.

1.4 COST DETERMINATION

A. Total cost of extra work shall be the sum of labor costs, material costs, equipment rental costs and specialist costs as defined herein plus overhead and profit as allowed herein. This limit applies in all cases of claims for extra work, whether calculating Change Orders, RFIs, or calculating claims of all types, and applies even in the event of fault, negligence, strict liability, or tort claims of all kinds, including misrepresentation, concealment, strict liability or negligence. No other costs arising out of or connected with the performance of extra work, of any nature, may be recovered by Contractor. No special, incidental or consequential damages may be claimed or recovered against CLPCCD, its representatives or agents, whether arising from breach of contract, negligence or strict liability, unless specifically authorized in the Contract Documents.

B. Overhead:

1. Overhead shall be as defined in Article 1.08.

C. Taxes:

1. Alameda County Sales Tax should be included.
2. Federal and Excise Tax shall not be included.

D. Owner Operated Equipment: When owner-operated equipment is used to perform extra work, Contractor will be paid for equipment and operator as follows:

1. Payment for equipment will be made in accordance with Paragraph 1.05. C.

2. Payment for cost of labor will be made at no more than rates of such labor established by collective bargaining agreements for type of worker and location of work, whether or not owner-operator is actually covered by such an agreement.

1.5 COST BREAKDOWN

A. Labor - Contractor will be paid cost of labor for workers (including fore persons when authorized by Construction Manager) used in actual and direct performance of extra work. Labor rate, whether employer is Contractor, subcontractor or other forces, will be sum of following:

1. **Actual Wages** - Actual wages paid shall be limited to the applicable prevailing wage rate for the classification of labor actually and reasonably necessary to complete a Change. Prevailing wage rates shall be deemed to include all direct payment of wages to workers completing a Change and all employer burdens thereon, including without limitation all employer payments to or on behalf of workers for Workers Compensation, health and welfare, pension, vacation and other similar labor burdens. Contractors and subcontractors are required to provide their corresponding wage rate breakdown for the classification of labor under which they will complete a Change and on the form provided by the Owner for review and approval by the Owner and Construction Manager prior to processing and approval of payment for any completed Change.

B. Material - Only materials furnished by Contractor and necessarily used in performance of extra work will be paid for. Cost of such materials will be cost, including sales tax, to purchaser (Contractor, subcontractor or other forces) from supplier thereof, except, as the following are applicable:

1. If cash or trade discount by actual supplier is offered or available to purchaser, it shall be credited to CLPCCD notwithstanding fact that such discount may not have been taken.
2. For materials salvaged upon completion of extra work, salvage value of materials shall be deducted from cost, less discount, of materials.
3. If cost of a material is, in opinion of Construction Manager, excessive, then cost of material shall be deemed to be lowest current wholesale price at which material is available in quantities concerned delivered to Site, less any discounts as provided in subparagraph 1 above.

C. Equipment Rental: For Contractor or subcontractor-owned equipment, payment will be made at the lesser of actual rental rates or the rental rates listed for equipment in California Department of Transportation official equipment rental rate schedule which is in effect on date upon which extra work is accomplished and which schedule is incorporated herein by reference as though fully set forth herein. For rented equipment, payment will be made based on actual rental invoices. Equipment used on extra work shall be of proper size and type. If, however, equipment of unwarranted size or type and cost is used, cost of use of equipment shall be calculated at rental rate for equipment of proper size and type. Rental rates paid shall be deemed to cover cost of fuel, oil, lubrication, supplies, small tools, necessary attachments, repairs and maintenance of any kind, depreciation, storage, insurance, and all incidentals. Unless otherwise specified, manufacturer's ratings, and manufacturer-approved modifications, shall be used to classify equipment for determination of applicable rental rates. Individual pieces of equipment or tools not listed in said publication and having a replacement value of five hundred dollars ($500) or less, whether or not consumed by use, shall be considered to be small tools and no payment will be made therefore as payment is included in payment for labor. Rental time will not be allowed while equipment is inoperative due to breakdowns.

1. For equipment on Site, rental time to be paid for equipment shall be the time equipment is in operation on extra work being performed. The following shall be used in computing rental time of equipment:

    a. When hourly rates are listed, less than thirty (30) minutes of operation shall be considered to be one-half (1/2) hour of operation.
    b. When daily rates are listed, less than four (4) hours of operation shall be considered to be one-half (1/2) day of operation. Anything over four (4) hours and not more than eight (8) hours is considered one (1) full day of operation.

2. For equipment, which must be brought to Site to be used exclusively on extra work, cost of transporting equipment to Site and its return to its original location shall be determined as follows:

    a. CLPCCD will pay for costs of loading and unloading equipment.
    b. Cost of transporting equipment in low bed trailers shall not exceed hourly rates charged by established haulers.
    c. Cost of transporting equipment shall not exceed applicable minimum established rates of California Public Utilities Commission.
    d. Payment for transporting, and loading and unloading equipment as above provided will not be made if equipment is used on Work in any other way than upon extra work.

3. Rental period shall begin at time equipment is unloaded at Site of extra work and terminate at end of day on which Construction Manager directs Contractor to discontinue use of equipment. Excluding Saturdays, Sundays, and legal holidays, unless equipment is used to perform extra work on such days, rental time to be paid per day shall be four (4) hours for zero (0) hours of operation, six (6) hours for four (4) hours of operation and eight (8) hours for eight (8) hours of operation, time being prorated between these parameters. Hours to be paid for equipment, which is operated less than eight (8) hours due to breakdowns, shall not exceed eight (8) less number of hours equipment is inoperative due to breakdowns.

D. Work Performed by Special Forces or Other Special Services: When Construction Manager and Contractor, by agreement, determine that special service or item of extra work cannot be performed by forces of Contractor or those of any subcontractors, service or extra work item may be performed by specialist. Invoices for service or item of extra work on basis of current market price thereof may be accepted without complete itemization of labor, material, and equipment rental costs when it is impracticable and not in accordance with established practice of special service industry to provide complete itemization. In those instances wherein Contractor is required to perform extra work necessitating a fabrication or machining process in a fabrication or machine shop facility away from Site, charges for that portion of extra work performed in such facility may, by agreement, be accepted as a specialist billing. Construction Manager must be notified in advance of all offsite work. To specialist invoice price, less credit to CLPCCD for any cash or trade discount offered or available, whether or not such discount may have been taken, will be added 15 percent (15%) in lieu of overhead and profit provided in Paragraph 1.04.B.

1.6 FORCE-ACCOUNT

A. If it is impracticable because of nature of work, or for any other reason, to fix an increase or decrease in price definitely in advance, Change Order may fix a maximum price which shall not under any circumstances be exceeded, and subject to such limitation, such alteration, modification or extra shall be paid for at actual necessary cost as determined by CLPCCD Authority, which cost shall be determined pursuant to Article 1.04, and shall be known as Force-Account work.

B. Whenever any Force-Account work is in progress, definite price for which has not been agreed on in advance, Contractor shall report to Construction Manager each day in writing in detail amount and cost of labor and material used, and any other expense incurred in Force-Account work on preceding work day, and no claim for compensation for Force-Account work will be allowed unless report shall have been made. Daily report(s) shall be delivered to Construction Manager within one (1) business day of the day the work was performed. No late reports will be accepted. The intent is to have daily agreement on hours expended for labor and equipment on Force-Account work.

C. Above described methods of determining payment for work and materials shall not apply to performance of work or furnishings of material, which, in judgment of Construction Manager, may properly be classified under items for which prices are established in Contract.

1.7 CLPCCD FURNISHED MATERIALS

A. CLPCCD reserves right to furnish materials, as it deems advisable, and Contractor shall have no claims for costs and overhead and profit on such materials.

1.8 OVERHEAD DEFINED

A. The following constitutes charges that are included in overhead for all contract modifications, including Force-Account work:

1. Drawings: field drawings, shop drawings, etc. including submissions of drawings
2. Routine field inspection of work proposed
3. General Superintendence
4. General administration and preparation of change orders
5. Computer services
6. Reproduction services
7. Salaries of project engineer, Construction Manager, superintendent, timekeeper, storekeeper and secretaries
8. Janitorial services
9. Temporary on-site facilities
    a. Offices
    b. Telephones
    c. Plumbing
    d. Electrical: Power, lighting
    e. Platforms
    f. Fencing, etc.
10. Home office expenses
11. Insurance Premium
12. Procurement and use of vehicles and fuel used coincidentally in base bid work
13. Surveying
14. Estimating
15. Protection of work
16. Final cleanup
17. Other incidental work
18. Record Drawings
19. Warranty
20. Transportation expense to site for labor

1.9 RECORDS AND CERTIFICATION

A. Force-Account (cost reimbursement) charges shall be recorded daily upon Cost Breakdown for Contract Modification Form obtained from Inspector. Contractor or authorized representative shall complete and sign form. Inspector shall sign form for approval. Contract Modification Form shall provide names and classifications of workers and hours worked by each, itemize materials used, and also list size type and identification number of equipment, and hours operated, and shall indicate work done by specialists.

B. No payment for Force-Account work shall be made until Contractor submits original invoices substantiating materials and specialist charges.

C. CLPCCD shall have the right to audit all records in possession of Contractor relating to activities covered by Contractor's claims for modification of Contract, including Force-Account work, as set forth in General Conditions.

D. Further, CLPCCD shall have right to audit, inspect, or copy all records maintained in connection with this Contract, including financial records, in possession of Contractor relating to any transaction or activity occurring or arising out of, or by virtue of, Contract. If Contractor is a joint venture, right of CLPCCD shall apply collaterally to same extent to records of joint venture sponsor, and of each individual joint venture member.

PART 2 - PRODUCTS
Not applicable to this section.

PART 3 - EXECUTION
Not applicable to this section.

SAMPLE ONLY

COST BREAKDOWN FORM FOR CONTRACT MODIFICATION

One separate form shall be used by Contractor, each first tier subcontractor and each lower tier subcontractor. One form for each shall be used for each change order. One form for each, for each day shall be used for Force-Account work.

COST BREAKDOWN FOR CONTRACTOR PRICE PROPOSAL

SHEET 1 OF 3

GENERAL CONTRACTOR FORM

PROJECT NUMBER: _____

PROJECT NAME: _____

CONTRACTOR : _____

CHANGE ORDER NUMBER : _____ DATE: _____

CHANGE ORDER DESCRIPTION _____

SUMMARY OF TOTAL COSTS					
1. TOTAL LABOR COSTS		$ -			
2. Fifteen percent (15%) of Line 1		$ -			
3. Sum of Lines 1 & 2			$ -		
4. TOTAL MATERIAL COSTS		$ -			
5. Fifteen percent (15%) of Line 4		$ -			
6. Sum of Lines 4 & 5			$ -		
TOTAL EQUIPMENT RENTAL CO		$ -			
8. Fifteen percent (15%) of line 7		$ -			
9. Sum of lines 7 & 8			$ -		
TOTAL OF SUBCONTRACTED C		$ -			
ve percent (5%) of line 10 (excluding subcontractor ma		$ -			
12. Sum of Lines 10 & 11			$ -		
SUBTOTAL OF DIRECT COSTS & MARK-UP				$ -	
COST OF BONDS (does not apply to subcontractors)				$ -	

TOTAL OF CONTRACT MODIFICATION		$ -

COST BREAKDOWN FOR CONTRACTOR PRICE PROPOSAL

SHEET 2 OF 3

CONTRACTOR : _____

CHANGE ORDER NUMBER : _____ DATE: _____

CHANGE ORDER DESCRIPTION: _____

LABOR				
NAME	CLASSIFICATION	HOURS	RATE	TOTAL
				$ -
				$ -
				$ -
				$ -
TOTAL LABOR COSTS (Transfers to Line 1 of Sheet 1)				$ -

MATERIALS	
DESCRIPTION	COST
SUBTOTAL MATERIAL COSTS (Without Sales Tax)	$ -
SALES TAX ON MATERIAL AT 9.00%	$ -
TOTAL MATERIAL COSTS (Transfers to Line 4 of Sheet 1)	$ -

EQUIPMENT				
SIZE AND TYPE	I.D. #	HOURS	RATE	TOTAL
				$ -
				$ -
				$ -
				$ -
TOTAL EQUIPMENT RENTAL COSTS (Transfers to Line 7 of Sheet 1)				$ -

COST BREAKDOWN FORM FOR CONTRACT MODIFICATION

SHEET 3 OF 3

CHANGE ORDER NUMBER : _____ DATE: _____

CHANGE ORDER DESCRIPTION: _____

SUBCONTRACTED WORK		
SUBCONTRACTOR	DESCRIPTION OF WORK SUBCONTRACTED	COST
TOTAL COST OF SUBCONTRACTED WORK (Transfers to Line 10 of Sheet 1)		$

CONTRACTOR: _____ Date: _____

VERIFIED BY INSPECTOR: _____ Date: _____

SECTION 01 3100

PROJECT COORDINATION

PART 1 - –GENERAL

1.1 SECTION INCLUDES

A. Project coordination.

B. Field engineering.

C. Coordination drawings.

D. Workmanship.

E. Incidental costs.

F. Correspondence and Notices.

G. Miscellaneous provisions.

H. Damage and restoration.

1.2 RELATED SECTIONS

A. Section 01 1100 - Summary of Work.

B. Section 01 4500 - Quality Control.

C. Section 01 5000 – Temporary Facilities.

D. Section 01 7000 - Contract Closeout.

1.3 PROJECT COORDINATION

A. Coordination 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. 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.

C. Coordinate space requirements and installation of mechanical and electrical work, which are indicted diagrammatically on drawings. Follow route shown for pipes, ducts, and conduit, as closely as practicable: place runs parallel with line of building. Utilize space efficiently to maximize accessibility for other installations, for maintenance, and for repairs.

D. In finished areas except as otherwise indicated, conceal pipes, ducts, and wiring within the construction. Coordinate locations of fixtures and outlets with finished elements.

E. Submit a copy of site drawing and certificate signed by the Civil Engineer that the elevations and locations of the Work of separate Sections in preparation for Substantial Completion.

F. Coordinate completion and cleanup of Work of separate Sections in preparation for Substantial Completion.

G. After Owner occupancy of the Site, coordinate access to site for correction of defective Work and Work not in accordance with Contract Documents, to minimize disruption of Owner's activities.

1.4 FIELD ENGINEERING

A. Contractor shall locate and protect survey control and reference points.

B. Control datum for survey is that shown on drawings.

C. Contractor shall verify setbacks and easements; confirm drawing dimensions and elevations.

D. Provide field engineering services. Contractor shall establish lines, and levels, utilizing recognized engineering practices

1.5 COORDINATION DRAWINGS

A. Provide information required by Architect for preparation of coordination drawings.

B. Review drawings prior to submission to Architect.

1.6 WORKMANSHIP

A. Work shall be performed by craftsmen well experienced and competent in their particular trade.

B. Workmanship shall be thorough, finished and complete in every detail for finest quality installations as intended under these specifications.

1.7 INCIDENTAL COSTS

A. In addition to cost associated with GC Article 6: Insurance; Indemnity; Bonds:

1. Utilities: Refer to Section 01 5000.
2. Contractors and Subcontractors shall furnish at their own cost and expense all tools, consumable supplies, appliances, equipment, etc., necessary for execution of their work; and shall be responsible for care and guarding thereof.
3. Contractors and Subcontractors shall be entirely responsible for professional, trade, business or other licenses required by state statute or local government.

1.8 CORRESPONDENCE AND NOTICES

A. Clearly identify correspondence, notices and submittals with project name, subject and detailed references to drawings and specifications.

B. Notify Inspector or the Construction Manager two (2) working days in advance of required inspection.

C. The District's project management system shall be utilized for document controls for RFI, Submittals, Daily Logs, etc.

1.9 MISCELLANEOUS PROVISIONS

A. Contractor shall immediately refer to the Construction Manager any requirement shown or specified which Contractor in their experience and background finds or believes:

1. Is not equal to industry standards for achieving a first quality installation as intended;
2. Is excessive in cost or effort to affect the intended results;
3. Is below standard for proper enforcement of the guarantees required;
4. Or, is at variance with governing laws, regulations, codes or standards.

B. Work operations relative to any matter referred to Architect for consideration shall not proceed until receipt of appropriate instructions from Architect.

C. Inspection of Work and Materials: Contractor shall immediately make a close and thorough inspection of all materials as delivered and all work in progress; shall promptly reject and return all defective materials and re-do; and shall check and verify adequate performance or satisfactory results of all tests and inspections before allowing sub-work to proceed.

D. Warranty Period: During warranty periods, supervise investigation and correction of deficiencies found or occurring in the work.

E. Shop Fabricate and pre-assemble interrelated parts where possible.

F. 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.

G. Provide holes, slots, cutouts, blocking, screeds, nailers, chases and similar preparation as the work progresses, as required to receive or pass subsequent work without damage to previously completed work.

H. Exterior Work shall be made tight against direct or indirect entry of water into the concealed or interior spaces of the building. Seal joints or penetrations below grade or behind exterior trim and other conditions where water might enter the structure, as for exposed exterior work.

I. Structural Connections and Fasteners: Include as required for complete fabrication and installation of the work; of materials, types and sizes adequate for the purposes.

1. Place in concealed or obscured locations where possible.
2. Include suitable welding or brazing where required.

J. Powder Activated Fasteners: Limited to uses particularly shown, specified or approved by Architect. Operators shall be certified in accordance with California Industry Safety orders.

K. Ferrous Work permanently exposed to exterior or below grade shall be galvanized; related accessory members and fastening non-ferrous, galvanized or made rustproof by approved methods.

L. Galvanizing, prime painting and related touch-up and repair shall comply with requirements for metal fabricating and painting in Section 13125 - Relocatable Buildings.

M. Isolation: Provide between ferrous and non-ferrous or dissimilar metal components to protect the work against electrolysis, as follows:

1. For architectural work, provide cork fillers, asphaltic coatings, neoprene gaskets or similar separation as necessary; and use stainless steel fastenings only where interconnecting dissimilar parts.
2. For mechanical and electrical work, provide dielectric unions or similar separation. In particular, provide isolation as necessary between exterior underground systems and interior above-grade systems where they meet dissimilar metals.

N. Prior to starting a particular type or kind of work, examine for relevant information, all contract documents and subsequent data issued to the project.

1.10 DAMAGE AND RESTORATION

A. Damage to previously existing or newly placed facilities caused by movement of equipment or other operations, whether accidental or made necessary by reason of Contract requirements, shall be restored or replaced as specified or directed by Architect or Construction Manager.

B. Restoration shall be equal to the structural qualities or performance capacities of the original work, and finishes shall match the appearance of, as nearly as possible, like existing adjacent work. Restorations shall be subject to approval by Architect and shall be made as necessary at no added expense to Owner unless otherwise particularly provided for.

C. Work not properly restored or where not capable of being restored as intended under these Specifications shall be removed and replaced as directed by Architect at no added expense to Owner.

PART 2 - PRODUCTS
Not applicable to this section.

PART 3 - EXECUTION

3.1 CUTTING AND PATCHING

A. Employ skilled and experienced installer to perform cutting and patching.

B. Submit written request in advance of cutting or altering elements, which affects:

1. Structural integrity of element.
2. Integrity of weather-exposed or moisture-resistant elements.
3. Efficiency, maintenance, or safety of element.
4. Visual qualities of sight-exposed elements.

C. Execute cutting, fitting, and patching including excavation and fill, to complete Work, and to:

1. Fit the several parts together, to integrate with other Work.
2. Uncover Work to install or correct ill-timed work.
3. Remove and replace defective and non-conforming Work.
4. Remove samples of installed Work for testing.
5. Provide openings in elements of Work for penetrations of mechanical and electrical Work.

D. Execute work by methods, which will avoid damage to other Work, and provide proper surfaces to receive patching and finishing.

E. Cut rigid materials using masonry saw or core drill.

F. Restore Work with new products in accordance with requirements of Contract Document.

G. Fit Work tight to pipes, sleeves, ducts, conduit, and other penetrations through surfaces.

H. Maintain integrity of wall, ceiling, or floor construction; completely seal voids.

I. Refinish surfaces to match adjacent finishes. For continuous surfaces, refinish to nearest intersection; for an assembly, refinish entire unit.

J. Identify any hazardous substance or condition exposed during the Work to the Construction Manager for decision or remedy.

END OF SECTION

SECTION 01 3119

PROJECT MEETINGS

PART 1 - GENERAL

1.1 SUMMARY

A. This section describes the required meetings for this work. These meetings include:

1. Pre-construction Conference
2. Scheduling Meetings
3. Progress Meetings
4. Special Meetings

B. Related Sections

1. Section 01 1100: Summary of Work
2. Section 01 3200: Progress Schedules and Reports
3. Section 01 3300: Submittals

1.2 PRECONSTRUCTION CONFERENCE

A. Construction Manager will call for and administer Pre-construction Conference at time and place to be announced. Conference will occur as soon after award as can be reasonably scheduled.

B. Contractor, all subcontractors, and major suppliers shall attend Pre-construction Conference.

C. Agenda will include, but not be limited to, the following items:

1. Schedules
2. Personnel
3. Use of the Site
4. Temporary Utilities
5. Location of Contractor's on-site facilities
6. Project access
7. Employee parking
8. Security/Safety
9. Housekeeping
10. Submittals
11. Inspection and testing procedures, on-site and off-site
12. Utility shutdown procedures
13. Control and reference point survey procedures
14. Injury and Illness Prevention Program
15. Contractor's Initial CPM Schedule

16. Contractor Invoicing, Schedule of Values, Approval Procedures

D. Construction Manager will distribute copies of minutes to attendees. Attendees shall have five (5) working days to submit comments or additions to minutes. Minutes will constitute final memorialization of results of the Pre-construction Conference.

1.3 SCHEDULING MEETINGS

A. Meet with Construction Manager and Architect on Start Date of Contract and conduct initial review of Contractor's draft Shop Drawing and Sample Submittal Schedule, and draft Schedule of Values and Initial Construction Schedule ("Schedule Review Meeting").

B. Authorized representative in Contractor's organization, designated in writing, who will be responsible for working and coordinating with Construction Manager's representative(s) and Architect relative to preparation and maintenance of Progress Schedule shall attend initial Schedule Review Meeting.

C. Contractor shall, within thirty (30) days from the Notice to Proceed date, meet with Construction Manager and Architect to review the Original CPM Schedule submittal.

1. Contractor shall have its manager, superintendent, scheduler, and key subcontractor representatives, as required by CLPCCD, in attendance. The meeting will take place over a continuous one-day period.
2. CLPCCD's review of Schedule Submittals will be limited to conformance to Contract requirements, including, but not limited to, coordination requirements. However, review may also include:

    a. Clarifications of Contract Requirements
    b. Directions to include activities and information missing from submittal
    c. Requests to Contractor to clarify its schedule

3. Within five (5) days of the initial Schedule Review Meeting, Contractor shall respond in writing to all questions and comments expressed by CLPCCD at the meeting.

D. Construction Manager will administer scheduling meetings and shall distribute minutes of scheduling meetings to attendees. Attendees shall have five (5) working days to submit comments or additions to minutes. Minutes will constitute final memorialization of results of the scheduling meetings.

1.4 PROGRESS MEETINGS

A. Construction Manager and Architect will schedule and administer Progress Meetings throughout duration of Work. Progress meetings will be held weekly unless otherwise directed by Construction Manager.

1. Meetings shall be held at Construction Manager's on-site office unless otherwise directed by Construction Manager.
2. Construction Manager will prepare agenda and distribute to Contractor, Inspector and Architect/Engineer 24 hours in advance of meeting.
3. Construction Manager will preside at meeting.
4. Architect will record and distribute minutes to Contractor, Inspector, Construction Manager, all other participants, and those affected by decisions made at meeting, within three (3) working days after meeting. Attendees shall have five (5) working days to submit comments or additions to minutes. Minutes will constitute final memorialization of results of progress meetings.

B. Progress Meetings shall be attended by Contractor's job superintendent, major subcontractors and suppliers, when requested by Construction Manager or as appropriate, Construction Manager, Architect/Engineer, Inspector and others as appropriate to agenda topics for each meeting.

C. Agenda will contain the following items as appropriate:

1. Review of work progress
2. Status of Construction Schedule, adjustments
3. Submittals
4. Delivery schedules
5. Utility shutdowns, traffic disruptions, and interferences with public scheduled during the subsequent 2 weeks
6. Quality control
7. Pending changes
8. Substitutions
9. Review of Contractor's safety program activities and results, including report on all serious injury and/or damage accidents
10. Safety
11. Other items affecting progress of work

D. A separate meeting will be held on approximately the 25th of each month to review the schedule update submittal and progress payment application.

1. At this meeting, at a minimum, the following items will be reviewed:

    a. percent complete of each activity
    b. time impact evaluations for Change Orders and Time Extension Request
    c. actual and anticipated activity sequence changes
    d. actual and anticipated duration changes
    e. actual and anticipated contractor delays

2. These meetings are considered a critical component of overall monthly schedule update submittal and Contractor shall have appropriate personnel attend. At a minimum, these meetings shall be attended by Contractor's General Superintendent and Scheduler.
3. Contractor shall plan on progress meetings taking no less than four (4) hours.

1.5 SPECIAL MEETINGS

A. Special meetings may be called by any party by notifying all desired participants, Construction Manager, Architect, and Inspector four (4) working days in advance, giving reason for meeting. Special Meetings may be held without advance notice in emergency situations.

B. At any time during the progress of the Work, CLPCCD shall have authority to require Contractor to attend conference of any or all of the contractors engaged in the Work or in other work, and notice of such conference shall be duly observed and complied with by Contractor.

C. Contractor shall schedule and conduct coordination meetings as necessary to discharge coordination responsibilities in the General Conditions. Construction Manager shall be given five (5) days written notice of coordination meetings. Contractors shall maintain minutes of coordination meetings. Attendees shall have five (5) working days to submit comments or additions to minutes. Minutes will constitute final memorialization of results of the meetings.

D. Pre-installation meetings of manufactures' warranty scope of work, i.e., roofing, water-proofing, curtain wall, etc.

E. LEED kick-off meeting.

PART 2 - PRODUCTS
Not used.

PART 3 - EXECUTION
Not used.

END OF SECTION

SECTION 01 3200

PROGRESS SCHEDULES AND REPORTS

PART 1 - GENERAL

1.1 SUMMARY

A. Scheduling of Work under this Contract shall be performed by Contractor in accordance with requirements of this Section.

1. Development of schedule, cost and manpower loading of the schedule and schedule updates, monthly payment requests and project status reporting requirements of the Contract shall employ computerized Critical Path Method (CPM) scheduling.
2. Submit schedules and reports as specified in General Conditions.

B. Upon Award of Contract, Contractor shall immediately commence development of Initial and Original CPM Schedules to ensure compliance with CPM schedule submittal requirements.

C. Related Sections:

1. Section 01 1100: Summary of Work
2. Section 01 3300: Submittals

D. Definitions: The following definitions apply to this section:

1. ACTIVITY: A task, event or other project element on a schedule that contributes to completing the project. Activities have a description, start date, finish date, duration and one or more logic ties.
2. BASELINE SCHEDULE: The initial schedule representing the Contractor's work plan on the first day of the project.
3. CRITICAL PATH: The longest continuous chain of activities for the project that has the least amount of total float of all chains. In general, a delay on the critical path will extend the scheduled completion date.
4. CRITICAL PATH METHOD (CPM): A network based planning technique using activity durations and the relationships between activities to mathematically calculate a schedule for the entire project.
5. DATA DATE: The day after the date through which a schedule is current. Everything occurring earlier than the data date is "as-built" and everything on or after the data date is "planned".
6. EARLY COMPLETION TIME: The difference in time between an early scheduled completion date and the contract completion date.
7. FLOAT: The difference between the earliest and latest start or finish times for an activity.

8. MILESTONE: An event activity that has zero duration and is typically used to represent the beginning or end of a certain stage of the project.
9. NARRATIVE REPORT: A document submitted with each schedule that discusses topics related to project progress and scheduling.
10. NEAR CRITICAL PATH: A chain of activities with total float exceeding that of the critical path but having no more than 14 calendar days of total float.
11. SCHEDULED COMPLETION DATE: The planned project finish date shown on the current accepted schedule.
12. SUBSTANTIAL COMPLETION: The stage in the progress of the work when the work is complete in accordance with the Contract Documents, so that District can occupy or use the work for its intended purpose.
13. TIME IMPACT ANALYSIS: A schedule and narrative report developed specifically to demonstrate what effect a proposed change or delay has on the current scheduled completion date.
14. TIME-SCALED NETWORK DIAGRAM: A graphic depiction of a CPM schedule comprised of activity bars with relationships for each activity represented by arrows. The tail of each arrow connects to the activity bar for the predecessor and points to the successor.
15. TOTAL FLOAT: The amount of time that an activity or chain of activities can be delayed before extending the scheduled completion date.
16. UPDATED SCHEDULE: A current schedule developed from the baseline or subsequent schedule through regular monthly review to incorporate as-built progress and any planned changes.

1.2 QUALIFICATIONS

A. Contractor shall employ experienced scheduling personnel qualified to use the latest version of Primavera Project Planner or Microsoft Project scheduling software. Experience level required is set forth below. Contractor may employ such personnel directly or may employ a consultant for this purpose. After bid opening, the apparent successful low bidder shall provide CLPCCD a written verification that Contractor has the required personnel under its employ or that Contractor will employ the required CPM scheduling consultant.

1. The written statement shall identify individual who will perform CPM scheduling.
2. Capability and experience shall be verified by description of construction projects on which individual has successfully applied computerized CPM.
3. Required level of experience shall include at least two projects of similar nature, scope and value not less than three-fourths the Total Bid Price of this Project. The written statement shall provide contact persons for referenced projects with current telephone and address information.

B. CLPCCD reserves right to approve Contractor's scheduler, or consultant, and right to reject them at any time. CLPCCD also reserves right to refuse replacement of Contractor's scheduler or consultant if it believes such replacement will negatively affect Contract.

1.3 GENERAL

A. Progress Schedule shall be based on and incorporate milestones and completion dates specified in Contract Documents. Submit to the Owner baseline, monthly updated, and final updated schedules, each consistent in all respects with the time and order of work requirements of the contract. Work must be executed in the sequence indicated on the current accepted schedule. Schedules must show the order in which you propose to execute the work with logical links between time-scaled work activities and calculations made using the critical path method to determine the controlling activities. You are responsible for assuring that all activity sequences are logical and that each schedule shows a coordinated plan for complete performance of the work.

B. Overall time of completion and time of completion for each milestone shown on Progress Schedule shall adhere to times as stated in Contract Agreement, unless an earlier (advanced) time of completion is requested by Contractor and agreed to by CLPCCD. Any such agreement shall be formalized by a Change Order.

1. CLPCCD is not required to accept an earlier (advanced) schedule, i.e., one that shows early completion dates for the Contract Times.
2. Contractor shall not be entitled to extra compensation in the event agreement is reached on an earlier (advanced) schedule and Contractor completes its Work, for whatever reason (excepting approved changes with added time components) beyond completion date shown in earlier (advanced) schedule but within the Contract Times.
3. A schedule showing the work completed in less than the Contract Times, which has been accepted by CLPCCD, shall be considered to have Project Float. The Project Float is the time between the scheduled completion of the work and Contract Substantial Completion. Project Float is a resource available to both CLPCCD and the Contractor.

C. Float Ownership: Neither CLPCCD nor Contractor owns float. The Project owns the float. As such, liability for delay of the Substantial Completion Date rests with the party whose actions, last in time, actually cause delay to the Substantial Completion Date.

1. For example, if Party A uses some, but not all of the float and Party B later uses remainder of the float as well as additional time beyond the float, Party B shall be liable for the time that represents a delay to the Substantial Completion Date.
2. Party A would not be responsible for the time since it did not consume the entire float and additional float remained; therefore, the Substantial Completion Date was unaffected.

D. Progress Schedule shall be the basis for evaluating job progress, payment requests, and time extension requests associated with the changes. Responsibility for developing Contract CPM schedule and monitoring actual progress as compared to Progress Schedule rests with Contractor.

E. The Owner's review and acceptance of schedules does not waive any contract requirements and does not relieve Contractor of any obligation or responsibility for submitting complete and accurate information. Correct rejected schedules and resubmit corrected schedules to the Owner within seven (7) days of notification by the Owner, at which time a new review period of seven (7) days will begin.

1. Errors or omissions on schedules do not relieve Contractor from finishing all work within the time limit specified for completion of the contract. If, after a schedule has been accepted by the Owner, either the Contractor or the Owner discovers that any aspect of the schedule has an error or omission, it must be corrected on the next updated schedule.

F. Use Microsoft Project for Windows or Primavera P6. Such software shall be compatible with Windows operating system. Contractor shall transmit contract schedule files to CLPCCD on CD-ROM or flash drive at times requested by CLPCCD.

G. Transmit each item under form approved by CLPCCD.

1. Identify Project with CLPCCD Contract number and name of Contractor and file by date, project, and update number.
2. Provide space for Contractor's approval stamp and CLPCCD's review stamps.
3. Submittals received from sources other than Contractor will be returned to the Contractor without CLPCCD's review.

1.4 INITIAL CRITICAL PATH METHOD (CPM) SCHEDULE

A. Initial CPM Schedule submitted for review at the pre-construction conference shall serve as Contractor's schedule for up to ninety (90) calendar days after the Notice to Proceed.

B. Indicate detailed plan for the Work to be completed in first sixty (60) days of the Contract; details of planned mobilization of plant and equipment; sequence of early operations; and procurement of materials and equipment. Show Work beyond sixty (60) calendar days in summary form.

C. Initial CPM Schedule shall be time-scaled.

D. Initial CPM Schedule shall be cost and manpower loaded. Accepted cost and manpower-loaded schedule will be used as basis for monthly progress payments until acceptance of the Original CPM Schedule. Use of Initial CPM Schedule for progress payments shall not exceed sixty (60) calendar days.

E. CLPCCD and Contractor shall meet to review and discuss the Initial CPM Schedule within seven (7) calendar days after it has been submitted to CLPCCD.

1. CLPCCD's review and comment on the schedule shall be limited to Contract conformance (with sequencing, coordination, and milestone requirements) and accepted CPM principals.

2. Contractor shall make corrections to schedule necessary to comply with Contract requirements and shall adjust schedule to incorporate any missing information requested by CLPCCD. Contractor shall resubmit Initial CPM Schedule if requested by CLPCCD.

F. If, during the first sixty (60) days after Notice-to-Proceed, the Contractor is of the opinion that any of the Work included on its Initial CPM Schedule has been impacted, the Contractor shall submit to CLPCCD a written Time Impact Evaluation (TIE) in accordance with Article 1.09 of this Section. The TIE shall be based on the most current update of the Initial CPM Schedule.

1.5 ORIGINAL CRITICAL PATH METHOD (CPM) SCHEDULE

A. Submit a detailed proposed Original CPM Schedule presenting an orderly and realistic plan for completion of the Work, in conformance with requirements as specified herein.

B. The baseline schedule must not extend beyond the number of contract days. The baseline schedule must have a data date of the first working day of the contract and not include any completed work to date. The baseline schedule must not attribute negative float or negative lag to any activity.

C. Progress Schedule shall include or comply with following requirements:

1. Time scaled, cost and manpower loaded CPM schedule.
2. No activity on schedule shall have duration longer than twenty-one (21) calendar days, with exception of submittal, approval, fabrication and procurement activities, unless otherwise approved by CLPCCD.

    a. Activity durations shall be total number of actual days required to perform that activity.
    b. Activity coding capabilities to sort by responsibility, location, phase and CSI division.

3. The start and completion dates of all items of Work, their major components, and milestone completion dates, if any.
4. CLPCCD-furnished materials and equipment, if any, identified as separate activities.

5. Completion of the last activity in the schedule shall be constrained by the contract completion date. Schedule calculations shall result in a negative float when the calculated early finish date of the last activity is later than the contract completion date. The Contractor shall include as the last activity in the project schedule an activity called ÓFinal Completion . The ÓFinal Completion activity shall have an ÓLF constraint date equal to the contract completion date for the project, and with a zero day duration or by using the Óproject must finish by date in the scheduling software. The schedule shall have no constrained dates other than those specified in the contract. The use of artificial float constraints such as Ózero free float or Ózero total float are typically prohibited. There shall only be two (2) open ended activities: Start Project (or NTP) with no predecessor logic and Final Completion with no successor logic.
6. Processing/approval of submittals and shop drawings for all Contract-required material and equipment. Activities that are dependent on submittal acceptance or material delivery shall not be scheduled to start earlier than expected acceptance or delivery dates.

    a. Include time for submittals, resubmittals, and reviews by CLPCCD. Coordinate with accepted schedule for submission of shop drawings, samples and other submittals.
    b. Contractor shall be responsible for all impacts resulting from resubmittal of shop drawings and submittals.

7. Procurement of all contract required material and equipment, identified as separate activity.

    a. Include time for fabrication and delivery of manufactured products for the Work.
    b. Show dependencies between procurement and construction.

8. Complete activity description; what Work is to be accomplished and where.
9. The total cost of performing each activity shall be total of labor, material, equipment, excluding overhead and profit of Contractor. Total overhead and profit of the General Contractor shall be shown on a separate activity in the schedule. Sum of cost for all activities shall equal total Contract value.
10. Resources required (labor) to perform each activity.
11. Responsibility code for each activity corresponding to Contractor or Subcontractor responsible for performing the Work.
12. Identify the activities, which constitute the controlling operations or critical path. No more than twenty-five (25%) of the activities shall be critical or near critical. Near critical is defined as float in the range of one (1) to ten (10) days.
13. At least twenty-eight (28) calendar days for developing punch list(s), completion of punch list items and final clean-up for the Work or any designated portion thereof. No other activities shall be scheduled during this period.
14. Interface with the work of other contractors, CLPCCD, and agencies such as, but not limited to, utility companies.

15. Show detailed Subcontractor Work activities. In addition, furnish copies of Subcontractor schedules upon which CPM was built.

    a. Also furnish for each Subcontractor, as determined by CLPCCD, submitted on Subcontractor letterhead a statement certifying that Subcontractor concurs with Contractor's Original CPM Schedule and that Subcontractor's related schedules have been incorporated, including activity duration, cost and resource loading.
    b. Subcontractor schedules shall be independently derived and not a copy of Contractor's schedule.
    c. In addition to Contractor's schedule and resource loading, obtain from electrical, mechanical and plumbing Subcontractors, and other Subcontractors as required by CLPCCD, productivity calculations common to their trades, such as units per person day, feet of pipe per day per person, feet of wiring per day per person, and similar information.
    d. Furnish schedule for Contractor/Subcontractor CPM Schedule meetings which shall be held prior to submission of Original CPM Schedule to CLPCCD. CLPCCD shall be permitted to attend scheduled meetings as an observer.

16. Activity durations shall be in calendar days.
17. Submit with the schedule a list of anticipated non-Work days, such as weekends and holidays.

D. Original CPM Schedule Review Meeting: Contractor shall, within thirty (30) calendar days from the Notice to Proceed date, meet with CLPCCD to review the Original CPM Schedule submittal.

1. Contractor shall have its Construction Manager, Project Superintendent, Project Scheduler, and key Subcontractor representatives, as required by CLPCCD, in attendance. The meeting will take place over a continuous one-day period.
2. CLPCCD's review will be limited to submittal's conformance to Contract requirements, including, but not limited to, coordination requirements. However, review may also include:

    a. Accepted critical path method principles and tenets.
    b. Clarifications of Contract Requirements.
    c. Directions to include activities and information missing from submittal.
    d. Requests to Contractor to clarify its schedule.

3. Within five (5) days of the Schedule Review Meeting, Contractor shall respond in writing to all questions and comments expressed by CLPCCD at the Meeting.

1.6 ADJUSTMENTS TO CRITICAL PATH METHOD (CPM) SCHEDULE

A. Adjustments to Original CPM Schedule: Contractor shall have adjusted the Original CPM Schedule submittal to address all review comments from original CPM Schedule review meeting and resubmit network diagrams and reports for CLPCCD's review.

1. CLPCCD, within fourteen (14) days from date that Contractor submitted the revised schedule, will either:

    a. accept schedule and cost and resource loaded activities as submitted, or
    b. advise Contractor in writing to review any part or parts of schedule which either do not meet Contract requirements or are unsatisfactory for CLPCCD to monitor Project's progress, resources and status or evaluate monthly payment request by Contractor.

2. CLPCCD may accept schedule with conditions that the first monthly CPM schedule update be revised to correct deficiencies identified.
3. When schedule is accepted, it shall be considered as the "Original CPM Schedule" which will then be immediately updated to reflect the current status of the work.
4. CLPCCD reserves the right to require Contractor to adjust, add to, or clarify any portion of schedule which may later be discovered to be insufficient for monitoring of Work or approval of partial payment requests. No additional compensation will be provided for such adjustments, additions, or clarifications.

B. Acceptance of Contractor's schedule by CLPCCD will be based upon schedule's compliance with Contract requirements and accepted CPM principles.

1. By way of Contractor assigning activity durations and proposing sequence of Work, Contractor agrees to utilize sufficient and necessary management and other resources to perform work in accordance with the schedule.
2. Upon submittal of schedule update, updated schedule shall be considered "current" CPM schedule.
3. Submission of Contractor's schedule to CLPCCD shall not relieve Contractor of total responsibility for scheduling, sequencing, and pursuing Work to comply with requirements of Contract Documents, including adverse effects such as delays resulting from ill-timed work.

C. Submittal of Original CPM Schedule, and subsequent schedule updates, shall be understood to be Contractor's representation that the Schedule meets requirements of Contract Documents and that Work shall be executed in sequence indicated on the schedule.

D. Contractor shall distribute Original CPM Schedule to Subcontractors for review and written acceptance, which shall be noted on Subcontractors' letterhead to Contractor and transmitted to CLPCCD for the record.

1.7 MONTHLY CPM SCHEDULE UPDATE SUBMITTALS

A. Following acceptance of Contractor's Original CPM Schedule, Contractor shall monitor progress of Work and adjust schedule each month to reflect actual progress and any pre-approved changes to planned activities or logic.

1. Each schedule update submitted shall be complete, including all information requested for the Original CPM Schedule submittal.

2. Each update shall continue to show all work activities including those already completed. These completed activities shall accurately reflect "as built" information by indicating when activities were actually started and completed.

B. A meeting will be held on approximately the twenty-fifth (25th) of each month to review the schedule update submittal and progress payment application.

1. At this meeting, at a minimum, the following items will be reviewed: Percent complete of each activity; time impact evaluations for Change Orders and Time Extension Request; anticipated activity sequence changes; anticipated duration changes; actual and anticipated contractor delays.
2. These meetings are considered a critical component of overall monthly schedule update submittal and Contractor shall have appropriate personnel attend. At a minimum, these meetings shall be attended by Contractor's General Superintendent and Scheduler.
3. Contractor shall plan on the meeting taking no less than four (4) hours.

C. Within seven (7) calendar days after monthly schedule update meeting, Contractor shall submit the updated CPM Schedule update.

D. Within seven (7) calendar days of receipt of above noted revised submittals, CLPCCD will either accept or reject monthly schedule update submittal.

1. If accepted, percent complete shown in monthly update will be basis for Application for Payment by the Contractor. The schedule update shall be submitted as part of the Contractor's Application for Payment.
2. If rejected, update shall be corrected and resubmitted by Contractor before the Application for Payment is submitted.

E. Updating, changing or revising of any report, curve, schedule or narrative submitted to CLPCCD by Contractor under this Contract, nor CLPCCD's review or acceptance of any such report, curve, schedule or narrative shall not have the effect of amending or modifying, in any way, the Contract Substantial Completion date or milestone dates or of modifying or limiting, in any way, Contractor's obligations under this Contract.

F. Final Updated Schedule. Submit final updated, as-built schedule with actual start and finish dates for the activities, within 30 days after completion of contract work. Provide a written certificate with this submittal signed by your Project Manager or an officer of the company stating, ÓTo my knowledge and belief, the enclosed final update schedule reflects that actual start date and finish dates of the actual activities for the project contained herein . An officer of the company may delegate in writing the authority to sign the certificate to a responsible manager.

1.8 SCHEDULE REVISIONS

A. Updating the Schedule to reflect actual progress shall not be considered revisions to the Schedule. Since scheduling is a dynamic process, revisions to activity durations and sequences are expected on a monthly basis.

B. To reflect revisions to the schedule, the Contractor shall provide CLPCCD with a written narrative with a full description and reasons for each Work activity revised. For revisions affecting the sequence of work, the Contractor shall provide a schedule diagram which compares the original sequence to the revised sequence of work. The Contractor shall provide the written narrative and schedule diagram for revisions two (2) working days in advance of the monthly schedule update meeting.

C. Schedule revisions shall not be incorporated into any schedule update until the revisions have been reviewed by CLPCCD. CLPCCD may request further information and justification for schedule revisions and Contractor shall, within three (3) days, provide CLPCCD with a complete written narrative response to CLPCCD's request.

D. If the Contractor's revision is still not accepted by CLPCCD, and the Contractor disagrees with CLPCCD's position, the Contractor has seven (7) calendar days from receipt of CLPCCD's letter rejecting the revision, to provide a written narrative providing full justification and explanation for the revision. The Contractor's failure to respond in writing within seven (7) calendar days of CLPCCD's written rejection of a schedule revision shall be contractually interpreted as acceptance of CLPCCD's position, and the Contractor waives its rights to subsequently dispute or file a claim regarding CLPCCD's position.

E. At CLPCCD's discretion, the Contractor can be required to provide subcontractor certifications of performance regarding proposed schedule revisions affecting said subcontractors.

1.9 RECOVERY SCHEDULE

A. If the Schedule Update shows a substantial completion date fourteen (14) calendar days beyond the Contract Substantial Completion date, or individual milestone completion dates, the Contractor shall submit to CLPCCD the proposed revisions to recover the lost time within seven (7) calendar days. As part of this submittal, the Contractor shall provide a written narrative for each revision made to recapture the lost time. If the revisions include sequence changes, the Contractor shall provide a schedule diagram comparing the original sequence to the revised sequence of work.

B. The revisions shall not be incorporated into any schedule update until the revisions have been reviewed by CLPCCD.

C. If the Contractor's revisions are not accepted by CLPCCD, CLPCCD and the Contractor shall follow the procedures in paragraph 1.08.C, 1.08.D and 1.08.E above.

D. At CLPCCD's discretion, the Contractor can be required to provide subcontractor certifications for revisions affecting said subcontractors.

1.10 TIME IMPACTS EVALUATION (TIE) FOR CHANGE ORDERS, AND OTHER DELAYS

A. Time Impact Analysis (TIA). Submit a written TIA to the Owner with each request for adjustment of contract time, or when the Contractor or the Owner considers that an approved or anticipated change may impact the critical path or contract progress.

The TIA must illustrate the impacts of each change or delay on the current scheduled completion date or internal milestone, as appropriate. The analysis must use the accepted schedule that has a data date closest to and before the event. If the Owner determines that the accepted schedule used does not appropriately represent the conditions before the event, the accepted schedule must be updated to the day before the event being analyzed. The TIA must include an impact schedule developed from incorporating the event into the accepted schedule by adding or deleting activities, or by changing durations or logic of existing activities. If the impact schedule shows that incorporating the event modifies the critical path and scheduled completion date of the accepted schedule, the difference between scheduled completion dates of the two schedules must be equal to the adjustment of contract time. The Owner may construct and use an appropriate project schedule or other recognized method to determine adjustments in contract time until the Contractor provide the TIA.

B. Contractor shall be required to comply with the requirements of Paragraph 1.09.A for all types of delays such as, but not limited to, Contractor/Subcontractor delays, adverse weather delays, strikes, procurement delays, fabrication delays, etc.

C. Contractor shall be responsible for all costs associated with the preparation of Time Impact Evaluations, and the process of incorporating them into the current schedule update. The Contractor shall provide CLPCCD with 4 copies of each TIE.

D. Once agreement has been reached on a TIE, the Contract Times will be adjusted accordingly. If agreement is not reached on a TIE, the Contract Times may be extended in an amount CLPCCD allows, and the Contractor may submit a claim for additional time claimed by Contractor.

1.11 TIME EXTENSIONS

A. The Contractor is responsible for requesting time extensions for time impacts that, in the opinion of the Contractor, impact the critical path of the current schedule update. Notice of time impacts shall be given in accord with Articles 1.12 and 1.15 of Contract Document General Conditions.

B. Where an event for which CLPCCD is responsible impacts the projected Substantial Completion date, the Contractor shall provide a written mitigation plan, including a schedule diagram, which explains how (e.g., increase crew size, overtime, etc.) the impact can be mitigated. The Contractor shall also include a detailed cost breakdown of the labor; equipment and material the Contractor would expend to mitigate CLPCCD caused time impact. The Contractor shall submit its mitigation plan to CLPCCD within fourteen (14) calendar days from the date of discovery of said impact. The Contractor is responsible for the cost to prepare the mitigation plan.

C. Failure to request time, provides TIE, or provides the required mitigation plan will result in Contractor waiving its right to a time extension and cost to mitigate the delay.

D. No time will be granted under this Contract for cumulative effect of changes.

E. CLPCCD will not be obligated to consider any time extension request unless requirements of Contract Documents are complied with.

F. Failure of the Contractor to perform in accordance with the current schedule update shall not be excused by submittal of time extension requests.

G. If the Contractor does not submit a TIE within the required fourteen (14) calendar days for any issue, it is mutually agreed that the Contractor does not require a time extension for said issue.

1.12 SCHEDULE REPORTS

A. Submit four (4) copies of the following reports with the Initial CPM Schedule, the Original CPM Schedule, and each monthly update.

B. Required Reports:

1. Two (2) activity-listing reports: one sorted by activity number and one by total float. These reports shall also include each activity's early/late and actual start and finish dates, original and remaining duration, float, responsibility code and the logic relationship of activities.
2. Cost report sorted by activity number including each activity's associated cost, percentage of Work accomplished, earned value to-date, previous payments and amount earned for current update period.
3. Schedule plots presenting time scaled network diagram showing activities and their relationships with the controlling operations or critical path clearly highlighted.
4. Cash flow report calculated by early start, late start and indicating actual progress. Provide an exhibit depicting this information in graphic form.

C. Furnish CLPCCD with electronic report files containing all Microsoft Project .mpp or Primavera .xer schedule files along with report files.

1.13 PROJECT STATUS REPORTING

A. In addition to submittal requirements for CPM scheduling identified in this Section, Contractor shall provide a monthly project status report (i.e., written narrative report) to be submitted in conjunction with each CPM Schedule as specified herein. Status reporting shall be in form specified below.

B. Contractor shall prepare monthly written narrative reports of status of Project for submission to CLPCCD. Written status reports shall include:

1. Transmittal letter
2. Work completed during the period, percent complete of activities
3. Identification of unusual conditions or restrictions regarding labor, equipment or material: including multiple shifts, 6-day work weeks, specified overtime or work at times other than regular days or hours
4. Description of the current critical path
5. Changes to the critical path and scheduled completion date since the last schedule submittal
6. Description of problem areas
7. Current and anticipated delays:

    a. Cause of delay
    b. Impact of delay on other activities, milestones and completion dates
    c. Corrective action and schedule adjustments to correct the delay

8. Contractor may include any other information pertinent to status of Project. Contractor shall include additional status information requested by CLPCCD at no additional cost.
9. Status reports, and the information contained therein, shall not be construed by the Contractor as claims, notice of claims, notice of delay, or requests for changes or compensation.

1.14 WEEKLY SCHEDULE REPORT

A. At the Weekly Progress Meeting, the Contractor shall provide and present a time scaled four (4) week schedule one (1) week behind and three (3) week look ahead schedule that is based and correlated by activity number to the current schedule (i.e., Initial, Original CPM, or Schedule Update).

1.15 DAILY CONSTRUCTION REPORTS

A. On a daily basis, Contractor shall submit a daily activity report to CLPCCD for each workday, including weekends and holidays, when worked. Contractor shall develop the daily construction reports on a computer generated database capable of sorting daily Work, manpower and man-hours by Contractor, Subcontractor, area, sub area, and change order work. Upon request of CLPCCD, furnish computer disk of this database. Obtain CLPCCD's written approval of daily construction report database format prior to implementation. Include in report:

1. Project name and Project number.
2. Contractor's name and address.
3. Weather, temperature and any unusual site conditions.
4. Brief description and location of the day's scheduled activities and any special problems and accidents, including Work of Subcontractors. Descriptions shall be referenced to CPM scheduled activities.
5. Worker quantities for its own Work force and for Subcontractors of any tier.
6. Equipment, other than hand tools, utilized by Contractor and Subcontractors.

1.16 PERIODIC VERIFIED REPORTS

A. The Contractor shall complete and submit the Final Verified Report required by DSA. In addition to other conditions precedent to Final Payment, the Contractor's completion and submission of the Final Verified Report is an express condition precedent to the District's obligation to make the Final Payment. In addition to completion and submission of the Final Verified Report, as a material obligation under the Contract Documents, the Contractor shall comply all DSA requests for reports or other data relating to the Work, the status thereof or conformity of the Work to the Contract Documents.

PART 2 - PRODUCTS
Not applicable to this section.

PART 3 - EXECUTION
Not applicable to this section.

END OF SECTION

SECTION 01 3300

SUBMITTAL PROCEDURES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes administrative and procedural requirements for submitting Shop Drawings, Product Data, Samples, and other submittals including:

1. Procedures
2. Schedule of Shop Drawing and Sample Submittals
3. Safety Plan
4. Progress Schedule
5. Product Data
6. Shop Drawings
7. Samples
8. Quality Control Submittals
9. Design Data
10. Test Reports
11. Certificates
12. Manufacturers' Instructions
13. Machine Inventory Sheets Operations and Maintenance Manuals Computer Programs
14. Project Record Documents
15. LEED Submittals

1.3 RELATED SECTIONS

A. Section 01 1100: Summary of Work.

B. Section 01 2600: Contract Modification Procedures.

C. Section 01 3200: "Progress Schedules and Reports" for submitting schedules and reports, including Contractor's Construction Schedule and the Submittals Schedule.

D. Section 01 7000: Contract Closeout

E. Section 01 7800: Project Record Documents.

1.4 DEFINITIONS

A. Action Submittals: Written and graphic information that requires Architect's responsive action.

B. Informational Submittals: Written information that does not require Architect's responsive action. Submittals may be rejected for not complying with requirements.

1.5 SUBMITTAL PROCEDURES

A. General: Electronic copies of CAD Drawings of the Contract Drawings are always through Architect for Contractor's use in preparing submittals. Files are used as background use only.

B. Coordination: Coordinate preparation and processing of submittals with performance of construction activities.

1. Coordinate each submittal with fabrication, purchasing, testing, delivery, other submittals, and related activities that require sequential activity.
2. Coordinate transmittal of different types of submittals for related parts of the Work so processing will not be delayed because of need to review submittals concurrently for coordination.

a. Architect reserves the right to withhold action on a submittal requiring coordination with other submittals until related submittals are received.

C. Submittals Schedule: Comply with requirements in Division 1 Section "Construction Progress Documentation" for list of submittals and time requirements for scheduled performance of related construction activities.

D. Processing Time: Allow enough time for submittal review, including time for resubmittals, as follows. Time for review shall commence on Construction Manager's receipt of submittal. No extension of the Contract Time will be authorized because of failure to transmit submittals enough in advance of the Work to permit processing, including resubmittals.

1. Initial Review: Allow 15 work days for initial review of each submittal. Allow additional time if coordination with subsequent submittals is required. Construction Manager will advise Contractor when a submittal being processed must be delayed for coordination.
2. Sequential Review: Where sequential review of submittals by Architect's consultants, Owner, or other parties is indicated, allow 21 days for initial review of each submittal.

E. Submit at own expense, a minimum of two (2) printed sets or copies and one (1) electronic PDF set- Schedule of Shop Drawing and Sample Submittals, Safety Plans, Progress Schedule, Product Data, Shop Drawings, Samples, Quality Control Data, Machine Inventory Sheets, Operations and Maintenance Manuals, Computer Programs, and Project Record Documents required by the Contract Documents.

F. Transmit each item with a standard letter of transmittal in form approved by Construction Manager.

G. Identify project, Contractor, subcontractor, major supplier, pertinent drawing sheet and detail number, and specification section number as appropriate. Provide space for Contractor, Construction Manager and Architect/Engineer review stamps.

H. Where manufacturer's standard drawings or data sheets are used, they shall be marked clearly to show those portions of the data, which are applicable to this project.

I. Submit Shop Drawings, Samples and other submittals to Construction Manager for review and approval by Architect/Engineer in accordance with accepted schedule of Shop Drawings and Samples submittals. If no such schedule is agreed upon, then all Shop Drawing, Samples and product data submittals shall be completed within ninety (90) days after receipt of Notice to Proceed from CLPCCD.

J. The data shown on the Shop Drawings shall be complete with respect to quantities, dimensions, specified performance and design criteria, materials and similar data to show Architect/Engineer the materials and equipment Contractor proposes to provide and to enable Architect/Engineer to review the information for the limited purposes specified below. Samples shall be identified clearly as to material, supplier, pertinent data such as catalog numbers and the use for which it is intended and otherwise as Architect/Engineer may require enabling Architect/Engineer to review the submittal. The number of each Sample to be submitted will be as specified in the Specifications.

K. At the time of each submission, Contractor shall give Construction Manager, Architect/Engineer, and Inspector specific written notice of all variations, if any; that the Shop Drawing or Sample submitted may have from the requirements of the Contract Documents, and the reasons therefore. This written notice shall be in a written communication separate from the submittal. In addition, Contractor shall cause a specific notation to be made on each Shop Drawing and Sample submitted to Construction Manager for review and approval of each such variation by Architect/Engineer. The Architect/Engineer may make adjustments to submittals that may result in changes to the contract. The appropriate change order request should be prepared by the Contractor within ten (10) days of receipt of submittals.

L. If CLPCCD accepts deviation, CLPCCD shall issue appropriate Contract Modification.

M. Submittal coordination and verification is responsibility of Contractor; this responsibility shall not be delegated in whole or in part to subcontractors or suppliers. Before submitting each Shop Drawing or Sample, Contractor shall have determined and verified:

1. All field measurements, quantities, dimensions, specified performance criteria, installation requirements, materials, catalog numbers and similar information with respect thereto;
2. All materials with respect to intended use, fabrication, shipping, handling, storage, assembly and installation pertaining to the performance of the Work; and
3. All information relative to Contractor's sole responsibilities and of means, methods, techniques, sequences and procedures of construction and safety precautions and programs incident thereto.

N. Contractor shall also have reviewed and coordinated each Shop Drawing or Sample with other Shop Drawings and Samples and with the requirements of the Work and the Contract Documents.

O. Contractor's submission to Construction Manager of a Shop Drawing or Sample submittal will constitute Contractor's representation that it has satisfied its obligations under the Contract Documents, and as set forth immediately above, with respect to Contractor's review and approval of that submittal.

P. Designation of work "by others", if shown in submittals, shall mean that work will be responsibility of Contractor rather than subcontractor or supplier who has prepared submittals.

Q. After review by Architect/Engineer of each of Contractor's submittals, one electronic set will be returned to Contractor with actions defined as follows:

1. NO ACTION TAKEN – Submittal is unreviewed.
2. NO EXCEPTIONS TAKEN - Accepted subject to its compatibility with future submittals and additional partial submittals for portions of the work not covered in this submittal. Does not constitute approval or deletion of specified or required items not shown on the submittal.
3. MAKE CORRECTIONS NOTED (NO RESUBMISSIONS REQUIRED) - Same as 2. above, except that minor corrections as noted shall be made by Contractor.
4. REVISE AND RESUBMIT - Rejected because of major inconsistencies or errors which shall be resolved or corrected by Contractor prior to subsequent review by Architect/Engineer.
5. REJECTED (RESUBMIT) - Submitted material does not conform to Plans and Specifications in major respect, i.e.: wrong size, model, capacity, or material.

R. It is considered reasonable that Contractor shall make a complete and acceptable submittal at least by second submission.

1. CLPCCD reserves the right to deduct monies from payments due Contractor to cover additional costs of Architect's/Engineer's review beyond the second submission. Illegible submittals will be rejected and returned to Contractor for resubmission.

S. Favorable review will not constitute acceptance by CLPCCD or Architect/Engineer of any responsibility for the accuracy, coordination and completeness of the submittals. Accuracy, coordination, and completeness of Submittals shall be sole responsibility of Contractor, including responsibility to back check comments, corrections, and modifications from CLPCCD's or Architect's/Engineer's review before fabrications. Submittals may be prepared by Contractor, subcontractors, or suppliers, but Contractor shall ascertain that submittals meet requirements of Contract Documents, while conforming to structural space and access conditions at point of installation. Architect/Engineer's review will be only to determine if the items covered by the submittals will, after installation or incorporation in the Work, conform to the information given in the Contract Documents and be compatible with the design concept of the completed Project as a functioning whole as indicated by the Contract Documents. Favorable review of submittal, method of work, or information regarding materials and equipment Contractor proposes to furnish shall not relieve Contractor of responsibility for errors therein and shall not be regarded as assumption of risks or liability by Architect/Engineer or CLPCCD, or any officer or employee thereof, and Contractor shall have no claim under Contract on account of failure or partial failure or inefficiency or insufficiency of any plan or method of work or material and equipment so accepted. Favorable review shall be considered to mean merely that Architect/Engineer or CLPCCD has no objection to Contractor using, upon his own full responsibility, plan or method of work proposed, or furnishing materials and equipment proposed.

T. Architect's/Engineer's review will not extend the means, methods, techniques, sequences or procedures of construction or to safety precautions or programs incident thereto. The review and approval of a separate item as such will not indicate approval of the assembly in which the item functions.

U. Submit complete initial submittal for those items where required by individual specification Sections. Complete submittal shall contain sufficient data to demonstrate that items comply with Specifications, shall meet minimum requirements for submissions cited in technical specifications, shall include motor data and seismic anchorage certifications, where required, and shall include necessary revisions required for equipment other than first named. If Contractor submits incomplete initial submittal, when complete submittal is required, submittal may be returned to Contractor without review.

V. It shall be Contractor's responsibility to copy, conform and distribute reviewed submittals in sufficient numbers for Contractor's files, subcontractors and vendors.

W. After Architect/Engineer review of submittal, revise and resubmit as required. Identify changes made since previous submittal.

1. Begin no fabrication or work, which require submittals until return of submittals not requiring resubmittal.

2. Normally, submittals will be processed and returned to Construction Manager within fifteen (15) working days of receipt by Architect. The processing time spent to review submittals by Construction Manager shall be in addition to the fifteen (15) days.
3. Distribute copies of reviewed submittals to concerned persons. Instruct recipients to promptly report any inability to comply with provisions.

1.6 SCHEDULE OF SHOP DRAWING, DSA DEFERRED APPROVAL SUBMITTALS AND SAMPLE SUBMITTALS

A. Submit preliminary Schedule of Shop Drawing and Sample Submittals as required by General Conditions. Submit two (2) copies and one (1) electronic PDF of final and accepted schedule of submittals of shop drawings and samples as required by General Conditions, and in no event later than thirty (30) days following Notice of Award.

B. Schedule of Shop Drawing and Sample Submittals will be used by Architect/Engineer to schedule their activities relating to review of submittals. Schedule of submittals shall indicate a spreading out of submittals and early submittals of long lead-time items and of items, which require extensive review.

C. Schedule of Shop Drawing and Sample Submittals shall be reviewed by Construction Manager and shall be revised and resubmitted until accepted by Construction Manager.

D. DSA Deferred Approval Submittals shall be prepared for review by the Architect/Engineer within 30 days of receipt of Notice to Proceed. Contractor shall promptly make corrections to documents for Architect to submit to DSA for approval. Contractor shall have the sole responsibility for obtaining DSA approval via the Architect's office for all deferred approval submittals in a timely manner. There will be no time extensions granted for delay in obtaining such approval.

1.7 SAFETY PLAN

A. Submit one (1) copies and one (1) electronic PDF of Safety Plan specific to this Contract to Construction Manager within fifteen (15) calendar days after Start Date of the Contract Time.

B. No on-site work shall be started until Safety Plan has been reviewed and accepted by CLPCCD. Acceptance of Safety Plan shall not affect Contractor's responsibility for maintaining a safe working place and instituting safety programs in connection with project in full compliance with local, state and federal regulations.

1.8 Progress SCHEDULE

A. Schedule all items requiring Architect action for submission during first 25 percent of construction period.

B. See Section 01 3200 “Progress Schedules and Reports” for schedule and report requirements.

C. Submit (3) print copies, one (1) electronic report file in PDF format, and either Microsoft Project .mpp or Primavera .xer schedule program files:

1. Initial CPM Schedule at the Pre-construction Conference.
2. Original CPM Schedule within thirty (30) days of Notice to Proceed (NTP).
3. Adjustments to the CPM Schedule as required.
4. CPM Schedule updates monthly, five (5) days prior to monthly progress meeting.

D. Submit three (3) copies and one (1) electronic PDF copy of the reports listed in Section 01 3200 “Progress Schedules and Reports” with:

1. Initial CPM Schedule
2. Original CPM Schedule
3. Each monthly Schedule update
4. Each weekly three (3) week look ahead Schedule

E. Progress Schedules and Reports shall be submitted electronically, in addition to hard copies as specified above.

1.9 QUALITY CONTROL SUBMITTALS

A. Design Data: Not applicable.

B. Test Reports: Three (3) copies minimum. One (1) copy will be marked with Architect's/Engineer's review comments and returned to Contractor.

1. Indicate that material or product conforms to or exceeds specified requirements.
2. Reports may be from recent or previous tests on material or product, but must be acceptable to Construction Manager. Comply with requirements of each individual specification Section.

C. Certificates: Three (3) copies minimum. One (1) copy will be marked with Architect's/Engineer's review comments and returned to Contractor.

1. Indicate that material or product conforms to or exceeds specified requirements.
2. Submit supporting reference data, affidavits, and certifications as appropriate.
3. Certificates may be recent or from previous test results on material or product, but must be acceptable to Construction Manager.

D. Manufacturers' Instructions: Three (3) copies minimum. One (1) copy will be marked with Architect's/Engineer's review comments and returned to Contractor.

1. Include manufacturer's printed instructions for delivery, storage, assembly, installation, startup, adjusting, and finishing.
2. Identify conflicts between manufacturer's instructions and Contract Documents.

1.10 COMPUTER PROGRAMS

A. When any equipment requires operation by computer programs, submit copy of program on CD(s) plus all user manuals and guides for operating the programs and making changes in the programs for upgrading and expanding the databases. Provide required licenses to CLPCCD at no additional cost.

1. Include at least three (3) years prepaid software license renewals, which includes software upgrades and updates.

1.11 PROJECT RECORD DOCUMENTS

A. Submit one copy of each of the Project Record Documents listed in Section 01 7000 Contract Closeout.

1.12 DELAY OF SUBMITTALS

A. Delay of submittals by Contractor is considered avoidable delay. Liquidated damages incurred because of late submittals will be assessed to the Contractor.

PART 2 - PRODUCTS

2.1 SUBMITTALS

A. Within fifteen (15) calendar days after Start Date of the Contract Time submit two (2) copies and one (1) electronic PDF of complete list of substitutions of major products proposed for use, with name of manufacturer, trade name, and model number of each product.

B. Contractor shall be responsible for and make all submissions.

1. Submit items specified herein to Architect and Construction Manager.
2. Submit all submittals through the Construction Manager's Electronic Submittal Program.
3. Identify each transmittal using the 6-digit specification number, i.e., metal handrails might be numbered 05 5000, along with an individual submittal number for each section number. Submittal numbers shall be sequential. If returning submittal "12" for re-submission, second submission would be identified as "12A". Should submittal be rejected multiple times (12b, 12c, etc), the Contractor may be required to reimburse the Owner/Architect for labor to review subsequent submissions.
4. Develop, for maintenance by the Construction Manager, a schedule of all submittals and their status. Refer to Paragraph 1.3 below. The schedule will be reviewed each week at the project meeting.

C. Transmittals, shop drawings, or samples submitted to Architect shall have the Contractor's stamp on it with his signature and be marked "approved." Contractor's stamp on these items indicates that Contractor has performed the following:

1. Verified field dimensions and quantities.
2. Verified field construction criteria, materials, catalog numbers and similar data.
3. Reviewed and coordinated submittal data with requirements of the Work and the Contract Documents.
4. ITEMS NOT STAMPED BY THE CONTRACTOR WILL BE RETURNED UNREVIEWED.

D. Indicate any item, component, material or portion of Work, which deviates from Contract Documents. Unless such departures are accepted as indicated in paragraph "Review" below, such departures will not be permitted.

E. Make submittals sufficiently in advance of data required to allow Architect reasonable time for review and additional resubmission and review cycles if necessary.

1. Items submitted without Contractor's review stamp will be returned, without action, for resubmission.
2. Items not submitted in accordance with provisions of this Section will be returned, without action, for resubmission.
3. Submissions on items not approved for use by specifications or addenda will be rejected.
4. Drawings transmitted by other than the Prime Contractor will be returned to the Prime Contractor without action of any kind. Drawings will not be returned to subcontractors.

2.2 SUBMITTALS – PRODUCT DATA

A. For products specified only by reference standards, give manufacturer, trade name, model or catalog designation, and reference standards.

B. Tabulate products by specification section number.

C. Supplemental Data:

1. Submit number of copies, which Contractor requires, plus three (3) copies, which will be retained by Construction Manager.
2. Mark each copy to identify applicable products, models, options, and other data. Supplement manufacturer's standard data to provide information unique to Project.

D. Provide copies for Project Record Documents described in Section 01 7000 Contract Closeout.

2.3 SUBMITTALS - SHOP DRAWINGS

A. Identify drawings with manufacturer, item, use, type, project designation, specification section or drawing detail reference.

B. Minimum Sheet Size: 8-1/2 inches by 11 inches. All others: Multiples of 8-1/2 inches by 11 inches, 34 inches by 44 inches maximum.

C. For 8-1/2 inch by 11 inch and 11 inch by 17-inch sheets, submit number of copies, which contractor requires plus three (3) copies, which will be retained by Construction Manager.

D. For 17 inch by 22 inch through 34 inch by 44-inch sheets, submit one [1] electronic and a minimum of three [3] prints. After review, reproduce and distribute.

E. Original sheet or reproducible transparency will be marked with Architect's/Engineer's review comments and returned to Contractor.

F. Each sheet/copy must include project name and project number and bid number on all sheets.

G. Mark each copy to identify applicable Products, models, options, and other data; supplement manufacturers' standard data to provide information unique to Work.

H. Include manufacturers' installation instructions when required by specification section.

I. Submit a copy of the Shop Drawing Transmittal Form with each submittal and resubmittal.

2.4 SUBMITTALS - SAMPLES

A. Identify samples with manufacturer's name, item, use, type, project designation, specification section or drawing detail reference, color, range, texture, finish and other pertinent data.

1. Submit samples to illustrate functional and aesthetic characteristics of Product, with integral parts and attachment devices. Coordinate submittal of different categories for interfacing work.

B. Submit full range of manufacturers' standard colors, textures, and patterns for Construction Manager's selection.

C. Submit a minimum of three (3) samples unless otherwise specified in the construction documents.

D. Sizes: Unless otherwise specified, provide the following:

1. Paint Chips: Manufacturers' standard

2. Flat or Sheet Products: Minimum 6 inches square, maximum 12 inches square
3. Linear Products: Minimum 6 inches, maximum 12 inches long
4. Bulk Products: Minimum 1 pint, maximum 1 gallon

E. Full size samples may be used in Work upon approval.

F. Mock-ups:

1. Erect field samples and mock-ups at Project site in accordance with requirements of Specification sections.
2. Modify or make additional field samples and mock-ups as required to provide appearance and finishes approved by Construction Manager.
3. Approved field samples and mock-ups may be used in Work upon approval.

G. Architect may, at his option, retain samples for comparison purposes until completion of Work.

1. Samples will be returned or may be used in the Work unless the technical section specifically indicates otherwise.
2. Remove samples when directed.
3. Pay all costs of furnishing or constructing, and removing samples.

H. Resubmit samples of rejected items.

I. Performance and Design Criteria: Where professional design services or certifications by a design professional are specifically required of Contractor by the Contract Documents, provide products and systems complying with specific performance and design criteria indicated.

1. If criteria indicated are not sufficient to perform services or certification required, submit a written request for additional information to Architect.

PART 3 - EXECUTION

3.1 CONTRACTOR'S REVIEW

A. Review each submittal and check for coordination with other Work of the Contract and for compliance with the Contract Documents. Note corrections and field dimensions. Mark with approval stamp before submitting to Architect and Construction Manager.

B. Approval Stamp: Stamp each submittal with a uniform, approval stamp. Include Project name and location, submittal number, Specification Section title and number, name of reviewer, date of Contractor's approval, and statement certifying that submittal has been reviewed, checked, and approved for compliance with the Contract Documents.

3.2 ARCHITECT REVIEW

A. General: Architect and Construction Manager will not review submittals that do not bear Contractor's approval stamp and will return them without action.

B. Action Submittals: Architect and Construction Manager will review each submittal, make marks to indicate corrections or modifications required, and return it. Architect and Construction Manager will stamp each submittal with an action stamp and will mark stamp appropriately to indicate action taken.

C. Reproduce and distribute submittals that the Architect reviews and stamps as follows, to indicate the action taken:

1. Reviewed: Where submittal is marked "Reviewed," that part of the Work covered by the submittal may proceed provided it complies with requirements of the Contract Documents; final acceptance will depend upon that compliance.
2. Reviewed -- Additional Information Required: Where submittal is marked "Reviewed -- Additional Information Required," the information submitted has been reviewed and approved as noted. However, additional information as noted and/or required by Contract Documents needs to be submitted.
3. Make Corrections As Noted: When submittal is marked "Furnish As Corrected," that part of the Work covered by the submittal may proceed provided it complies with notations or corrections on the submittal and requirements of the Contract Documents; final acceptance will depend on that compliance.
4. Submit Specified Item: When submittal is marked "Revise and Resubmit," do not proceed with that part of the Work covered by the submittal, including purchasing, fabrication, delivery, or other activity. Revise or prepare a new submittal in accordance with the notations; resubmit without delay. Repeat if necessary to obtain a different action mark.

    a. Do not permit submittals marked "Revise and Resubmit" to be used at the Project site, or elsewhere where Work is in progress.

5. Rejected: When submittal is marked "Rejected," information submitted is not in compliance with Contract Documents. Resubmit submittal as required by Contract Documents.

D. Contractor shall retain 1 copy of each "Reviewed," "Reviewed -- Additional Information Required" or "Furnish as Corrected" submittal on file at the job site.

E. Architect shall retain 1 copy of each "Reviewed," "Reviewed -- Additional Information Required" or "Furnish as Corrected" submittal in the project file.

F. Contractor shall resubmit items stamped "Revise and Resubmit" or "Rejected" by Architect.

1. Provide a print of previous drawing with resubmission for comparison.
2. Add letter suffix to previous transmittal number, to indicate resubmission.

3. It shall be the Contractor's responsibility to assure that previously approved documents are destroyed when they are superseded by a resubmittal.

G. Architect review is general and does not:

1. Permit departure from Contract Documents.
2. Relieve Contractor from responsibility for errors in detail, in dimensions or related items.
3. Approve departure from previous instructions or details.
4. Relieve Contractor of the responsibility to provide all components, wiring, etc., required to make item operable or usable.
5. Imply acceptance of items for which no data is submitted.

H. For items constituting a departure from Contract Documents see Section 01 2500.

I. Reviewed samples submitted or constructed and approved by Architect constitute criterion for judging completed work. Finish work or items not equal to samples will be rejected.

J. Start of work which requires submittals, prior to return of submittals with Architect or Owner's stamp indicating review and approval is at Contractor's risk.

3.3 DISTRIBUTION

A. Contractor shall copy and distribute all "Reviewed," "Reviewed -- Additional Information Required" or "Furnish as Corrected" submittals, including one copy to the Owner.

END OF SECTION

SECTION 01 4100

REGULATORY REQUIREMENTS

PART 1 - GENERAL

1.1 SUMMARY

A. This section includes regulatory requirements applicable to Contract.

1.2 REFERENCES TO REGULATORY REQUIREMENTS

A. Codes, laws, ordinances, rules and regulations referred to shall have full force and effect as though printed in full in these specifications.

B. Conform to referenced codes, laws, ordinances, rules and regulations, which are in effect on date of receipt of bids.

1.3 CODES

A. Codes, which apply to Contract, include, but are not limited to, the following:

1. 2019 California Building Code (Part 2, Title 24, C.C.R.)
2. 2019 California Electrical Code (Part 3, Title 24, C.C.R.)
3. 2019 California Mechanical Code (Part 4, Title 24, C.C.R.)
4. 2019 California Plumbing Code (Part 5, Title 24, C.C.R),
5. 2019 State Elevator Safety Regulations (Part 7, Title 24, C.C.R.)
6. 2019 California Fire Code (Part 9, Title 24, C.C.R.)
7. 2019 California Energy Code (Part 6, Title 24, C.C.R.)

1.4 LAWS, ORDINANCES, RULES AND REGULATIONS

A. During prosecution of Work to be done under Contract, comply with applicable laws, ordinances, rules and regulations, including, but not limited to, the following:

B. Federal

1. Americans With Disabilities Act
2. 29 CFR, Section 1910.1001, Asbestos
3. 40 CFR, Subpart M, National Emission Standards for Asbestos
4. Executive Order 11246

C. State of California

1. California Code of Regulations, Titles 5, 8, 19, 21, 24
2. California Education Code
3. California Public Contract Code

4. California Health and Safety Code
5. California Government Code
6. California Labor Code
7. California Civil Code
8. California Code of Civil Procedure
9. CPUC General Order 95, Rules for Overhead Electric Line Construction
10. CPUC General Order 128, Rules for Construction of Underground Electric Supply and Communications Systems

D. State of California Agencies

1. Bay Area Air Quality Management District (BAAQMD / www.baaqmd.gov)
2. State and Consumer Services Agency
3. Department of General Services
4. Division of the State Architect Office of the State Fire Marshall Office of Public School Construction

E. Local Agencies:

1. City of Livermore
2. Alameda County

1.5 COMPLIANCE WITH AMERICANS WITH DISABILITIES ACT

A. Contractor acknowledges that, pursuant to the Americans with Disabilities Act (ADA), programs, services and other activities provided by a public entity to the public, whether directly or through a contractor, must be accessible to the disabled public. Contractor shall provide the services specified in this Agreement in a manner that complies with the ADA and any and all other applicable federal, state and local disability rights legislation. Contractor agrees not to discriminate against disabled persons in the provision of services, benefits or activities provided under this Agreement and further agrees that any violation of this prohibition on the part of Contractor, its employees, agents or assigns shall constitute a material breach of this Agreement.

PART 2 - –PRODUCTS
Not applicable.

PART 3 - –EXECUTION
Not applicable.

END OF SECTION

SECTION 01 4110

REGULATORY REQUIREMENTS HAZARDOUS WASTE

PART 1 - GENERAL

1.1 SUMMARY

A. This section includes regulatory requirements applicable to Contract work in connection with hazardous waste abatement and disposal, including, but not limited to, asbestos and asbestos containing materials, lead based paint, polychlorinated biphenyls, petroleum contaminated soils and materials, construction and demolition debris and any other hazardous substance or hazardous waste.

B. This section supplements Section 01 4100 and the work specific listings of applicable regulatory requirements elsewhere in the specifications.

C. Related Sections.

1. Section 01 4100: Regulatory Requirements.

1.2 REFERENCES TO REGULATORY REQUIREMENTS

A. Codes, laws, ordinances, rules, and regulations applicable to the Work shall have full force and effect as though printed in full in these specifications. Codes, laws, ordinances, rules, and regulations are not furnished to Contractor since Contractor is assumed to be familiar with their requirements. The listing herein of applicable codes, laws and regulations for hazardous waste abatement work is supplied to Contractor as a courtesy and shall not limit Contractor's responsibility for complying with all applicable laws, regulations or ordinances having application to the Work. Where conflict among the requirements or with these specifications exists, the most stringent requirements shall be used.

B. Contractor's work shall conform to all applicable codes, laws, ordinances, rules, and regulations that are in effect on date of receipt of bids.

1.3 LAWS, ORDINANCES, RULES AND REGULATIONS

A. During prosecution of Work under Contract, Contractor shall comply with applicable laws, ordinances, rules, and regulations, including, but not limited to, those listed below.

B. Federal:

1. Statutory Requirements:

a. Resource Conservation and Recovery Act, 42 U.S.C.. 6901 et seq.

b. Comprehensive Environmental Response, Compensation and Liability Act of 1980, as amended by the Superfund Amendments and Reauthorization Act of 1986,42 U.S. C" 9601 et seq.
c. Toxic Substances Control Act of 1976,15 U.S.C.. 2601 et seq.
d. Hazardous Materials Transportation Act of 1975, 49 U.S. C" 1801 et seq.
e. Clean Water Act, 33 U.S.C.. 1251 et seq.
f. Safe Drinking Water Act, 42 U.S. C.. 3001 et seq.
g. Clean Air Act, section 112, 42 U.S. C.. 7412
h. Occupational Safety and Health Act of 1970, 29 U.S.C.. 651 et seq.
i. Underground Storage Tank Law, 42 U.S. C.. 6991 et seq.
j. The Emergency Planning and Community Right to Know Act of 1986,42 U.S.C.. 11001 et seq. j.

2. Environmental Protection Agency (EPA):

a. 40 C.F.R. Parts. 260, 264, 265, 268, 270
b. 40 C.F.R. Parts 258 et seq.
c. 40 C.F.R. Part 761
d. 40 C.F.R. Parts 122-124

3. Occupational Safety and Health Administration (OSHA):

a. OSHA Worker Protection Standards, Title 29 CFR Part 1926.58, Construction Standards and 29 CFR 1910.1001 General Industry Standard
b. OSHA, 29 C. F. R. Part 1926.1101, Construction Standards for Asbestos
c. OSHA, Lead Exposure in Construction: Interim Final Rule, 29 C.F.R. 1926.62
d. National Emission Standard for Hazardous Air Pollutants, Title 40 CFR Part 61
e. Asbestos Hazardous Emergency Response Act, Title 40 C.F.R. 763

4. Department of Transportation:

a. Title 49 C.F.R. 173.1090
b. Title 49 C.F.R.172
c. Title 49 C.F.R. 173
d. DOT, HM 181 and MH126f

C. State of California Requirements:

1. Statutory Law:

a. The Carpenter-Presley-Tanner Hazardous Substance Account Act, Cal. Health & Saf. Cod~ 25300 et seq.
b. Health and Safety Cod~ 25359.4
c. Hazardous Waste Control Law, Health & Safety Code. 25100 § seq.
d. Porter Cologne Water Quality Control Act, Cal. Water Cod~ 13000 et seq.
e. Health and Safety Cod~ 25915-25924

f. Cal. Labor Code Chapter 6, including, without limitation, 6382, 6501.5-6501.9,6503.5, 9021.5, 9080
g. Cal. Bus. and Prof. Code, including without limitation, 7058.5, 7065.01, 7118.5. Underground Storage of Hazardous Substance Act,
h. Cal. Health & Saf. Cod~ 25280 § seq.
i. Petroleum Underground Storage Tank Cleanup, Health and Safety Cod~ 25299.10 et seq.
j. Safe Drinking Water and Toxic Enforcement Act of 1986, Health & Saf. Cod~ 25249.5 et seq. (Proposition 65)
k. Above Ground Petroleum Storage Act, Health and Safety Code. 25270 et seq.

2. Hazardous Materials Release Response Plans and Inventory, California Health and Safety Code Chapter 6.95.
3. Administrative Code and Regulations:

a. 22 C.C.R.. 6600 et seq.
b. Title 22 C.C.R.. Standards for Management of Hazardous and Extremely Hazardous Waste
c. DTSC Treatment Standard for PCB Wastes, Title 22 C.C.R.,. 66268.110
d. Cal OSHA Worker Protection Standards, Title 8 C.C.R.. 1529, 5208
e. Title 8 C. C. R.. 1532.1, Lead in Construction
f. 22 C.C.R.. 66999(b)
g. Title 23 C.C.R.. 2610 et seq.

4. Local Agency Requirements:

a. Bay Area Air Quality Management District, Fugitive Dust Rules
b. Bay Area Air Quality Management District Regulation 11-2-303
c. State Water Resource Control Board, General Construction Activity Stormwater Permit Requirements (Order 92-0S DWQ)

5. City Requirements:

a. Hayward Fire Department (www.haywardcal.us/fire_dept/fd.htm)
b. Ordinances

1.4 PERMITS

A. Contractor shall comply with, implement, or acknowledge effectiveness of all CLPCCD held permits, and initiate and cooperate in securing all required notifications or approvals therefore, including but not limited to permits affecting environmental work and the following:

1. BAAQMD, Permit to Excavate or Treat Contaminated Soil;
2. State Water Resources Control Board, General Construction Activity Stormwater Permit

PART 2 - PRODUCTS
Not used.

PART 3 - ÓEXECUTION
Not used.

END OF SECTION

SECTION 01 4113

ADDITIONAL REQUIREMENTS FOR DSA

PART 1 - GENERAL

1.1 DSA DEFERRED APPROVALS

A. Refer to Contract Drawings.

1.2 INSPECTION AND SUPERVISION

A. Supervision by DSA shall be in accordance with Section 4-334 of Part 1, Title 24, CCR.

B. District shall employ a full-time Project Inspector approved by DSA. The Project Inspector shall observe construction in accordance with Section 4-333(b) and 4-342 of Part 1, Title 24, CCR.

C. Reports: Project Inspector shall submit the following in accordance with DSA IR A-7.

1. Start of Project Report: Notify DSA of start of construction in accordance with Section 4-331 of Part 1, Title 24, CCR.
2. Semi-Monthly Reports: Comply with Section 4-337 of Part 1, Title 24, CCR.
3. Verified Reports: Comply with Section 4-336 of Part 1, Title 24, CCR.

D. Special Inspection Requirements:

1. Comply with Section 4-333(c) of Part 1, Title 24, CCR.
2. Special inspection costs are to be paid by the Owner.
3. Conduct special inspection as per DSA Structural Tests and Inspections Sheet (SSS 103-1).

1.3 TESTING LABORATORY REQUIREMENTS

A. Comply with Section 4-335 of Part 1, Title 24, CCR.

B. The Owner shall select the testing Laboratory approved by DSA, Architect, and Structural Engineer.

C. Sampling and testing shall be performed by properly qualified persons in accordance with American Society for Testing and Materials (ASTM) standards.

D. Conduct tests as per DSA Structural Tests and Inspections Sheet (SSS 103-1).

E. Submit one copy of test reports to DSA.

1.4 ADDENDA AND CHANGE ORDERS

A. Comply with Section 4-338 of Part 1, Title 24, CCR.

B. Comply with DSA IR A-6.

C. Obtain DSA approval for changes to code-regulated construction and inspection/testing functions prior to start of that work. Code-regulated construction refers to work that is regulated by code provisions applicable to public school construction, including those adopted by DSA Structural Safety (DSA/SS), DSA Access Compliance (DSA/AC) and State Fire Marshal (SFM).

D. Changes can be approved through either the change order *(CO)* process or preliminary change order (PCO) process. Comply with DSA IR A-6, Sub-paragraph 2.2 - Change Order Process and DSA IR A-6, Sub-paragraph 2.1 - Preliminary Change Order Process.

E. Do not begin any work under addendum or change order until required DSA written approval is obtained.

PART 2 - PRODUCTS

Not Applicable.

PART 3 - EXECUTION

Not Applicable.

END OF SECTION

SECTION 01 4200

REFERENCES AND DEFINITIONS

PART 1 - GENERAL

1.1 SUMMARY

A. This section includes reference standards, abbreviations, symbols, and definitions used in Contract Documents.

B. Full titles and edition dates are given in this section for standards cited in other sections of Specifications.

C. Material and workmanship specified by reference to number, symbol, or title of specific standard such as state standard, commercial standard, federal specifications, technical society, or trade association standard, or other similar standard shall comply with requirements of standards except when more rigid requirements are specified or required by applicable codes.

D. Standards referred to, except as modified herein, shall have full force and effect as though printed in the Contract Documents. Standards are not furnished to Contractor since manufacturers and trades involved are assumed to be familiar with their requirements.

1.2 REFERENCE TO STANDARDS AND SPECIFICATIONS OF TECHNICAL SOCIETIES; REPORTING AND RESOLVING DISCREPANCIES:

A. Reference to standards, specifications, manuals or codes of any technical society, organization or association, or to the laws or regulations of any governmental authority, whether such reference be specific or by implication, shall mean the latest standard, specification, manual, code or laws or regulations in effect at the time of opening of Bids, except as may be otherwise specifically stated in the Contract Documents.

B. If during the performance of the Work, Contractor discovers any conflict, error, ambiguity or discrepancy within the Contract Documents or between the Contract Documents and any provision of any such law or regulation applicable to the performance of the Work or of any such standard, specification, manual or code or of any instruction of any supplier, Contractor shall report it in writing at once to Inspector, with copies to Construction Manager and Architect, and Contractor shall not proceed with the Work affected thereby until consent to do so is given by the Construction Manager.

C. Except as otherwise specifically stated in the Contract Documents or as may be provided by Change Order, or supplemental instruction, the provisions of the Contract Documents shall take precedence in resolving any conflict, error, ambiguity, or discrepancy between the Contract Documents and:

1. The provisions of any such standard, specification, manual, code, or instruction (whether or not specifically incorporated by reference in the Contract Documents); or
2. The provisions of any such laws or regulations applicable to the performance of the Work (unless such an interpretation of the provisions of the Contract Documents would result in violation of such law or regulation).

D. No provision of any such standard, specification, manual, code or instruction shall be effective to change the duties and responsibilities of CLPCCD, Contractor, Construction Manager, or Architect/Engineer, or any of their subcontractors, consultants, agents, or employees, from those set forth in the Contract Documents, nor shall it be effective to assign to CLPCCD, Architect/Engineer, Construction Manager, or any of their consultants, agents or employees any duty or authority to supervise or direct the furnishing or performance of the Work or any duty or authority to undertake responsibility inconsistent with the provisions of the Contract Documents.

1.3 STANDARDS

A. ACI (American Concrete Institute)

1. Standard 318, Building Code Requirements for Reinforced Concrete

B. AISC (American Institute of Steel Construction

1. Specifications and Code of Standard Practice for Steel Buildings and Bridges

C. ANSI (American National Standards Institute, formerly American Standards Association)

1. Standard C2, NESC (National Electrical Safety Code)

D. ASTM (American Society for Testing and Materials)

1. *C31,* Making and Curing Concrete Test Specimens in the Field
2. *C42,* Obtaining and Testing Drilled Cores and Sawed Beams of Concrete
3. *C143,* Test Method for Slump of Portland Cement Concrete

E. IAPMO (International Association of Plumbing and Mechanical Officials)

F. ICC (International Code Council)

1. Refer to Section 01 4100 - Regulatory Requirements

G. NEMA (National Electric Manufacturer's Association)

H. NFPA (National Fire Protection Association)

1. Pamphlet 1, Fire Prevention Code
2. Pamphlet 13, Sprinkler Systems, Installation

3. Pamphlet 24, Private Fire Service Mains
4. Pamphlet 70, NEC (National Electric Code)
5. Pamphlet 71, Signaling Systems, Central Station
6. Pamphlet 80, Fire Doors and Windows
7. Pamphlet 101, Life Safety Code

I. UL (Underwriters' Laboratories, Inc.)

1.4 ABBREVIATIONS

A. Following abbreviations may be used in Contract Documents:

1. AAP Affirmative Action Program
2. ACI American Concrete Institute
3. ADA American Disabled Act
4. AISC American Institute of Steel Construction
5. ANSI American National Standards Institute (formerly American Standards Association)
6. ASI Architect's Supplemental Instructions
7. ASTM American Society for Testing and Materials
8. BIL Basic Insulation Level
9. Cal/OSHA California Occupational Safety and Health Administration
10. CCD Construction Change Directive
11. CCR California Code of Regulations
12. CFR Code of Federal Regulations
13. CO Change Order
14. CPUC California Public Utilities Commission
15. CPM Critical Path Method
16. DSA Division of State Architect
17. HVAC Heating, Ventilating and Air Conditioning
18. IAPMO International Association of Plumbing and Mechanical Officials
19. ICBO International Conference of Building Officials
20. I.D. Identification
21. JATC Joint Apprenticeship Training Committee
22. JV Joint Venture
23. Kw Kilowatt
24. LBE Local Business Enterprise
25. MBE Minority Business Enterprise
26. M/WBE Minority and Woman-Owned Business Enterprise
27. ml milliliter
28. mm millimeter
29. NEC National Electric Code
30. NEMA National Electric Manufacturer's Association National Electrical Safety Code
31. NFPA National Fire Protection Association
32. PM Preventive Maintenance
33. PR Proposal Request

34. RFI Request for Information
35. RFS Request for Substitution
36. SFM State of California, Office of State Fire Marshal
37. CBC California Building Code
38. CFC California Fire Code
39. UL Underwriters' Laboratories, Inc.
40. CMC California Mechanical Code
41. CPC California Plumbing Code
42. WOBE Woman-Owned Business Enterprise
43. WMBE Woman/Minority Business Enterprise

B. Additional abbreviations, used only on drawings, are listed thereon.

1.5 SYMBOLS

A. Symbols, used only on Drawings, are shown thereon.

1.6 DEFINITIONS

A. Wherever any of the words or phrases defined below, or a pronoun used in place thereof, is used in any part of the Contract Documents, it shall have the meaning here set forth:

1. **ADDENDA:** Written or graphic instruments issued prior to the opening of Bids, which clarify, correct, or change the bidding requirements or the Contract Documents. Addenda shall not include the minutes of the Pre-bid Conference and Site Visit.
2. **ADDITIVE BID:** The sum to be added to the Base Bid if the change in scope of work as described in Additive Bid is accepted by CLPCCD.
3. **AGREEMENT:** Agreement is the basic contract document that binds the parties to construction Work. Agreement defines relationships and obligations between CLPCCD and Contractor and by reference incorporates Conditions of Contract, Drawings, and Specifications and contains Addenda and all Modifications subsequent to execution of Contract.
4. **ALTERNATE**: Work added to or deducted from the Base Bid, if accepted by CLPCCD.
5. **APPROVED EQUAL**: Approved in writing by CLPCCD as being of equivalent quality, utility, and appearance.
6. **ARCHITECT or ARCHITECT/ENGINEER:** The person holding a valid California State Architect's license, whose firm has been designated within the Contract Documents as the Architect to provide architectural services on the project. Refer to Section 341, Part 1, Title 24, C. C. R.

a. When the Architect is referred to within the Contract Documents and no Architect has in fact been designated, then the matter shall be referred to CLPCCD. The term Architect shall be construed to include all its consultants retained for the project, as well as employees of the Architect. When the designated Architect is an employee of CLPCCD, his authorized representations on the project within the district will be included under the term Architect.

7. **BID**: The offer or proposal of the Bidder submitted on the prescribed form setting forth the prices for the Work to be performed.
8. **BIDDER**: One who submits a Bid.
9. **CLPCCD**: Chabot-Las Positas Community College District. Unless otherwise expressly indicated or required by the context of usage, the terms "District" and "Owner" as used in the Contract Documents shall be deemed references to CLPCCD.
10. **CLPCCD**-**FURNISHED**, **CONTRACTOR**-**INSTALLED**: Items furnished by CLPCCD at its cost for installation by Contractor at its cost under this Contract.
11. **CLPCCD REPRESENTATIVE**(S): The person or persons assigned by CLPCCD to be CLPCCD's representatives or, if so designated, agent(s) at the site.
12. **BY CLPCCD:** Work that will be performed by CLPCCD or its agents at the CLPCCD's expense.
13. **BY OTHERS:** Work that is outside scope of Work to be performed by Contractor under this Contract, which will be performed by CLPCCD, other contractors, or other means.
14. **CHANGE ORDER**: A written instrument prepared by CLPCCD and signed by CLPCCD and Contractor, stating their agreement upon all of the following:

    a. a change in the Work,
    b. the amount of the adjustment in the Contract Sum, if any, and
    c. the amount of the adjustment in the Contract Time, if any.
    d. As appropriate, change orders are subject to approval by the Division of the State Architect. Refer to section 4-338, Part 1, Title 24, California Code of Regulations.

15. **CONCEALED:** Work not exposed to view in the finished Work, including within or behind various construction elements.
16. **CONTRACT CONDITIONS:** Conditions of Contract define basic rights, responsibilities, and relationships of Contractor and CLPCCD and consists of two parts: General Conditions and Supplementary Conditions.

    a. General Conditions are general clauses, which are common to the CLPCCD Contracts.
    b. Supplementary conditions modify or supplement General Conditions to meet specific requirements for this Contract.

17. **CONSTRUCTION MANAGER:** CLPCCD's authorized representative, who shall represent CLPCCD in all matters relative to this Contract. Construction Manager may authorize agents and representatives to act in carrying out Construction Manager's duties, including a "Project Manager", to act under the authority of the Construction Manager. As CLPCCD's agent, the Construction Manager is the beneficiary of all contract obligations of Contractor to CLPCCD, including without limitation, all releases, and indemnities. Construction Manager shall not have any personal liability arising from this Contract or any activity there under and Contractor releases Construction Manager fully from all loss, cost, damage, expense or liability arising out of or connected with this Project, whether arising from contract, negligence or tort claims of all kinds.
18. **CONTRACT DOCUMENTS:** Contract Documents shall consist of the documents identified as the Contract Documents in Contract Agreement, plus all changes, addenda, and modifications thereto.
19. **CONTRACT MODIFICATION:** Either:

    a. a written amendment to Contract signed by Contractor and CLPCCD; or
    b. a Change Order; or
    c. a written directive for a minor change in the Work issued by CLPCCD.

20. **CONTRACT SUM:** The sum stated in the Agreement and, including authorized adjustments, the total amount payable by CLPCCD to Contractor for performance of the Work and the Contract Documents. (Also referred to as the CONTRACT PRICE.)
21. **CONTRACT TIMES:** The number or numbers of days or the dates stated in the Agreement (i) to achieve substantial completion of the Work or designated milestones and/or (ii) to complete the Work so that it is ready for final payment and is accepted.
22. **CONTRACTOR:** The person or entity identified as such in the Agreement and referred to throughout the Contract Documents as if singular in number and neuter in gender. The term "Contractor" means the Contractor or its authorized representative.
23. **CONTRACTOR'S EMPLOYEES:** Persons engaged in execution of Work under Contract as direct employees of Contractor, as subcontractors, or as employees of subcontractors.
24. **DATE OF SUBSTANTIAL COMPLETION:** Date of Substantial Completion of Work or designated portion thereof is date certified by Construction Manager when construction is sufficiently complete in accordance with Contract Documents for CLPCCD to occupy Work or designated portion thereof for its use for which it is intended.
25. **DAY:** One calendar day unless the word "day" is specifically modified to the contrary.
26. **DEDUCTIVE BID:** The sum to be subtracting to the Base Bid if the change in scope of work as described in Deductive Bid is accepted by CLPCCD.

27. **DEFECTIVE:** An adjective which, when modifying the word "Work", refers to Work that is unsatisfactory or unsuited for the use intended, faulty, or deficient, that it does not conform to the Contract Documents, or does not meet the requirements of any inspection, reference standard, test or approval referred to in the Contract Documents (including but not limited to approval of samples and "or equal" items), or has been damaged prior to final payment (unless responsibility for the protection thereof has been assumed by CLPCCD). Construction Manager is the judge of whether Work is defective.
28. **DRAWINGS:** The graphic and pictorial portions of Contract Documents, wherever located and whenever issued, showing the design, location, and dimensions of the Work, generally including plans, elevations, sections, details, schedules, and diagrams.
29. **ENGINEER:** Where referenced in the Contract Documents, the person holding a valid California State Engineer's license, whose firm has been designated (if any designated) within the Contract Documents as the Engineer to provide engineering services on the project. Refer to section 4-341, Part 1, Title 24, C.C.R.
30. **EQUAL:** Equal in opinion of Architect. Burden of proof of equality is responsibility of Contractor.
31. **EXPOSED:** Work exposed to view in the finished Work, including behind louvers, grilles, registers, and various other construction elements.
32. **FINAL ACCEPTANCE or FINAL COMPLETION:** All Work satisfactorily completed in accordance with Contract Documents. It includes, but is not limited to:

    a. All Systems having been tested and accepted as having met requirements of Contract Documents.
    b. All required instructions and training sessions having been given by Contractor.
    c. All as-built drawings and operations and maintenance manuals and Machine Inventory Sheets having been submitted by Contractor, reviewed by Architect/Engineer, and accepted by CLPCCD.
    d. All punch list work, as directed by CLPCCD, having been completed by Contractor.
    e. Generally, all work, except Contractor maintenance after Final Acceptance, having been completed to satisfaction of CLPCCD.

33. **FORCE-ACCOUNT:** Work directed to be performed without prior agreement as to lump sum or unit price cost thereof, and which is to be billed at cost for labor, materials, equipment, taxes, and other costs, plus a specified percentage for overhead and profit.
34. **FURNISH:** Supply only, do not install.
35. **INDICATED:** Shown or noted on the Drawings.

36. **INSPECTOR:** The person engaged by CLPCCD to inspect the workmanship, materials, or manner of construction of buildings or portions of buildings, to determine if such construction complies with the Contract Documents and applicable codes. The inspector is subject to approval by the Architect, CLPCCD and, as appropriate, Division of the State Architect, and he will report to CLPCCD. Refer to section 4-333 and section 4-342, Part 1, Title 24, California Code of Regulations. The terms "Inspector" and "Project Inspector" are used interchangeably in the Contract Documents.
37. **INSTALL:** Install or apply only, do not furnish.
38. **LATENT:** Not apparent by reasonable inspection, including but not limited to, the inspections and research required as a condition to bidding under the General Conditions.
39. **MATERIAL OR MATERIALS:** These words shall be construed to embrace machinery, manufactured articles, materials of construction (fabricated or otherwise), and any other classes of material to be furnished in connection with Contract, except where a more limited meaning is indicated by context.
40. **MILESTONE:** A principal event specified in Contract Documents relating to an intermediate completion date or time prior to Substantial Completion of all Work.
41. **MODIFICATION**: Same as Contract Modification.
42. **NOT IN CONTRACT:** Work that is outside the scope of work to be performed by Contractor under this Contract.
43. **NOTICE OF AWARD:** A written notice given by CLPCCD to lowest responsive, responsible bidder advising that Bidder's bid and other qualifying information is acceptable to CLPCCD, requiring Bidder to fulfill the requirements of Article 1.03 of Document 00600 General Conditions.
44. **NOTICE TO PROCEED:** A written notice given by CLPCCD to Contractor fixing the date on which the Contract Time will commence to run and on which contractor shall start to perform Contractor's obligations under the Contract Documents.
45. **OFF SITE:** Outside geographical location of the Project.
46. **OWNER**: Chabot Las Positas Community College District (CLPCCD).
47. **PROGRESS REPORT:** a periodic report submitted by Contractor to CLPCCD with progress payment invoices accompanying actual work accomplished to the Project Schedule. See Section 01310 Progress Schedules and Reports, Document 00600 General Conditions.
48. **PROJECT**: Total construction of which Work performed under this Contract may be whole or part.
49. **PROJECT MANUAL:** Project Manual consists of Bidding Requirements, Agreement, Bonds, Certificates, Contract Conditions, and Specifications. The Project Manual is deemed to include and incorporate all matters noted in any Addenda issued by or on behalf of the District during the bidding for the Work.
50. **PROJECT STABILIZATION AGREEMENT:** The Contractor or Subcontractor (CONTRACTOR) on this project accepts and agrees to be bound by the terms and conditions of the Chabot-Las Positas Project Stabilization Agreement , together with any and all amendments and supplements now existing or which are later made by executing the Letter of Assent.
51. **PROVIDE:** Furnish and install.

52. **REQUEST FOR INFORMATION (RFI):** A document prepared by Contractor, CLPCCD or Architect/Engineer requesting information from one of the parties regarding the Project or Contract Documents. The RFI system is also a means for CLPCCD and Architect to submit Contract Document clarifications or supplements to Contractor.
53. **RFI-REPLY:** A document consisting of supplementary details, instructions or information issued by the Architect/Engineer, which clarifies or supplements Contract Documents and with which Contractor shall comply. RFI-Replies do not constitute changes in Contract Sum or Contract Times except as otherwise agreed in writing by CLPCCD. RFI-Replies will be issued through the RFI administrative system.
54. **SAMPLES:** Physical examples of materials, equipment, or workmanship that are representative of some portion of the Work and which establish the standards by which such portion of the Work will be judged.
55. **SHOP DRAWINGS:** All drawings, diagrams, illustrations, schedules and other data or information which are specifically prepared or assembled by or for Contractor and submitted by Contractor to illustrate some portion of the work.
56. **SHOWN:** As indicated on Drawings.
57. **SITE:** The particular geographical location of Work performed pursuant to Contract, including staging areas, work areas, storage and lay down areas, access, and parking.
58. **SPECIFICATIONS:** The written portion of the Contract Documents consisting of requirements for materials, equipment, construction systems, standards and workmanship for the Work, and performance of related services; and are contained in Divisions 1 through 32.
59. **SPECIFIED:** As written in Specifications.
60. **SUBCONTRACTOR:** A person or entity who has a direct contract with Contractor to perform a portion of the Work at the site. The term "subcontractor" is referred to throughout the Contract Documents as if singular in number and neuter in gender and means a subcontractor or an authorized representative of the subcontractor. The term "subcontractor" does not include a separate contractor or subcontractors of a separate contractor.
61. **SUBSTANTIAL COMPLETION:** The Work (or a specified part thereof) has progressed to the point where, in the opinion of the Construction Manager and the Architect/Engineer as evidenced by a Certificate of Substantial Completion, it is sufficiently complete, in accordance with Contract Documents, so that the Work (or specified part) can be utilized for the purposes for which it is intended; or if no such certificate is issued, when the Work is complete and ready for final payment is evidenced by written recommendation of the Construction Manager and the Architect/Engineer for final payment. The terms "substantially complete" and "substantially completed" as applied to all or part of the Work refer to Substantial Completion thereof.
62. **SUPPLEMENTAL INSTRUCTION:** A written work change directive to Contractor from Architect/Engineer, approved by Construction Manager, ordering alterations or modifications which do not result in change in Contract Sum or Contract Times, and do not substantially change Drawings or Specifications.

63. **UNDERGROUND FACILITIES:** All pipelines, conduits, ducts, cables, wires, manholes, vaults, tanks, tunnels or other such facilities or attachments, and any encasements containing such facilities which have been installed underground to furnish any of the following services or materials: Electricity, gases, steam, liquid petroleum products, telephone or other communications, cable television, sewage and drainage removal, traffic or other control systems or water.
64. **VERIFIED REPORT:** A periodic verified report submitted to DSA. Refer to sections 4-336, 4-337 and 4-343, Part 1, Title 24, California Code of Regulations.
65. **WORK**: The entire completed construction or the various separately identifiable parts thereof required to be furnished under the Contract Documents. Work includes and is the result of performing or furnishing labor and furnishing and incorporating materials and equipment into the construction, and performing or furnishing services and furnishing documents, all is required by the Contract Documents. Wherever the word "work" is used, rather than the word "Work", it shall be understood to have its ordinary and customary meaning.

    a. Wherever words "as directed", "as required", "as permitted", or words of like effect are used, it shall be understood that direction, requirements, or permission of CLPCCD or Construction Manager is intended. Words "sufficient", "necessary", "proper", and the like shall mean sufficient, necessary, or proper in judgment of CLPCCD or Construction Manager. Words "approved", "acceptable", "satisfactory", "favorably reviewed" or words of like import, shall mean approved by, or acceptable to, or satisfactory to, or favorably reviewed by CLPCCD or Construction Manager.
    b. Wherever the word "may" be used, the action to which it refers is discretionary. Wherever the word "shall" is used, the action to which it refers is mandatory.

PART 2 - ÓPRODUCTS
Not applicable.

PART 3 - ÓEXECUTION
Not applicable.

END OF SECTION

SECTION 01 4500

QUALITY CONTROL

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Quality assurance and control of installation.

B. References.

C. Mock-Up.

D. Inspection and testing laboratory services.

E. Manufacturer's field services.

1.2 RELATED SECTIONS

A. Submission of manufacturers' instructions and

B. Sections requiring Laboratory Testing:

1. Section 01 3300 - Submittals: certificates
2. Section 31 0000 - Earthwork
3. Section 32 1216 - Asphalt Concrete Paving
4. Section 32 1313 - Portland Cement Concrete Paving
5. Section 03 2000 - Concrete Reinforcement
6. Section 03 3000 - Cast-in-Place Concrete
7. Section 05 1200 - Structural Steel
8. Section 05 5010 - Metal Fabrications

1.3 QUALITY ASSURANCE AND CONTROL OF INSTALLATION

A. Monitor quality control over suppliers, manufacturers, products, services, site conditions, and workmanship, to produce Work of specified quality.

B. Comply fully with manufacturers' instructions, including each step in sequence.

C. If manufacturers' instructions conflict with Contract Documents, request clarification from Architect/Engineer before proceeding.

D. Comply with specified standards as a minimum quality for the Work except when more stringent tolerances, codes, or specified requirements indicate higher standards or more precise workmanship.

E. Perform work by persons qualified to produce workmanship of specified quality.

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

1.4 REFERENCES

A. Conform to reference standard by date of issue current on date specified in product sections.

B. Should specified reference standards conflict with Contract Documents, request clarification from Architect/Engineer before proceeding.

C. 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 MOCK-UP

A. Mock-up and sample panels will be performed under various sections and identified as sample panels or mock-ups.

B. Assemble and erect specified items with specified attachments, anchorage, flashing, seals and finishes.

C. Where mock-up has been accepted by Architect/Engineer and is specified in product specification section to be removed, remove mock-up and clear area as directed.

D. Whereas, mock-up submittals will be submitted until the acceptance by Architect/Engineer and Construction Manager.

1.6 INSPECTION AND TESTING LABORATORY SERVICES

A. CLPCCD will appoint, employ and pay for services of an independent firm to perform inspection and testing.

B. The independent firm will perform inspections, tests, and other services specified in individual specification sections and as required by the Architect/Engineer. Promptly notify Construction Manager, Architect/Engineer, DSA, Project Inspector, and Contractor of observed irregularities or deficiencies of work or products.

C. Reports will be submitted by the independent firm, one copy each, to the Construction Manager, Architect, Engineer, Division of the State Architect, Contractor and Project Inspector. Indicate observations and results of tests and indicate compliance or non-compliance with Contract Documents and Title 24, C.C.R. specifically, each report will include the following:

1. Date issued; date and time of sampling or inspection; date of test.

2. Project title and number; testing laboratory name, address and telephone number; name and signature of laboratory inspector.
3. Location of sampling or test; temperature and weather condition.
4. Type of inspection or test; identification of product and specification section; results of test and compliance with Contract Documents and Title 24, C.C.R.
5. Perform additional tests as required by Architect/Engineer and/or Project Inspector; interpret test results, when requested by Architect/Engineer.
6. Special Inspections: as shown on attached Tests & Inspections (T&I) list for each section.

D. Contractor shall cooperate with independent firm; furnish samples of materials, design mix, equipment, tools, storage and assistance as requested.

1. Notify Architect/Engineer 72 hours in advance and/or independent firm 24 hours prior to expected time for operations requiring services.
2. Make arrangements with independent firm and pay for additional samples and tests required for Contractor's use.
3. Employment of the laboratory shall in no way relieve Contractor's obligations to perform the work of the contract.

E. Retesting required because of non-conformance to specified requirements shall be performed by the same independent firm on instructions by the Architect/Engineer and/or Project Inspector. Payment for retesting will be paid by the Contractor by deducting inspection or testing charges from the Contract Sum on the next scheduled payment.

1.7 MANUFACTURER'S FIELD SERVICES

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, startup of equipment as applicable, and to initiate instructions when necessary.

B. Submit qualifications of observer to Construction Manager thirty (30) calendar days in advance of required observations. Observer shall be subject to approval of Construction Manager and Architect/Engineer.

C. Report observations and site decisions or instructions given to applicators or installers that are supplemental or contrary to manufacturers' written instructions.

D. Refer to Section 01 3300 - Submittals: Manufacturers' Instructions.

PART 2 - PRODUCTS
Not applicable to this section.

PART 3 - EXECUTION
Not applicable to this section.

END OF SECTION

SECTION 01 4523

TESTING AND INSPECTION SERVICES

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. Section Includes:

1. Administration and procedures to evaluate completed Work for conformance to requirements.

a. Quality control deliverables.

1) Tests and inspections schedule.
2) Test and inspection reports.
3) Test and inspection log.
4) Manufacturer's technical representative's field reports.
5) Factory-authorized service representative's reports.

b. Preconstruction tests.
c. Tests.
d. Inspections.
e. Special tests and inspections.

B. Related Requirements:

1. Section 01 2100 "Allowances" for testing and inspection allowances.
2. Section 01 4300 "Quality Assurance" for qualifications of individuals and agencies, and for mockups.
3. Section 01 4500 "Quality Control" for administration of quality control activities.

1.3 REFERENCES

A. See Section 01 4200 "References".

B. Codes:

1. California Building Code (CBC): Title 24 Part 2.
2. California Energy Code, Title 24 Part 6.
3. California Green Building Standards Code (CALGreen): Title 24 Part 11.

C. Reference Standards:

1. AAMA 501.2 Quality Assurance and Diagnostic Water Leakage Field Check of Installed Storefronts, Curtain Walls, and Sloped Glazing Systems.
2. AAMA 502: Voluntary Specification for Field Testing of Newly Installed Fenestration Products.
3. AAMA/WDMA/CSA 101/I.S.2/A440: North American Fenestration Standard.
4. ANSI A326.3: American National Standard Test Method for Measuring Dynamic Coefficient of Friction of Hard Surface Flooring Materials.
5. ASTM C482: Standard Test Method for Bond Strength of Ceramic Tile to Portland Cement Paste.
6. ASTM C794: Standard Test Method for Adhesion-in-Peel of Elastomeric Joint Sealants.
7. ASTM C1087: Standard Test Method for Determining Compatibility of Liquid-Applied Sealants with Accessories Used in Structural Glazing Systems.
8. ASTM C1135: Standard Test Method for Determining Tensile Adhesion Properties of Structural Sealants.
9. ASTM C1193: Standard Guide for Use of Joint Sealants.
10. ASTM C1248: Standard Test Method for Staining of Porous Substrate by Joint Sealants.
11. ASTM C1401: Standard Guide for Structural Sealant Glazing.
12. ASTM C1521: Standard Practice for Evaluating Adhesion of Installed Weatherproofing Sealant Joints.
13. ASTM D4541: Standard Test Method for Pull-Off Strength of Coatings Using Portable Adhesion Testers.
14. ASTM D5957: Standard Guide for Flood Testing Horizontal Waterproofing Installations.
15. ASTM D7234: Standard Test Method for Pull-Off Adhesion Strength of Coatings on Concrete Using Portable Pull-Off Adhesion Testers.
16. ASTM E783: Standard Test Method for Field Measurement of Air Leakage Through Installed Exterior Windows and Doors.
17. ASTM E1105: Standard Test Method for Field Determination of Water Penetration of Installed Exterior Windows, Skylights, Doors, and Curtain Walls, by Uniform or Cyclic Static Air Pressure Difference.
18. ASTM E2357: Standard Test Method for Determining Air Leakage Rate of Air Barrier Assemblies.
19. ASTM F710: Standard Practice for Preparing Concrete Floors to Receive Resilient Flooring.
20. ASTM F1869: Standard Test Method for Measuring Moisture Vapor Emission Rate of Concrete Subfloor Using Anhydrous Calcium Chloride.
21. ASTM F2170: Standard Test Method for Determining Relative Humidity in Concrete Floor Slabs Using in situ Probes.
22. RILEM Test No. II.4 - Water Absorption Under Low Pressure (Pipe Method).

D. Definitions:

1. Quality Control Services: Tests, inspections, procedures, and related actions during and after execution of the Work to evaluate that actual products incorporated into the Work and completed construction comply with requirements. Contractor's quality control services do not include contract administration activities performed by Architect[or Construction Manager].
2. Testing Agency: An entity engaged to perform specific tests, inspections, or both. Testing laboratory shall mean the same as testing agency.
3. Product Tests: Tests and inspections that are performed by a nationally recognized testing laboratory (NRTL) according to 29 CFR 1910.7, by a testing agency accredited according to NIST's National Voluntary Laboratory Accreditation Program (NVLAP), or by a testing agency qualified to conduct product testing and acceptable to authorities having jurisdiction, to establish product performance and compliance with specified requirements.
4. Preconstruction Testing: Tests and inspections performed specifically for Project before products and materials are incorporated into the Work, to verify performance or compliance with specified criteria.
5. Source Quality Control Tests: Tests and inspections that are performed at the source; for example, plant, mill, factory, or shop.
6. Field Quality Control Tests: Tests and inspections that are performed on-site for installation of the Work and for completed Work.

1.4 INFORMATIONAL SUBMITTALS

A. See Section 01 3300 "Submittal Procedures".

B. Schedule of Tests and Inspections: Prepare in tabular form and include the following:

1. Specification Section number and title.
2. Entity responsible for performing tests and inspections.
3. Description of test and inspection.
4. Identification of applicable standards.
5. Identification of test and inspection methods.
6. Number of tests and inspections required.
7. Time schedule or time span for tests and inspections.
8. Requirements for obtaining samples.
9. Unique characteristics of each quality-control service.

C. Reports: Prepare and submit certified written reports and documents as specified.

1. See Section 01 4500 "Quality Control" for additional information.

D. Permits, Licenses, and Certificates: For Owner's record, submit copies of permits, licenses, certifications, inspection reports, releases, jurisdictional settlements, notices, receipts for fee payments, judgments, correspondence, records, and similar documents established for compliance with standards and regulations bearing on performance of the Work.

1.5 CLOSEOUT SUBMITTALS

A. See Section 01 7800 "Project Record Documents".

B. Test and Inspection Log.

1.6 COORDINATION

A. Coordinate sequence of activities to accommodate required quality-control services with a minimum of delay and to avoid necessity of removing and replacing construction to accommodate testing and inspection.

1. Schedule times for tests, inspections, obtaining samples, and similar activities.

1.7 TESTS AND INSPECTIONS SCHEDULE

A. Schedule of Tests and Inspections: Prepare a schedule of tests, inspections, and similar quality-control services required by the Contract Documents. Coordinate and submit concurrently with Contractor's Construction Schedule. Update as the Work progresses.

B. Schedule of Tests and Inspections: Prepare in tabular form and include the following:

1. Specification Section number and title.
2. Entity responsible for performing tests and inspections.
3. Description of test and inspection.
4. Identification of applicable standards.
5. Identification of test and inspection methods.
6. Number of tests and inspections required.
7. Time schedule or time span for tests and inspections.
8. Requirements for obtaining samples.
9. Unique characteristics of each quality-control service.

C. Distribution: Distribute schedule to Owner, Architect,[Commissioning Authority,] [Construction Manager,] testing agencies, and each party involved in performance of portions of the Work where tests and inspections are required.

1.8 TEST AND INSPECTION REPORTS

A. Prepare and submit certified written reports specified in other Sections. Include the following:

1. Date of issue.
2. Project title and number.
3. Name, address, telephone number, and email address of testing agency.
4. Dates and locations of samples and tests or inspections.
5. Names of individuals making tests and inspections.
6. Description of the Work and test and inspection method.
7. Identification of product and Specification Section.

8. Complete test or inspection data.
9. Test and inspection results and an interpretation of test results.
10. Record of temperature and weather conditions at time of sample taking and testing and inspection.
11. Comments or professional opinion on whether tested or inspected Work complies with the Contract Document requirements.
12. Name and signature of laboratory inspector.
13. Recommendations on retesting and reinspecting.

1.9 TEST AND INSPECTION LOG

A. Test and Inspection Log: Prepare a record of tests and inspections. Include the following:

1. Date test or inspection was conducted.
2. Description of the Work tested or inspected.
3. Date test or inspection results were transmitted to Architect.
4. Identification of testing agency or special inspector conducting test or inspection.

B. Maintain log on Project website. Post changes and revisions as they occur. Provide view and print capabilities to team members.

1. Submit hardcopy of log at Project closeout as part of Project record documentation.

1.10 MANUFACTURER'S TECHNICAL REPRESENTATIVE'S FIELD REPORTS

A. Prepare written information documenting manufacturer's technical representative's tests and inspections specified in other Sections. Include the following:

1. Name, address, telephone number, and email address of technical representative making report.
2. Statement on condition of substrates and their acceptability for installation of product.
3. Statement that products at Project site comply with requirements.
4. Summary of installation procedures being followed, whether they comply with requirements and, if not, what corrective action was taken.
5. Results of operational and other tests and a statement of whether observed performance complies with requirements.
6. Statement whether conditions, products, and installation will affect warranty.
7. Other required items indicated in individual Specification Sections.

1.11 FACTORY-AUTHORIZED SERVICE REPRESENTATIVE'S REPORTS

A. Prepare written information documenting manufacturer's factory-authorized service representative's tests and inspections specified in other Sections. Include the following:

1. Name, address, telephone number, and email address of factory-authorized service representative making report.
2. Statement that equipment complies with requirements.
3. Results of operational and other tests and a statement of whether observed performance complies with requirements.
4. Statement whether conditions, products, and installation will affect warranty.
5. Other required items indicated in individual Specification Sections.

PART 2 - PRODUCTS

2.1 REGULATORY REQUIREMENTS

A. See Section 01 4100 "Regulatory Requirements".

B. Inspections include requirements of CBC Section 110 "Inspections".

C. Special inspections include requirements of CBC Chapter 17 "Special Inspections and Tests".

1. Approved agency or agencies to perform special inspections and testing must be independent from the Contractor (CBC 1703.1.1).

D. Work to receive inspections and testing is to remain accessible and exposed for authority having jurisdiction (CBC 110.1 and 1704.2.2).

E. Refer to "Inspections" and "Special Tests and Inspections" Articles below for additional information.

PART 3 - EXECUTION

3.1 TESTING AND INSPECTIONS, GENERAL

A. Engage qualified testing and inspection agencies to perform tests and inspections listed in this project manual.

1. Refer to Section 01 4300 "Quality Assurance" for testing and inspection agency qualifications.

B. Testing: Assemblies shall comply with performance requirements indicated, as evidenced by reports based on testing by a qualified testing agency.

C. Test Frequency: Owner to approve amount of tests, with recommendations by testing agency, manufacturer's representative, and Architect.

3.2 PRECONSTRUCTION TESTS

A. Mockup Testing: See Section 01 4500 "Quality Control" for additional information.

1. Finish Mockups: Perform floor finish slip resistance testing, as described below, prior to installation of finish material on Project.

B. Sealant [and Structural Glazing Sealant]Laboratory Testing, General Requirements.

1. Submit manufacturer's recommended number of pieces of each type of material, including joint substrates, joint-sealant backings, and miscellaneous materials.

    a. Structural Glazing Sealant: Also include shims and secondary seals.

2. Schedule sufficient time for testing and analyzing results to prevent delaying the Work.
3. For materials failing tests, obtain joint-sealant manufacturer's written instructions for corrective measures, including use of specially formulated primers.
4. Testing will not be required if joint-sealant manufacturers submit data that are based on previous testing, not older than 24 months, of sealant products for adhesion to, staining of, and compatibility with joint substrates and other materials matching those submitted.

C. Sealant and Glazing Sealant Laboratory Testing.

1. See Sections 079200 "Joint Sealants" and 088100 "Glass Glazing" for additional information.
2. Submit to joint-sealant manufacturers, for testing indicated below, samples of materials that will contact or affect joint sealants.

    a. Adhesion Testing: Use test method indicated below to determine whether priming and other specific joint preparation techniques are required to obtain rapid, optimum adhesion of joint sealants to joint substrates using ASTM C794.
    b. Compatibility Testing: Use ASTM C1087 to determine sealant compatibility when in contact with glazing and gasket materials.
    c. Stain Testing: Use ASTM C1248 to determine stain potential of sealant when in contact with stone and masonry substrates.

D. Structural Glazing Sealant Laboratory Testing.

1. See Section 08 8100 "Glass Glazing" for additional information.
2. Submit to structural glazing sealant manufacturer, for testing indicated below, samples of each glazing material type, tape sealant, gasket, glazing accessory, and glass-framing member that is in close proximity to or is touching the structural or nonstructural sealants of a structural glazed system.

    a. Adhesion Testing: Test for adhesion or lack of adhesion of a structural sealant to the surface of another material or component using ASTM C1135.
    b. Compatibility: Test materials or components using ASTM C1087.

3.3 TESTS

A. Exterior Finish Adhesion Testing: Modified ASTM C482, or as otherwise recommended by testing agency.

1. Perform for the following finishes, installed as part of an exterior wall assembly:

a. Precast Concrete Specialties - Trim (Section 03 4800).
b. Surface-Bonded Brick Masonry (Section 04 2113.23).
c. Manufactured Stone Masonry (Section 04 7300).
d. Ceramic Tiling (Section 09 3013).
e. Stone Tiling (Section 09 3033).

B. Concrete and Masonry Water Repellent Testing: RILEM tube test, Test Method II.4.

1. Perform for the following finishes, installed as part of an exterior wall assembly:

a. Cast-in-Place Concrete (Section 03 3000).
b. Unit Masonry (Section 04 2000).
c. Surface-Bonded Brick Masonry (Section 04 2113.23).
d. Adhered Stone Masonry Veneer (Section 04 4313.16).
e. Manufactured Stone Masonry (Section 04 7300).

2. Confirm water amount to be used with product manufacturer.
3. Test both treated and untreated substrates of the same material.
4. For masonry, test both masonry unit and mortar joint.
5. Record measurements and take photos of the test apparatus at 5, 10, 15, 20, 30, and 60 minute time intervals.

C. Air Barrier Adhesion Testing: For air-barrier adhesion to substrate, according to ASTM D4541.

1. Perform for the following:

a. Fluid-Applied Membrane Air Barrier (Section 07 2726).

D. Roof Wood Sheathing Substrate Fastener Pullout Testing: Perform according to roof system manufacturer's written instructions.

1. Perform for the following:

a. Polyvinyl Chloride (PVC) Roofing (Section 07 5419).
b. Thermoplastic-Polyolefin (TPO) Roofing (Section 07 4523).

E. Flood Testing: Flood test each area for leaks, according to recommendations in ASTM D5957, after completing material installation but before overlying construction is placed. Install temporary containment assemblies, plug or dam drains, and flood with potable water.

1. Perform for the following horizontal installations:

    a. Hot Fluid-Applied Rubberized Asphalt Waterproofing (Section 07 1413).
    b. Cold Fluid-Applied Waterproofing (Section 07 1416).
    c. Traffic Coatings (Section 07 1800).
    d. Cementitious Pedestrian Traffic Coatings (Section 07 1813.13).
    e. Polyvinyl Chloride (PVC) Roofing (Section 07 5419).
    f. Thermoplastic-Polyolefin (TPO) Roofing (Section 07 5423).
    g. Ceramic Tiling (Section 09 3013).

2. Perform tests before overlying construction is placed.
3. Flood to an average depth of 2-1/2 inches with a minimum depth of 1 inch and not exceeding a depth of 4 inches. Maintain 2 inches of clearance from top of base flashing.
4. Flood each area for 24 hours.
5. After flood testing, repair leaks, repeat flood tests, and make further repairs until roofing and flashing installations are watertight.

F. Roof Low-Voltage Electrical Conductance Testing: Testing agency shall survey entire roof area and flashings to locate discontinuity in the roof membrane.

1. Perform for the following:

    a. Polyvinyl Chloride (PVC) Roofing (Section 07 5419).
    b. Thermoplastic-Polyolefin (TPO) Roofing (Section 07 4523).

2. Perform tests before overlying construction is placed.
3. After testing, repair areas of discontinuities, repeat tests, and make further repairs until roofing and flashing installations are contiguous.

G. Sealant Adhesion (Pull) Testing: Method A, Field-Applied Sealant Joint Hand Pull Tab, in Appendix X1.1 in ASTM C1193 or Method A, Tail Procedure, in ASTM C1521.

1. Perform for sealants installed as part of the exterior wall assembly:

    a. Joint Sealants (Section 07 9200).
    b. Glazing Joint Sealants (Section 08 8100).

2. For joints with dissimilar substrates, verify adhesion to each substrate separately; extend cut along one side, verifying adhesion to opposite side. Repeat procedure for opposite side.
3. Report whether sealant failed to adhere to joint substrates or tore cohesively. Include data on pull distance used to test each kind of product and joint substrate. For sealants that fail adhesively, retest until satisfactory adhesion is obtained.
4. Sealants not evidencing adhesive failure from testing, in absence of other indications of noncompliance with requirements, will be considered satisfactory. Do not use sealants that fail to adhere to joint substrates during testing.

H. Structural Glazing Sealant Adhesion (Pull) Testing: Test structural glazing sealant according to recommendations in ASTM C1401, Destructive Test Method A, "Hand Pull Tab (Destructive)", Appendix X2.

1. Perform for sealants installed as part of the exterior wall assembly:

    a. Structural Glazing Sealants (Section 08 8100).

2. Test a minimum of [two] [four] [six] areas on each building facade.
3. Repair installation areas damaged by testing.

I. Doors:

1. Perform for the following exterior door types:

    a. Aluminum Terrace Doors (Section 08 1316.13).
    b. Vinyl Doors and Frames (Section 08 1500).
    c. Fiberglass Doors (Section 08 1613).
    d. Sliding Aluminum-Framed Glass Doors (Section 08 3213).
    e. Sliding Vinyl-Framed Glass Doors (Section 08 3216).
    f. Sliding Wood-Framed Glass Doors (Section 08 3219).
    g. Panel Folding Glass Doors (Section 08 3513.33).

2. Air Infiltration: Test pressure as indicated in applicable door sections to determine compliance with AAMA/WDMA/CSA 101/I.S.2/A440 performance grade.

    a. Allowable Air Leakage Rate: 1.5 times the applicable AAMA/WDMA/CSA 101/I.S.2/A440 rate for product type and performance class rounded down to one decimal place.

3. Water Resistance: Test pressure of 2/3 tmes test pressure required to determine compliance with AAMA/WDMA/CSA 101/I.S.2/A440 performance grade indicated.

    a. No water penetration allowed.

J. Aluminum Framing Assemblies and Windows:

1. Perform for the following exterior aluminum framing and window types:

    a. Aluminum Storefronts (Section 08 4313).
    b. Aluminum Curtain Walls (Section 08 4413).
    c. Window Wall Assemblies (Section 08 4600).
    d. Vinyl Windows (Section 08 5313).

2. Water-spray test per AAMA 501.2, and shall not evidence water penetration.
3. Air Infiltration: Test per ASTM E783.

a. Perform at 1.5 times the rate specified for laboratory testing in "Performance Requirements" of applicable window assembly Sections, but not more than 0.09 cfm/sq. ft. at a static air pressure differential of 1.57 lbf/sq. ft..

4. Water Penetration: Test per ASTM E1105.

a. Perform at 0.67 times static air pressure differential specified for laboratory testing in "Performance Requirements" of applicable window assembly Sections, but not less than 6.24 lbf/sq. ft., and shall not evidence water penetration.

K. Concrete Floors - Moisture Vapor Emission-Control Testing:

1. Concrete Substrate Testing:

a. Alkalinity Testing: Perform pH testing according to ASTM F710.
b. Moisture Testing: Perform tests so that each test area does not exceed 1000 square feet. Perform no fewer than three tests in each installation area, with tests evenly spaced within installation areas.

1) Anhydrous Calcium Chloride Test: ASTM F1869, if allowable by moisture vapor emission control product manufacturer and finish floor product manufacturer.
2) Internal Relative Humidity Test: Using in situ probes, ASTM F2170.

2. Tensile-Bond-Strength Testing: Test installed fluid-applied moisture vapor emission control system to ASTM D 7234.
3. Remediation: See Section 09 0561.13 "Moisture Vapor Emission Control".

L. Floor Finish Slip Resistance Testing: Dynamic Coefficient of Friction (DCOF) AcuTest, per ANSI A326.3.

1. Perform for the following floor finishes:

a. Polished Concrete Finishing (Section 03 3543).
b. Concrete Topical Treatments (Section 03 3546).
c. Ceramic Tiling (Section 09 3013).
d. Stone Tiling (Section 09 3033).
e. Resinous Flooring (Section 09 6723).

2. Minimum Threshold: 0.42 DCOF.

3.4 INSPECTIONS

A. Refer to "Regulatory Requirements" Article above.

B. Notify Owner and Architect minimum 48 hours in advance of date and time of inspections.

C. Final Waterproofing Inspection:

1. Perform for the following waterproofing systems:

    a. Self-Adhering Sheet Waterproofing (Section 07 1326).
    b. Hot Fluid-Applied Rubberized Asphalt Waterproofing (Section 07 1413).
    c. Cold Fluid-Applied Waterproofing (Section 07 1416).

2. Arrange for waterproofing manufacturer's technical personnel to inspect installation on completion, and submit report.
3. Repair or remove and replace components of waterproofing where test results or inspections indicate that they do not comply with specified requirements.

    a. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.

4. Do not backfill or otherwise conceal waterproofing components until:

    a. Owner and Architect have received manfacturer's technical report, indicating that installed waterproofing complies with specified requirements and warranty requirements.
    b. Installation has been properly and extensively documented.

        1) See Section 01 3233 "Photographic Documentation".

    c. Permission to backfill or conceal is provided by Architect in writing, or agreed to by Owner, Architect, and Contractor during progress meeting.

        1) See Section 01 3119 "Project Meetings" for additional information.

5. If waterproofing installation is complex or extensive, multiple inspections and backfilling or concealing operations can be made with the prior approval of Owner and Architect.

D. Final Roof Inspection: Arrange for roofing system manufacturer's technical personnel to inspect roofing installation on completion, and submit report.

1. Repair or remove and replace components of membrane roofing system where test results or inspections indicate that they do not comply with specified requirements.

    a. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.

3.5 SPECIAL TESTS AND INSPECTIONS

A. Refer to "Regulatory Requirements" Article above.

B. Special Tests and Inspections: Owner will engage a qualified testing agency or special inspector to conduct special tests and inspections required by authorities having jurisdiction as the responsibility of the Owner[, as indicated in the Statement of Special Inspections], and as follows:

1. Verifying that manufacturer maintains detailed fabrication and quality-control procedures and reviewing the completeness and adequacy of those procedures to perform the Work.
2. Notifying Architect[, Commissioning Authority,] [, Construction Manager,] and Contractor promptly of irregularities and deficiencies observed in the Work during performance of its services.
3. Submitting a certified written report of each test, inspection, and similar quality-control service to Architect[and Commissioning Authority][, through Construction Manager,] with copy to Contractor and to authorities having jurisdiction.
4. Submitting a final report of special tests and inspections at Substantial Completion, which includes a list of unresolved deficiencies.
5. Interpreting tests and inspections and stating in each report whether tested and inspected work complies with or deviates from the Contract Documents.
6. Retesting and reinspecting corrected work.

3.6 REPAIR AND PROTECTION

A. General: On completion of testing, inspection, sample taking, and similar services, repair damaged construction and restore substrates and finishes.

1. Provide materials and comply with installation requirements specified in other Specification Sections or matching existing substrates and finishes. Restore patched areas and extend restoration into adjoining areas with durable seams that are as invisible as possible.
2. Comply with the Contract Document requirements for cutting and patching in Section 01 7300 "Execution."

B. Protect construction exposed by or for quality control service activities.

C. Repair and protection are Contractor's responsibility, regardless of the assignment of responsibility for quality control services.

END OF SECTION 01 4523

SECTION 01 5000

TEMPORARY FACILITIES

PART 1 - GENERAL

1.1 SUMMARY

A. This section describes the temporary facilities required for the Project site. The Project site shall be maintained by Contractor as set forth in this section.

1.2 TEMPORARY FACILITIES

A. Contractor shall obtain permits for, install and maintain in safe condition, whatever scaffolds, hoisting equipment, barricades, walkways, or other temporary structures, which may be required to accomplish the work on the Project. Contractor shall enclose and secure Project Site, including lay down area with a temporary chain link fence. Such structures shall be adequate for the intended use and capable of safely accepting all loads that may be imposed upon them. They shall be installed and maintained in accordance with all applicable State and local codes and regulations.

B. Contractor shall provide and maintain temporary heat from an approved source whenever in the course of the Work it may become necessary for curing and drying of materials or to warm spaces as may be required for the installation of materials or finishes.

C. Contractor shall provide and maintain any and all facilities that may be required for dewatering in order that work may proceed on the Project. If it is necessary for dewatering to occur continually, Contractor shall have on hand whatever spare parts or equipment that may be required to prevent interruption of dewatering.

D. Contractor shall provide and maintain all utility services necessary to perform the work under this Contract. These may include, but are not limited to, temporary electricity, water, gas, sewer and telephone, including charges and installation fees. Contractor shall furnish and maintain all means of distribution of utility services required within the site to properly complete the Project.

E. Materials, tools, accessories, etc., shall be stored only where directed by CLPCCD. Storage area shall be kept neat and clean. Security of stored items shall be Contractor's responsibility.

F. When flammable materials are stored on site, extra precautions, including clear identification, shall be the responsibility of Contractor.

G. Contractor shall provide and maintain temporary toilets in quantities and locations as required by CAL/OSHA and other local codes and regulations. They shall be maintained and supplied in a usable and sanitary condition at all times.

H. If water at construction site is determined to be non-potable by Inspector, Contractor shall provide and maintain adequate potable water stations at site until final completion of the Project.

I. Contractor shall maintain an office at the Project site, which will be his headquarters for the Project. Any communications delivered to this office shall be considered as delivered to Contractor. Location and size of office shall be such that it will adequately serve the needs of Contractor's superintendent and assistants in the performance of their duties.

J. Contractor shall also provide and maintain additional temporary facilities required for the duration of the project. Contractor shall obtain approval of the plans and specifications for any temporary facilities from Construction Manager prior to delivery to job site. Construction Manager shall have the option to reject said facilities if they do not meet Construction Manager's needs.

K. Contractor shall promptly remove all such Temporary Facilities when they are no longer needed for the work or for completion of the Project, mutually agreed upon by Contractor and CLPCCD.

L. Contractor shall provide and maintain in the Temporary Facilities a copy of the California Code of Regulations Title 24 (latest edition) Parts I & II.

1.3 SIGNS

A. No signs may be displayed on or about CLPCCD's property (except those required by law) without CLPCCD's specific approval; the size, content, and location to be as specified by CLPCCD.

1.4 USE OF ROADWAYS AND WALKWAYS

A. Contractor shall never block or interfere with use of any existing roadway, walkway or other facility for vehicular or pedestrian traffic, from any party entitled to use it. Wherever and whenever such interference becomes necessary for the proper and convenient performance of the Work, and no satisfactory detour route exists, Contractor shall, before beginning the interference, provide a satisfactory detour, including temporary bridge if necessary, or other proper facility for traffic to pass around or over the interference. Contractor shall maintain the detour in a safe and satisfactory condition as long as the interference continues, all without extra payment unless otherwise expressly stipulated in the Specifications.

PART 2 - PRODUCTS
Not used.

PART 3 - EXECUTION
Not used.

END OF SECTION

SECTION 01 6100

MATERIAL AND EQUIPMENT

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Products

B. Transportation and handling.

C. Storage and protection.

1.2 RELATED SECTIONS

A. Section 01 1100 - Summary of Work.

B. Section 01 4500 - Quality Control: Product Quality Monitoring.

1.3 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. Provide interchangeable components of the same manufacturer, for similar components.

1.4 TRANSPORTATION AND HANDLING

A. Transport and handle products in accordance with manufacturer's instructions and construction schedules. Coordinate to avoid conflict with work and conditions at the site.

B. Promptly inspect shipments to assure that products comply with requirements, quantities are correct, and products are undamaged.

C. Provide equipment and personnel to handle products by methods to prevent soiling, disfigurement, or damage.

1.5 STORAGE AND PROTECTION

A. Store and protect products in accordance with manufacturer's instructions, with seals and labels intact and legible. Store sensitive products in weather-tight, climate controlled enclosures.

B. For exterior storage of fabricated products, place on sloped supports, above ground, to prevent soiling and staining.

C. Provide off-site storage and protection when site does not permit on-site storage or protection.

D. Cover products subject to deterioration with impervious sheet covering. Provide ventilation to avoid condensation.

E. Store loose granular materials on solid flat surfaces in a well-drained area. Prevent mixing with foreign matter.

F. Provide equipment and personnel to store products by methods to prevent soiling, disfigurement, or damage.

G. Arrange storage of products to permit access for inspection. Periodically inspect to assure products are undamaged and are maintained under specified conditions.

H. Provide substantial covering and protection after installation of products from damage due to traffic and subsequent construction operations. Remove when no longer needed.

PART 2 - PRODUCTS

Not applicable to this section.

PART 3 - EXECUTION

Not applicable to this section.

END OF SECTION

SECTION 01 7000

CONTRACT CLOSEOUT

PART 1 - GENERAL

1.1 SUMMARY

A. This section describes contract closeout procedures including:

1. Removal of temporary construction facilities
2. Substantial completion
3. Final completion
4. Final cleaning
5. Project record documents
6. Material, equipment and finish data
7. Project guarantee
8. Warranties
9. Turn-in
10. Release of claims
11. Guaranty and Maintenance Bonds

1.2 REMOVAL OF TEMPORARY CONSTRUCTION FACILITIES

A. Remove temporary materials, equipment, services, and construction prior to Substantial Completion Inspection.

B. Clean and repair damage caused by installation or use of temporary facilities.

C. Restore permanent facilities used during construction to specified condition.

1.3 SUBSTANTIAL COMPLETION

A. When Contractor considers Work or designated portion thereof as substantially complete, submit written notice, with list of items to be completed or corrected to Construction Manager.

B. Within reasonable time, Construction Manager and Architect/Engineer will inspect to determine status of completion.

C. Should Construction Manager or Architect/Engineer determine that Work is not substantially complete; Construction Manager will promptly notify Contractor in writing, listing all defects and omissions.

D. Remedy deficiencies and send a second written notice of substantial completion. Architect/Engineer will reinspect the Work. If deficiencies previously noted are not corrected on reinspection, then Contractor shall pay the cost of the reinspection.

E. When Architect/Engineer determines that Work is substantially complete, Construction Manager will issue a Certificate of Substantial Completion.

F. Manufactured units, equipment and systems, which require startup, must have been started up and run for periods prescribed by Construction Manager, Architect/Engineer, or Owner before a Certificate of Substantial Completion will be issued.

1.4 FINAL COMPLETION

A. When Contractor considers Work is complete, submit written certification that:

1. Contractor has inspected Work for compliance with Contract Documents.
2. Work, except for Contractor maintenance after Final Acceptance, has been completed in accordance with Contract Documents and deficiencies listed with Certificate of Substantial Completion have been corrected.
3. Work is complete and ready for final inspection.
4. Contractor has achieved all requirements for Final Acceptance as that term is defined in Section 01 4100 - Regulatory Requirements.

B. In addition to submittals required by conditions of Contract, provide submittals required by governing authorities and submit final statement of accounting giving total adjusted Contract Sum, previous payments, and sum remaining due.

C. When Architect/Engineer finds Work is acceptable and final submittal is complete, Construction Manager will issue final change order reflecting approved adjustments to Contract Sum not previously made by Change Order.

1.5 FINAL CLEANING

A. Execute final cleaning prior to final inspection.

B. Clean interior and exterior surfaces exposed to view; remove temporary labels, stains and foreign substances, polish transparent and glossy surfaces, vacuum carpeted and soft surfaces.

1. Clean equipment and fixtures to a sanitary condition, clean or replace filters of mechanical equipment operated during construction, clean ducts, blowers and coils of units operated without filters during construction.
2. Employ skilled workers for final cleaning.

C. Clean Site; mechanically sweep-paved areas.

D. Remove waste and surplus materials, rubbish, and construction facilities from Site.

1.6 PROJECT RECORD DOCUMENTS

A. General

1. Project Record Documents required include:

    a. Marked-up copies of Contract Drawings
    b. Marked-up copies of Shop Drawings
    c. Newly prepared Drawings
    d. Marked-up copies of Specifications, Addenda and Change Orders
    e. Marked-up Project Data submittals
    f. Record Samples
    g. Field records for variable and concealed conditions
    h. Record information on Work that is recorded only schematically
    i. Maintenance forms for major equipment
    j. Comments to all required DSA documentation
    k. All approved change orders

2. Specific Project Record Documents requirements that expand requirements of this Section are included in the individual Sections of Divisions 2 through 33.
3. Maintenance of Documents and Samples:

    a. Store Project Record Documents and samples in the field office apart from Contract Documents used for construction.
    b. Do not permit Project Record Documents to be used for construction purposes.
    c. Maintain Project Record Documents in good order, and in a clean, dry, legible condition.
    d. Make documents and samples available at all times for inspection by Architect/Engineer.

4. CLPCCD will provide one set of sepias and one blueline set of the construction drawings and one-project manuals for the Contractor's use and copying during construction.

B. Project Record Drawings

1. Mark-up Procedure: During the construction period, maintain a set of blueline or blackline prints of Contract Drawings and Shop Drawings for Project Record Document purposes.
2. Mark these Drawings to indicate the actual installation where the installation varies appreciably from the installation shown originally. Give particular attention to information on concealed elements, which would be difficult to identify or measure and record later. Items required to be marked include, but are not limited to:

    a. Dimensional changes to the building
    b. Drawings Revisions to details shown on the Contract Drawings
    c. Drawings Depths of foundations below the first floor
    d. Locations and depths of underground utilities
    e. Revisions to routing of piping and conduits
    f. Revisions to electrical circuitry

g. Actual equipment locations
h. Duct size and routing
i. Locations of concealed internal utilities
j. Changes made by Change Order
k. Details not on original Contract Drawings

3. Mark completely and accurately Project Record Drawing prints of Contract Drawings or Shop Drawings, whichever is the most capable of showing actual physical conditions. Where Shop Drawings are marked, show cross-reference on Contract Drawings location.
4. Mark Project Record Drawing sets with red erasable colored pencil; use other colors to distinguish between changes for different categories of the Work at the same location.
5. Mark important additional information, which was either shown schematically or omitted from original Drawings.
6. Note construction change directive numbers; alternate numbers; Change Order numbers and similar identification.
7. Responsibility for Mark-up: Where feasible, the individual or entity who obtained Project Record Drawing data, whether the individual or entity is the installer, subcontractor, or similar entity, is required to prepare the mark-up on Project Record Drawings.

    a. Accurately record information in an understandable and legible drawing technique.
    b. Record data as soon as possible after it has been obtained. In the case of concealed installations, record and check the mark-up prior to concealment.

8. At time of Substantial Completion, submit Project Record Drawings to Construction Manager for CLPCCD's records. Organize into sets, bind and label sets for CLPCCD's continued use.
9. All record documents shall be submitted in an electronic format and hard copy.

C. Preparation of Documents: Immediately prior to inspection for Certification of Substantial Completion, review completed marked-up Project Record Drawings with the Architect/Engineer. When authorized, prepare a full set of correct Contract Drawings and Shop Drawings.

1. Incorporate changes and additional information previously marked on print sets. Erase, redraw, and add details and notations where applicable. Identify and date each Drawing; include the printed designation "PROJECT RECORD DRAWINGS" in a prominent location on each Drawing.
2. Refer instances of uncertainty to the Architect/Engineer for resolution.

3. Review of Documents: Before copying and distributing, submit corrected drawings and the original marked-up prints to the Architect/Engineer for review. When acceptable, the Architect/Engineer will initial and date each document, indicating acceptance of general scope of changes and additional information recorded, and of the quality of drafting.

    a. Documents and the original marked-up prints will be returned to the Contractor for organizing into sets, printing, binding, and final submittal.

D. Copies and Distribution: After completing the preparation of Project Record Drawings, print three (3) blue-line or black-line prints of each Drawing, whether or not changes and additional information were recorded. Organize the copies into manageable sets. Bind each set with durable paper cover sheets, with appropriate identification, including titles, dates and other information on cover sheets.

1. Organize and bind original marked-up set of prints that were maintained during the construction period in the same manner.
2. Organize Project Record Drawings into sets matching the print sets. Place these sets in durable tube-type drawing containers with end caps. Mark the end cap of each container with suitable identification.
3. Submit the marked-up Project Record Drawings set and three (3) copy sets to the Construction Manager for CLPCCD's records; the Architect/Engineer will retain one copy set.

E. Project Record Specifications

1. During the construction period, maintain one copy of the Project Specifications, including addenda and modifications issued, for Project Record Document purposes.
2. Mark the Project Record Specifications to indicate the actual installation where the installation varies substantially from that indicated in Specifications and Modifications issued. Note related Project Record Drawing information, where applicable. Give particular attention to substitutions, selection of product options, and information on concealed installation that would be difficult to identify or measure and record later.

    a. In each Specification Section where products, materials or units of equipment are specified or scheduled, mark the copy with the proprietary name and model number of the product furnished.
    b. Record the name of the manufacturer, supplier and installer, and other information necessary to provide a record of selections made and to document coordination with Project Record Product Data submittals and maintenance manuals.
    c. Note related Project Record Product Data, where applicable, for each principal product specified, indicate whether Project Record Product Data has been submitted in maintenance manual instead of submitted as Project Record Product Data.

3. Upon completion of mark-up, submit Project Record Specifications to the Construction Manager for CLPCCD's records.

F. Project Record Product Data.

1. During the construction period, maintain one copy of each Project Record Product Data submittal for Project Record Document purposes.
2. Mark Project Record Product Data to indicate the actual product installation where the installation varies substantially from that indicated in Project Record Product Data submitted. Include significant changes in the product delivered to the site, and changes in manufacturer's instructions and recommendations for installation.
3. Give particular attention to information on concealed products and installations that cannot be readily identified and recorded later.
4. Note related Change Orders and mark-up of Project Record Drawings, where applicable.
5. Upon completion of mark-up, submit a complete set of Project Record Product Data to the Construction Manager for CLPCCD's records.
6. Where Project Record Product Data is required as part of maintenance manuals, submit marked-up Project Record Product Data as an insert in the manual, instead of submittal as Project Record Product Data.
7. Each prime Contractor is responsible for mark-up and submittal of record Project Record Product Data for its own Work.

G. Material, Equipment and Finish Data

1. Provide data for primary materials, equipment and finishes as required under each specification section.
2. Submit two (2) sets prior to final inspection, bound in 8-1/2 inches by 11 inches three-ring binders with durable plastic covers; provide typewritten table of contents for each volume.
3. Arrange by Specification division and give names, addresses, and telephone numbers of subcontractors and suppliers. List:

    a. Trade names
    b. Model or type numbers
    c. Assembly diagrams
    d. Operating instructions
    e. Cleaning instructions
    f. Maintenance instructions
    g. Recommended spare parts
    h. Product data

H. Final As-Built Drawings, Specifications.

1. As-Built Drawings and Specifications are the official record drawing that documents what was constructed

2. These drawings shall be available to the Architect and shall be provided to the District upon completion of the of the work.
3. Requirements:

    a. One hard copy set of full size (24x36) or (36x48) As-Built Plans, with DSA App #, and "AS BUILT" stamped on each sheet in red.
    b. One hard copy set of half size As-Built Plans, with DSA App #, and "AS BUILT" stamped on each sheet in red.
    c. One hard copy set of specifications with "AS BUILT" stamped on the cover page in red.
    d. A CD/DVD in PDF and CAD formats (CAD format to be compatible with AutoCAD 2016) with the following naming convention for the CD/DVD cover:

        1) College Name
        2) Project Name
        3) DSA Application #
        4) Do not check the "read only" option
        5) Do not password protect any files

I. Miscellaneous Project Record Submittals

1. Refer to other Specification Sections for miscellaneous record keeping requirements and submittals in connection with various construction activities. Immediately prior to Substantial Completion, complete miscellaneous records and place in good order, properly identified and bound or filed, ready for use and reference. Submit to the Construction Manager for CLPCCD's records.
2. Categories of requirements resulting in miscellaneous records include, but are not limited to the following:

    a. Field records on excavations and foundations
    b. Field records on underground construction and similar work
    c. Survey showing locations and elevations of underground lines
    d. Invert elevations of drainage piping
    e. Surveys establishing building lines and levels
    f. Authorized measurements utilizing unit prices or allowances
    g. Records of plant treatment
    h. Ambient and substrate condition tests
    i. Certifications received in lieu of labels on bulk products
    j. Batch mixing and bulk delivery records
    k. Testing and qualification of tradespersons
    l. Documented qualification of installation firms
    m. load and performance testing
    n. Inspections and certifications by governing authorities' leakage and water-penetration tests
    o. Fire resistance and flame spread test results
    p. Final inspection and correction procedures

1.7 PROJECT GUARANTEE

A. Neither recordation of final acceptance nor final certificate for neither payment nor provision of the Contract nor partial or entire use or occupancy of the Site by CLPCCD shall constitute acceptance of Work not done in accordance with Contract Documents nor relieve Contractor of liability in respect to express warranties or responsibility for faulty materials or workmanship.

B. Requirements for Contractor's guarantee of completed Work are included in General Conditions, Article 1.09. Contractor shall guarantee Work done under Contract against failures, leaks or breaks or other unsatisfactory conditions due to defective equipment, materials or workmanship, and perform repair work or replacement required, at Contractor's sole expense, for period of 2 years from date of Final Acceptance, as required by paragraph 13.2 of General Conditions.

C. CLPCCD may make repairs to defective Work as set forth in paragraph 12.6 of General Conditions, if, within 5 working days after mailing of written notice of defective work to Contractor or authorized agent, Contractor shall neglect to make or undertake with due diligence repairs; provided, however, that in case of leak or emergency where, in opinion of CLPCCD, delay would cause hazard to health or serious loss or damage, repairs may be made without notice being sent to Contractor, and Contractor shall pay cost thereof.

D. If, after installation, operation or use of materials or equipment to be furnished under Contract proves to be unsatisfactory to Construction Manager, CLPCCD shall have right to operate and use materials or equipment until it can, without damage to CLPCCD, be taken out of service for correction or replacement. Period of use of defective materials or equipment pending correction or replacement shall in no way decrease guarantee period required for acceptable corrected or replaced items of materials or equipment.

E. Nothing in this Section shall be construed to limit, relieve or release Contractor's, subcontractors' and equipment suppliers' liability to CLPCCD for damages sustained as result of latent defects in equipment caused by negligence of suppliers' agents, employees or subcontractors. Stated in another manner, warranty contained in the Contract Documents shall not amount to, nor shall it be deemed to be, waiver by CLPCCD of any rights or remedies (or time limits in which to enforce such rights or remedies) it may have for defective workmanship or defective materials under laws of this State pertaining to acts of negligence.

1.8 WARRANTIES AND BONDS

A. Execute Contractor's submittals and assemble documents executed by subcontractors, suppliers, and manufacturers.

1. Provide table of contents and assemble in 8-1/2 inches by 11 inches three-ring binder with durable plastic cover.
2. Assemble in Specification Section order.
3. Provide an electronic copy of all warranties on thumb drive in PDF format

B. Submit material prior to final application for payment.

1. For equipment put into use with CLPCCD's permission during construction, submit within ten (10) working days after first operation.
2. For items of Work delayed materially beyond Date of Substantial Completion, provide updated submittal within ten (10) working days after acceptance, listing date of acceptance as start of warranty period.

C. Warranties are intended to protect CLPCCD against failure of work and against deficient, defective and faulty materials and workmanship, regardless of sources.

D. Limitations: Warranties are not intended to cover failures, which result from the following:

1. Unusual or abnormal phenomena of the elements
2. Vandalism after substantial completion
3. Insurrection or acts of aggression including war

E. Related Damages and Losses: Remove and replace Work which is damaged as result of defective Work, or which must be removed and replaced to provide access for correction of warranted Work.

F. Warranty Reinstatement: After correction of warranted Work, reinstate warranty for corrected Work to date of original warranty expiration or to a date not less than 365 days after corrected Work was done, whichever is later.

G. Replacement Cost: Replace or restore failing warranted items without regard to anticipated useful service lives.

H. Warranty Forms: Submit drafts to Construction Manager for approval prior to execution. Forms shall not detract from or confuse requirements or interpretations of Contract Documents.

1. Warranty shall be countersigned by manufacturers.
2. Where specified, warranty shall be countersigned by subcontractors and installers.

I. Rejection of Warranties: CLPCCD reserves right to reject unsolicited and coincidental product warranties, which detract from or confuse requirements or interpretations of Contract Documents.

J. Term of Warranties: For materials, equipment, systems and workmanship warranty period shall be two (2) years minimum from date of substantial completion of entire Work except where:

1. Detailed specifications for certain materials, equipment or systems require longer warranty periods.

2. Materials, equipment or systems are put into beneficial use of CLPCCD prior to Substantial Completion as agreed to in writing by Construction Manager.

K. Warranty of Title: No material, supplies, or equipment for Work under Contract shall be purchased subject to any chattel mortgage, security agreement, or under a conditional sale or other agreement by which an interest therein or any part thereof is retained by seller or supplier. Contractor warrants good title to all material, supplies, and equipment installed or incorporated in Work and agrees upon completion of all work to deliver the Site, together with improvements and appurtenances constructed or placed thereon by Contractor, to CLPCCD free from any claim, liens, security interest, or charges, and further agrees that neither Contractor nor any person, firm, or corporation furnishing any materials or labor for any Work covered by Contract shall have right to lien upon the Site or improvement or appurtenances thereon. Nothing contained in this Paragraph, however, shall defeat or impair right of persons furnishing materials or labor under bond given by Contractor for their protection or any rights under law permitting persons to look to funds due Contractor in hands of CLPCCD.

1.9 TURN-IN

A. Contract will not be closed out and final payment will not be made until all personnel Identification Media, vehicle permits and keys issued to Contractor during prosecution of Work are turned in to CLPCCD.

1.10 RELEASE OF CLAIMS

A. Contract will not be closed out and final payment will not be made until Contract Agreement and Release of Any and All Claims, is completed and executed by Contractor and CLPCCD.

1.11 FIRE INSPECTION COORDINATION

A. Contractor shall coordinate fire inspection and secure sufficient notice to CLPCCD to permit convenient scheduling.

PART 2 - PRODUCTS

Not applicable to this section.

PART 3 - EXECUTION

Not applicable to this section.

END OF SECTION

SECTION 01 7329

CUTTING AND PATCHING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 DESCRIPTION

A. Work Included: This Section establishes general requirements pertaining to cutting, fitting, and patching of the work required to:

1. Make the several parts fit properly.
2. Uncover work to provide for installation, inspection, or both of ill-timed work.
3. Remove and replace work not conforming to requirements of the Contract Documents.
4. Remove and replace defective work.

1.3 QUALITY ASSURANCE

A. Perform all cutting and patching in accordance with pertinent requirements of the specifications and in the event no such requirements are determined, in conformance with the Architect's written direction. In the absence of either of the previous, the work shall be completed as a minimum to industry standards for the given scope and project.

B. In all cases, exercise extreme care in cutting operations and perform such operations under adequate supervision by competent mechanics skilled in the applicable trade. Openings shall be neatly cut and shall be kept as small as possible to avoid unnecessary damage. Careless and/or avoidable cutting damage, etc., will not be tolerated, and the Contractor will be held responsible for such avoidable or willful damage.

C. All replacing, patching, and repairing of materials and surfaces cut or damaged in the execution of the work shall be performed by experienced mechanics of the several trades involved. Such replacing, repairing, and/or patching shall be done with the applicable materials, in such a manner that all surfaces so replaced, etc., will upon completion of the work, match the surrounding similar surfaces.

1.4 SUBMITTALS

A. Request for the Architect's Consent:

1. Prior to cutting which affects structural safety, submit a written request to the Architect for permission to proceed with cutting.
2. Should conditions of the work, or schedule, indicate a required change of materials or methods for cutting and patching, notify the Architect and secure his written permission prior to proceeding.

B. Notices to the Architect:

1. Submit written notice to the Architect and Construction Manager designating the time the work will be uncovered, therefore providing a time for the Architect's observation.

PART 2 - PRODUCTS

2.1 MATERIALS

A. For replacement of work removed, use materials which comply with the pertinent Section of these specifications. If materials are not covered within these documents, products and methods shall be provided and installed to match existing conditions.

2.2 CUTTING AND PATCHING

A. Employ skilled and experienced installer to perform cutting and patching.

B. Submit written request in advance of cutting or altering elements, which affects:

1. Structural integrity of element.
2. Integrity of weather-exposed or moisture-resistant elements.
3. Efficiency, maintenance, or safety of element.
4. Visual qualities of sight-exposed elements.

C. Execute cutting, fitting, and patching including excavation and fill, to complete Work, and to:

1. Fit the several parts together, to integrate with other Work.
2. Uncover Work to install or correct ill-timed work.
3. Remove and replace defective and non-conforming Work.
4. Remove samples of installed Work for testing.
5. Provide openings in elements of Work for penetrations of mechanical and electrical Work.

D. Execute work by methods, which will avoid damage to other Work, and provide proper surfaces to receive patching and finishing.

E. Cut rigid materials using masonry saw or core drill.

F. Restore Work with new products in accordance with requirements of Contract Document.

G. Fit Work tight to pipes, sleeves, ducts, conduit, and other penetrations through surfaces.

H. Maintain integrity of wall, ceiling, or floor construction; completely seal voids.

I. Refinish surfaces to match adjacent finishes. For continuous surfaces, refinish to nearest intersection; for an assembly, refinish entire unit.

J. Identify any hazardous substance or condition exposed during the Work to the Architect for decision or remedy.

PART 3 - EXECUTION

3.1 CONDITIONS

A. Inspect existing conditions, including elements subject to movement or damage during cutting and patching.

B. After uncovering the work, inspect conditions affecting installation of new work.

3.2 DISCREPANCIES

A. If uncovered conditions are not as anticipated, immediately notify the Architect through the Construction Manager and secure needed directions.

B. Do not proceed in areas of discrepancy until all such discrepancies have been fully resolved.

3.3 PREPARATION PRIOR TO CUTTING

A. Provide all required protection including, but not necessarily limited to, shoring, bracing, and support to maintain structural integrity of the work.

3.4 PERFORMANCE

A. Perform cutting and demolition by methods which will prevent damage to other portions of the work and will provide a proper surface to receive new installation or repair and new work. Perform fitting and adjustment of products to provide finished installation complying with the specified tolerance and finishes.

END OF SECTION

SECTION 01 7800

PROJECT RECORD DOCUMENTS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes: Administrative and procedural requirements for Project Record Documents.

B. Project Record Documents required include:

1. Marked-up copies of Drawings
2. Marked-up copies of Shop Drawings
3. Newly prepared Drawings
4. Marked-up copies of Specifications, Addenda, Change Orders and CCDs
5. Marked-up Product Data submittals
6. Record Samples
7. Field records for variable and concealed conditions
8. Record information on Work that is recorded only schematically
9. Maintenance forms for major equipment
10. Comments to all required DSA documentation
11. All approved change orders

C. Specific Project Record Documents requirements that expand requirements of this Section are included in the individual Sections of Divisions 2 through 33.

D. General Project closeout requirements are included in Section 01 7000 (Contract Closeout).

E. Maintenance of Documents and Samples:

1. Store Project Record Documents and Samples in the field office apart from Contract Documents used for construction.
2. Do not permit Project Record Documents to be used for construction purposes.
3. Maintain Project Record Documents in good order and in a clean, dry, legible condition.
4. Make Documents and Samples available at all times for inspection by District.

F. District will provide one full size blueline set of the Drawings and one Project Manual for Contractor's use for recording as-built conditions.

1.2 PROJECT RECORD DRAWINGS

A. Mark-up Procedure: During the construction period, maintain a set of blueline or blackline prints of Contract Drawings and Shop Drawings for Project Record Documents purposes. Label each document (on first sheet or format page) PROJECT RECORD in 2-inch high printed letters. Keep record documents current. Note: A reference by number to a Change Order, CCD, RFI, RFQ, RFP, Field Order or other such document is not acceptable as sufficient record information on any record document. Do not permanently conceal any Work until required information has been recorded.

1. Mark these Drawings to indicate the actual installation where the installation varies appreciably from the installation shown originally. Give particular attention to information on concealed elements that would be difficult to identify or measure and record later. Items required to be marked include but are not limited to:

    a. Dimensional changes to the Drawings
    b. Revisions to details shown on the Drawings
    c. Depths of various elements of foundation in relation to main floor level or survey datum
    d. Horizontal and vertical location of underground utilities and appurtenances referenced to permanent surface improvements
    e. Location of internal utilities and appurtenances concealed in construction referenced to visible and accessible features of structure
    f. Locations of underground work, points of connection with existing utilities, changes in direction, valves, manholes, catch basins, capped stub outs, invert elevations, and similar items
    g. Actual numbering of each electrical circuit
    h. Field changes of dimension and detail
    i. Revisions to routing of piping and conduits
    j. Revisions to electrical circuitry
    k. Actual equipment locations
    l. Duct size and routing
    m. Changes made by Change Order or CCD
    n. Details not on original Contract Drawings

2. Mark completely and accurately Project Record Drawing prints of Contract Drawings or Shop Drawings, whichever is the most capable of showing actual physical conditions. Where Shop Drawings are marked, show cross-reference on Contract Drawings location.
3. Mark Project Record Drawing sets with red, erasable colored pencil; use other colors to distinguish between changes for different categories of the Work at the same location.
4. Mark important additional information that was either shown schematically or omitted from original Drawings.
5. Note CCD numbers; alternate numbers, Change Order numbers, and similar identification.
6. Responsibility for Mark-up: Where feasible, the individual or entity who obtained Project Record Drawing data, whether the individual or entity is the installer, Subcontractor, or similar entity, is required to prepare the mark-up on Project Record Drawings.

a. Accurately record information in an understandable and legible drawing technique.
b. Record data as soon as possible after it has been obtained. In the case of concealed installations, record and check the mark-up prior to concealment.

B. Preparation of Record Drawings: Immediately prior to inspection for Certification of Substantial Completion, review completed marked-up Project Record Drawings with District. When authorized, prepare a full set of correct transparencies of Contract Drawings and Shop Drawings.

1. Incorporate changes and additional information previously marked on print sets. Erase, redraw, and add details and notations where applicable. Identify and date each Drawing; include the printed designation "PROJECT RECORD DRAWING" in a prominent location on each Drawing.
2. Refer instances of uncertainty to District for resolution.
3. Distribution: Whether or not changes and additional information were recorded, organize and bind original marked-up set of prints that were maintained during the construction period into manageable sets. Bind the set with durable paper cover sheets, with appropriate identification, including titles, dates, and other information on cover sheets.

C. Distribution of Marked-Up Drawings: Submit three full, bound sets and one digital set in AutoCAD 2000 format, the marked-up Project Record Drawings set to District for District's records.

D. Shop Drawings and Samples: Maintain as record documents; legibly annotate Shop Drawings and Samples to record changes made after review.

E. In addition to requirements of this Section, comply with supplemental requirements of Divisions 15 and 16.

1. Divisions 15 and 16 of the Specifications require the preparation of large scale, detailed layout drawings of the Work of those Divisions. These layout drawings are not Shop Drawings as defined by General Conditions, but together with Shop Drawings or layout drawings of all other affected Sections are used to check, coordinate, and integrate the work of the various Sections.
2. Include these layout drawings as part of the Project Record Documents.

1.3 PROJECT RECORD SPECIFICATIONS

A. During the construction period, maintain one copy of the Project Specifications, including addenda and modifications issued, for Project Record Documents purposes.

B. Mark the Project Record Specifications to indicate the actual installation where the installation varies substantially from that indicated in Specifications and Modifications issued. Note related Project Record Drawing information, where applicable. Give particular attention to substitutions, selection of product options, Change Order and Construction Change Directive work, and information on concealed installation that would be difficult to identify or measure and record later.

1. In each Specification Section where products, materials or units of equipment are specified or scheduled, mark the copy with the proprietary name and model number of the product furnished.
2. Record the name of the manufacturer, catalog number, supplier and installer, and other information necessary to provide a record of selections made and to document coordination with Project Record Product Data submittals and maintenance manuals.
3. Note related Project Record Product Data, where applicable, for each principal product specified, indicate whether Project Record Product Data has been submitted in maintenance manual instead of submitted as Project Record Product Data.
4. Upon completion of mark-up, submit Project Record Specifications to District for District's records.

1.4 ADDITIONAL REQUIREMENTS FOR FINAL PROJECT RECORD DOCUMENTS

A. Prior to Substantial Completion of the Work, District will make available to Contractor originals of the Drawings and Specifications, as Microsoft®Word 2000 for Windows, and AutoCAD 2000 Land Development Desktop for Windows in drawing format (.DWG) files. Note all changes thereon for the final Project Record Documents and one set of revised Specifications and one set of disks or CDs to be submitted to District.

B. After Substantial Completion and before Final Completion, carefully transfer all data shown on the job set of Record Drawings to the corresponding computer files, coordinating the information as required.

C. Clearly indicate at each affected detail and other drawings a full description of changes made during construction, and the actual location of items as previously specified.

D. "Cloud" all affected areas.

E. Stamp each Record Drawing with the following information:

1. Project Record Document.
2. Prepared by: Contractor's name, permanent address.
3. Date prepared.
4. Contractor's signature.
5. District Contract Number.

1.5 PROJECT RECORD PRODUCT DATA

A. During the construction period, maintain one copy of each Project Record Product Data submittal for Project Record Document purposes.

1. Mark Project Record Product Data to indicate the actual product installation where the installation varies substantially from that indicated in Project Record Product Data submitted. Include significant changes in the product delivered to the Site, and changes in manufacturer's instructions and recommendations for installation.
2. Give particular attention to information on concealed products and installations that cannot be readily identified and recorded later.

3. Note related Change Orders and mark-up of Project Record Drawings, where applicable.
4. Upon completion of mark-up, submit a complete set of Project Record Product Data to District for District's records.
5. Where Project Record Product Data is required as part of maintenance manuals, submit marked-up Project Record Product Data as an insert in the manual, instead of submittal as Project Record Product Data.
6. Contractor is responsible for mark-up and submittal of Project Record Product Data for its own Work.

B. Material, Equipment, and Finish Data:

1. Provide data for primary materials, equipment and finishes as required under each Specification Section.
2. Submit three (3) hard copy sets and one (1) digital copy, on compact disc (CD) prior to final inspection, bound in 8-1/2 inches by 11 inches three-ring binders with durable plastic covers; provide typewritten table of contents for each volume.
3. Arrange by Specification Section Number and give names, addresses, and telephone numbers of Subcontractors and suppliers. List:

    a. Trade names.
    b. Model or type numbers.
    c. Assembly diagrams.
    d. Operating instructions.
    e. Cleaning instructions.
    f. Maintenance instructions.
    g. Recommended spare parts.
    h. Product data.

1.6 MISCELLANEOUS PROJECT RECORD SUBMITTALS

A. Refer to other Specification Sections for miscellaneous record keeping requirements and submittals in connection with various construction activities. Immediately prior to Substantial Completion, complete miscellaneous records and place in good order, properly identified and bound or filed, ready for use and reference. Submit to the District for District's records. Categories of requirements resulting in miscellaneous records include, but are not limited to, the following:

1. Field records on excavations and foundations
2. Field records on underground construction and similar work
3. Survey showing locations and elevations of underground lines
4. Invert elevations of drainage piping
5. Surveys establishing building lines and levels
6. Authorized measurements utilizing unit prices or allowances
7. Records of plant treatment
8. Ambient and substrate condition tests
9. Certifications received in lieu of labels on bulk products
10. Batch mixing and bulk delivery records

11. Testing and qualification of tradespersons
12. Documented qualification of installation firms
13. Load and performance testing
14. Inspections and certifications by governing authorities
15. Leakage and water-penetration tests
16. Fire resistance and flame spread test results
17. Final inspection and correction procedures
18. Final As-Built Construction Schedule

PART 2 - PRODUCTS
NOT APPLICABLE TO THIS SECTION.

PART 3 - EXECUTION

3.1 RECORDING

A. Post changes and modifications to the Contract Documents as they occur. Do not wait until the end of the Project. District may periodically review Project Record Documents to assure compliance with this requirement.

3.2 SUBMITTAL

A. At completion of Project, deliver Project Record Documents to District.

B. Accompany submittal with transmittal letter containing:

1. Date
2. Project title and number
3. Contractor's name and address
4. Number and title of each Project Record Document
5. Certification that each document as submitted is complete and accurate, and signature of Contractor or Contractor's authorized representative.

END OF SECTION

SECTION 02 41 13

SELECTIVE SITE DEMOLITION

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 RELATED SECTIONS

A. Section 01 74 20 – Construction Waste Management and Disposal: Concrete and Asphalt Recycling

B. Section 31 11 00 Clearing and Grubbing

C. Section 31 22 00 - Grading

D. Section 31 23 33 – Trenching and Backfilling

1.3 SUMMARY

A. Provide labor, material, and equipment required for demolishing, cutting, removing and disposing of existing construction as designated or required to provide for new work.

B. Recycle concrete and asphalt concrete paving for use as aggregate base and trench initial backfill.

C. Coordinate all work with capping or sealing of existing utilities.

1.4 SUBMITTALS

A. Comply with requirements of the Section 01 33 00 – Submittal Procedures.

B. Photographs or videotape, sufficiently detailed, of existing conditions of trees and plantings, adjoining construction, and site improvements that might be misconstrued as damage caused by site clearing.

C. Submit as-built drawings indicating location of all abandoned and capped utilities.

D. After site demolition is complete, submit a list of items that have been removed and salvaged.

1.5 QUALITY ASSURANCE

A. Comply with the following Standards: American National Standards Institute, Inc. “American National Standard Safety Requirements for Demolition” (ANSI A10.6 and A10.8).

B. Regulatory Agencies:
   1. Comply with rules and regulations of State of California, California Code of Regulations, Title 8, Industrial Relations, Chapter 4, Subchapter 4, “Construction Safety Order.”
   2. Comply with applicable local and state agencies having jurisdiction.
   3. Comply with governing EPA notification regulations.
   4. Comply with applicable state and local regulations regarding dust and noise mitigation during construction.

C. Secure all required Permits or Certificates for demolition prior to beginning the work.

1.6 PROJECT CONDITIONS

A. Owner assumes no responsibility for actual condition of the site to be altered.
   1. Conditions existing at time of inspection for bidding purpose will be maintained by Owner as far as practical.

B. Disposal of Existing Improvements:
   1. Unless otherwise indicated, all demolition waste shall become the property of the Contractor, except materials to be recycled. Dispose of demolished material outside the project site.
      a. Do not dispose of removed materials to the general public by sale, gift or in any other manner at the project site.
      b. These provisions shall not be construed as limiting or prohibiting sale or disposal of such materials at the Site to duly licensed Contractors or material suppliers, provided materials are removed from construction site by the Contractor.
   2. All removal of debris from the site, including removal of inventory to site of storage, is part of this Contract and shall be done by Contractor's employees and no others.

C. Recycling:
   1. Recycle AC pavement and Class II AB to the greatest extent possible in accordance with the geotechnical recommendations.
   2. Recycled concrete shall be ground and reused to meet the gradation and quality of Class II Aggregate Base as specified in Section 26-1.02A of the Caltrans Standard Specifications, 2010. Recycled concrete shall not be used for fill in areas to receive landscaping.
   3. Items indicated to be salvaged shall be removed carefully, cleaned, and returned to the Owner. Coordinate with the Project Manager.

D. Protection:
   1. Erect and maintain temporary bracing, shoring, lights, and barricades, except construction barricades for subsequent new construction, warning signs, and guards necessary to protect public, the Owner's employees, adjacent improvements to remain, and adjoining property from damage, all in accordance with applicable regulations.
   2. Wet down areas affected by this work as required to prevent dust and dirt from rising.

E. Scheduling:
   1. Coordinate with the Project Manager in scheduling noisy or dirty work.
   2. The Project Manager will supply a schedule of days on which no construction will be allowed.
   3. Contractor shall take school schedule into consideration during construction.
   4. Coordinate and schedule temporary water shut-downs and temporary water service with the Project Manager, Owner Facilities, and the Fire Department.

F. Traffic Circulations: Ensure minimum interference with roads, streets, driveways, sidewalks, and adjacent facilities.
   1. Minimize obstruction to public thoroughfares by first obtaining the required approval or permission of the responsible jurisdiction.
   2. Coordinate all closures of roads, driveways, sidewalks and pedestrian pathways with the Owner.

3. Where closing of a vehicular traffic circulation route is necessary, provide adequate directional signs to minimize the potential for confusion. Provide access at all times for emergency vehicles.

G. Erosion Control:

1. Comply with the following, whichever is more stringent.

a. "2012 U.S. Environmental Protection Agency (EPA) Construction General Permit (CGP), or.
b. Local equivalent.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION

3.1 EXAMINATION

A. Where existing conditions conflict with representations of the Construction Documents, notify the Project Manager and obtain clarifications. Do not perform work affecting the conflicting conditions until clarification of the conflict is received.

3.2 PREPARATION

A. Verify that the area to be demolished or removed has been vacated, and adequate space has been made available to perform the work.

B. Lay out saw cutting and coordinate with related work for which saw cutting is required.

C. Contractor shall coordinate and arrange the shutdown of utilities serving the site with Facilities, the Fire Department, and the Project Manager.

D. Maintain continuous service to the site fire loop and fire hydrants. If any interruption of service is necessary, notify the Owner a minimum of 72 hours in advance and cooperate fully with the Owner in managing the temporary interruption.

3.3 DEMOLITION

A. If known or suspected hazardous materials are encountered during operations, stop operations immediately and notify the Project Manager.

B. Perform work in accordance with ANSI A10.6-2006 unless otherwise noted.

C. Provide noise and dust abatement as required to prevent contamination of adjacent areas.

D. New construction areas shall be cleared of any existing buried piping and foundations, pre-existing fills, concrete slabs, pavements, abandoned underground utilities, and tree root bulbs, shrubs, and other vegetation designated to be removed.

E. Holes resulting from the removal of underground obstructions that extend below the planned finished grade shall be cleared of loose soil and debris, then backfilled with suitable material compacted to the requirements set forth within Section 31 00 00, Earthwork and Grading.

F. Remove all materials, including the concrete utility trench, not designated to be recycled or salvaged, in their entirety.

G. If unknown items such as human remains are encountered during operations, stop operations immediately and notify the Project Manager.

H. Stockpile salvaged items at a location on site, determined by the Project Manager.

I. Stockpile recycled concrete and asphalt concrete in areas designated and approved by the Owner.

J. Construction activities shall be limited to the hours of 7:00 am and 7:00 pm Monday through Friday. Noise-generating construction activities shall be limited to the hours of 8:00 am and 5:00 pm. Work on Saturdays shall require special approval of the Owner. No construction activity shall be permitted on Sundays or State and Federal Holidays.

3.4 DEMOLITION AND REMOVAL OF PAVEMENT

A. Sawcut pavement at edge of demolition area.

B. Break pavement and remove. Recycle concrete and asphalt concrete pavement in accordance with Caltrans Standard Specifications, 2019.

C. Remove any base material, gravel, and/or or any other non-native soil deemed unsuitable per Geotechnical recommendations.

3.5 SAW CUTTING

A. Make new openings neat.

B. Take care not to damage existing concrete or asphalt concrete pavement designated to remain in place.

3.6 RECYCLING

A. Refer to Caltrans Standard Specifications for recycling of concrete and asphalt concrete pavement.

3.7 DISPOSAL OF DEMOLISHED MATERIALS

A. Promptly dispose of demolished materials not indicated to be recycled. Do not allow demolished materials to accumulate on-site.

B. Burning of demolished materials is prohibited.

3.8 FIELD QUALITY CONTROL

A. The Project Manager will accompany the Contractor before and after performance of work to observe physical condition of existing structures or improvements involved.

END OF SECTION 02 41 13

SECTION 03 2000

CONCRETE REINFORCEMENT AND EMBEDDED ASSEMBLIES

PART 1 - GENERAL

1.1 GENERAL

Work of this Section shall conform to requirements of Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification sections.

1.2 SCOPE

Provide all labor, materials, equipment, services and transportation for reinforcing steel, accessories, embedments and miscellaneous anchorage accessories, joint fillers, and waterstops for cast-in-place concrete work as shown on Drawings, as specified herein, and as required by the job conditions.

1.3 RELATED WORK SPECIFIED IN OTHER SECTIONS

Submittals	Division 1
Quality Control	Division 1
Cast-in-Place Concrete	Section 03 3000
Thermal and Moisture Protection	Division 7

1.4 CODES AND STANDARDS

A. Building Code: Concrete work shall conform to the requirements of the Building Code identified on the Structural General Notes, and OSHA requirements, except where more stringent conditions or criteria occur in the standards referenced below and on the Drawings.

B. Standards:

1. ACI 117 – Standard Specifications for Tolerances for Concrete Construction and Materials.
2. ACI 301 –Specifications for Structural Concrete.
3. ACI 315 – Details and Detailing of Concrete Reinforcement.
4. ACI 318 – Building Code Requirements for Structural Concrete and Commentary.
5. ACI 355.2 – Qualification of Post-Installed Mechanical Anchors in Concrete and Commentary
6. ACI 355.4 – Qualification of Post-Installed Adhesive Anchors in Concrete and Commentary
7. American Society for Testing and Materials "ASTM Standards in Building Codes", various standards as referenced herein.

8. AWS D1.1 – Structural Welding Code-Steel.
9. AWS D1.4 – Structural Welding Code-Reinforcing Steel.
10. Concrete Reinforcing Steel Institute ”Manual of Standard Practice”

C. Definitions:

1. See Section 03 3000.

1.5 CONTRACTOR QUALIFICATIONS

A. The work of this section shall be performed by a fabricator specializing in the type of reinforcement fabrication required for this Project, with a minimum of 5 years of documented successful experience and shall be performed by skilled workmen thoroughly experienced in the necessary crafts.

1. Welders shall be qualified in accordance with applicable AWS Code within 12 months before starting the work.

a) Make qualification records available to the Design Professionals upon request.

B. Manufacturers shall specialize in manufacturing the types of concrete accessories required for cast-in-place concrete work, with a minimum of 10 years of documented successful experience and shall have the facilities capable of meeting all requirements of Contract Documents as a single-source responsibility and warranty for each type of accessory.

1.6 SUBMITTALS

A. Required Submittals - Where the SUBMITTALS section of this Specification is in conflict with Division 1 Submittals, the more stringent requirements for the Contractor apply. Required submittal items are listed here; see below for detailed requirements. Do not submit items not requested.

(1) Submittal Schedule
(2) Shop Drawings
(3) Product Data
(4) Mill Reports
(5) Reinforcement Strain Test
(6) Hazardous Materials Notification

1. Submittal Schedule: See Section 03 3000.
2. Shop Drawings: Submit for action shop drawings that shall clearly indicate, but not be limited to:

a) All details, dimensions and information required for fabrication and placement of concrete reinforcement in accordance with Contract

Documents, prepared in accordance with ACI 315 recommendations.

b) Elevations, plans, sections, and dimensions of concrete work with required reinforcement clearances.

c) Ledges, brackets, openings, sleeves, anchor rods, embedments, prefabricated bent-in dowel keyway systems, electrical conduit and items of other trades including interference with reinforcing materials.

d) Sizes, grade designations, spacing, locations, and quantities of wire fabric, reinforcement bars, temperature and shrinkage reinforcement dowels.

   i. Do not use dimensions scaled from Contract Drawings to determine bar lengths.
   ii. Hooks and bends not specifically dimensioned shall be detailed per ACI 318.

e) Bending and cutting schedules, assembly diagrams, splicing and connection requirements, details, and laps.

f) Each type of supporting and spacing devices, including miscellaneous accessories.

g) Construction joint type, details, and locations. Contractor shall coordinate construction joint type, details, and locations with concrete pour schedule. Submittal shall include details for each type of construction joint in accordance with Contract Documents.

h) Locations and dimensions of openings in structural members including floor slab, walls and beams. See SUBMITTALS Section of Specification 03 3000.

i) Concrete accessories and embedded items. See SUBMITTALS Section of Specification 03 3000.

3. Product Data: Submit for action for each type of product identified in Part 2. Product Data shall be clearly marked to indicate all technical information which specifies full compliance with this section and Contract Documents, including published installation instructions and I.C.C reports, where applicable, for products of each manufacturer specified in this section.
4. Mill Reports: Submit for record.
5. Reinforcement Strain Test: For Grade 75 reinforcement, submit for record certification that steel has a yield strength of no less than 75 ksi as measured by both ASTM A615 and ACI 318 Section 3.5.3.2 procedures.
6. Hazardous Materials Notification: Submit for record. In the event no product or material is available that does not contain hazardous materials as determined by the Owner, a "Material Safety Data Sheet" (MSDS) equivalent to OSHA Form 20 shall be submitted for that proposed product or material prior to installation.

B. Submittal Process: See Section 01 3300

C. SER Submittal Review: See Section 01 3300

D. Substitution Request: See Section 01 2500

E. Request for Information (RFI): See Section 01 2600

1.7 DELIVERY, STORAGE, AND HANDLING

A. Comply with General Conditions and Division 1, including the following:

1. Deliver reinforcing steel to Project site bundled, tagged and marked.

a) Use weatherproof tags indicating bar sizes, lengths and other information corresponding to markings shown on placement diagrams.

2. During construction period, properly store reinforcing steel and accessories to assure uniformity throughout the Project.
3. Deliver and store welding electrodes in accordance with AWS D1.4.
4. Immediately remove from site materials not complying with Contract Documents or determined to be damaged.
5. Store reinforcing steel above ground so that it remains clean.

a) Maintain steel surfaces free from materials and coatings that might impair bond.
b) Keep covered.
c) Protect against corrosion or deterioration of any kind.

1.8 QUALITY ASSURANCE BY OWNER'S TESTING AGENCY

A. Field Quality Assurance General: The Owner's Testing Agency shall test and inspect concrete reinforcement and embedded assemblies as Work progresses. Failure to detect any defective work or material shall not in any way prevent later rejection when such defect is discovered nor shall it obligate the Design Professionals for final acceptance.

B. Owner's Testing Agency shall provide qualified personnel at the site to inspect reinforcement, embedments, and accessories using the latest Drawings and reviewed shop drawings, as follows:

1. Prior to placement, inspect reinforcement and embeds for grade, quality of material, absence of foreign matter, and for suitable storage.
2. Provide continuous inspection of reinforcement and embedded assemblies during placement and immediately prior to concreting operations for: size, quantity, vertical and horizontal spacing and location, correctness of bends and splices, mechanical splices, clearances, compliance with specified tolerances, security of supports and ties, concrete cover, and absence of foreign matter.

3. Provide continuous inspection of adhesive anchors installed in horizontal or upwardly inclined orientations and those marked (CERT) on the latest Drawings.

C. Mechanical post-installed anchors shall be proof tested as follows:

1. The Owner's Testing Agency shall submit a mechanical anchorage proof testing plan to the SER for review and approval prior to performing the anchor proof testing. The anchorage testing plan shall meet the requirements as specified in this section and indicate which anchors have been selected for testing.
2. 5 percent of each type and size of mechanical anchor shall be proof tested by the Owner's Testing Agency. The required proof test for the anchors is as follows:

    a) For torque-controlled mechanical anchors, a proof torque shall be applied to the anchor using a calibrated torque wrench and the proof torque shall be achieved with no more than one-half turn of the anchor nut.

3. The required proof torque load for torque-controlled mechanical anchors shall be as specified in the general notes of the structural drawings.
4. All anchors selected for proof testing shall be production anchors. Sacrificial anchors are not acceptable for inclusion in the proof testing plan unless specifically approved by the SER prior to performance of the testing.
5. Concrete cracking in the vicinity of the anchor during or after proof torque load application shall be considered a failure.
6. If more than 10% of the tested mechanical anchors fail to achieve the specified proof torque load or set, 100% of the anchors of the same diameter and type as the failed anchor shall be proof tested, unless otherwise direct in writing by the SER. Immediately notify the SER of all failed proof tests.

D. Periodic inspection for post-installed adhesive and mechanical anchors shall be provided in accordance with the building code except that continuous inspection shall be provided for the conditions identified in section B.4. The inspector shall observe all aspects of the anchor installation and shall, at a minimum, verify the following items:

1. Hole drilling method in accordance with the Manufacturer's Published Installation Instructions (MPII) and these installation requirements.
2. Anchor spacing and edge distance.
3. Hole diameter and depth.
4. Hole cleaning in accordance with the MPII.
5. Anchor element type, material, diameter, and length.
6. For adhesive anchors, adhesive identification and expiration date.
7. For adhesive anchors, adhesive installation in accordance with the MPII.

8. For torque-controlled mechanical anchors, the number of turns required to achieve the anchor set torque per the MPII.

E. Owner's Testing Agency shall submit for record inspection, observation, and/or test reports to the Owner and Design Professionals, as required herein and shall provide an evaluation statement in each report stating whether or not concrete reinforcement, embedded assemblies, and post-installed anchors conforms to requirements of Specifications and Drawings and shall specifically note deviations therefrom.

F. Immediately notify the Contractor, Owner and Design Professionals of deficiencies.

1.9 QUALITY CONTROL BY CONTRACTOR

See Section 03 3000.

1.10 OBSERVATIONS AND CORRECTIONS BY DESIGN PROFESSIONALS

See Section 03 3000.

1.11 PERMITS AND WARRANTY

A. Permits: See Section 03 3000.

B. Warranty: See Section 03 3000. Failures include but are not limited to the following:

1. Bars with kinks or bends not indicated on Drawings or on approved shop drawings.
2. Bars damaged due to bending, straightening or cutting.
3. Bars heated for bending.

PART 2 - PRODUCTS

2.1 REINFORCEMENT

A. Reinforcing Steel:

1. Type: Deformed billet steel bars, ASTM A 615, Grade 60 or 75 as indicated on Drawings.
2. Size: As indicated on structural Drawings.
3. Where indicated on Drawings, reinforcing steel shall be hot-dipped galvanized after fabrication in accordance with ASTM A 767, Class II, with galvanizing material protected from embrittlement during galvanizing process in accordance with ASTM A 143.

a) Galvanized finish shall meet the bend and shear test requirements of ASTM A 615.

B. Reinforcement Coating Repair Materials:

1. Apply repair coating in accordance with the manufacturer's written procedures.
2. Galvanized Repair Coating: Zinc-based solder, paint containing zinc dust or sprayed zinc complying with ASTM A780.

2.2 ACCESSORIES

A. Tie Wire:

1. Type: Minimum 16 gauge (1.5mm) annealed steel wire, ASTM A 510 and ASTM A 853.
2. Wire Bar Type: Comply with CRSI.

B. Mechanical Splicing Systems:

1. Mechanical tension and compression splicing systems shall be used where indicated on Drawings or at contractor's option. For seismic design categories D, E and F, in plastic hinge regions, only Type 2 mechanical splices are permitted.
2. Splices shall be installed in accordance with manufacturer's requirements.
3. Acceptable Products:

a) Bartec Couplers by Dextra
b) Griptec Couplers by Dextra
c) Unitec Couplers by Dextra
d) Lenton Couplers by Erico
e) Lenton Cadweld by Erico
f) Bar Lock Couplers by Dayton Superior
g) Taper-Lock Couplers by Dayton Superior
h) Grip-Twist by BarSplice
i) BPI Barsplicer by BarSplice
j) BarGrip by BarSplice
k) 400 and 500 Series by Headed Reinforcement Corp

4. Mechanical compression splices shall be such that the compression stress is transmitted by end bearing held in concentric contact.

C. Headed Bars:

1. For bar sizes #11 (ø36) or smaller where specifically detailed on Drawings, mechanical bar terminators shall be used.
2. Headed bars shall meet the requirements of ASTM A970, Class HA.
3. Acceptable Products:

a) Headed Bars by Dextra
b) Lenton Terminator by Erico

c) Grip-Twist Doughnut by Bar-Splice
d) BPI ButtonHead by BarSplice
e) Zap T-Lok by BarSplice
f) Taper-Lock End Anchor Disc by Dayton Superior
g) 100, 550 and 670 Series by Headed Reinforcement Corp

D. Supports for Reinforcement:

1. Types: Bolsters, chairs, spacers, clips, chair bars, and other devices for properly placing, spacing, supporting, and fastening the reinforcement, plastic, or plastic protected steel.
2. For Contact with Forms: Use types with not less than 3/32" (2.5mm) of plastic between metal and concrete surface.

   a) Plastic tips shall extend not less than ½" (12mm) on metal legs.

3. Individual and continuous slab bolsters and chairs shall be of type to suit various conditions encountered and must be capable of supporting 300 pound (1.5kN) load without damage or permanent distortion.
4. Unless otherwise indicated on Drawings, bottom reinforcing bars in footings shall be supported by precast concrete bricks or individual high chairs with welded sand plates on bottom.

E. Prefabricated Bent-In Dowel Keyway Systems and Dowel Bar Replacements:

1. Type, Size and Grade as indicated on Drawings.
2. Dowels shall be installed in accordance with manufacturer's requirements
3. Acceptable Products:

   a) Lenton Form Savers by Erico
   b) Keyway Splice Box by Meadow Burke
   c) Metalstrip by Dayton Superior
   d) DBDI Splice System by Dayton Superior
   e) D50 DBR Coupler System by Dayton Superior
   f) BPI Barsplicer by BarSplice
   g) 300 Series by Headed Reinforcement Corp

2.3 ANCHORAGE ACCESSORIES

A. General: Miscellaneous anchorage accessories for anchoring structural, architectural, electrical, and mechanical items to poured concrete shall include but not be limited to the following:

1. Concrete Anchors: Headed or bent studs ASTM A 108/Grade 1015 through 1020, minimum yield strength of 50,000 psi (345MPa), minimum tensile strength of 60,000 psi (415MPa).

2. Anchor Rods: ASTM F1554, Grade as noted on Drawings.

PART 3 - EXECUTION

3.1 FABRICATION

A. Reinforcing Steel Fabrication:

1. Fabricate in accordance with approved shop Drawings, ACI 315 and Contract Documents.
2. Heating of Reinforcement: Will be permitted only with specific prior approval of the SER.
3. Welding: Comply with ANSI/AWS D1.4; use E9018 electrodes or approved electrodes.
4. Tolerances: Comply with ACI 117.
5. Unacceptable Materials: Reinforcement with any of following defects will not be permitted in Work.

a) Bar lengths, depths, and bends exceeding ACI fabrication tolerances.
b) Bends or kinks not indicated on Drawings or final shop drawings.
c) Bars with reduced cross-section due to excessive rusting or other cause.

B. Templates:

1. Required for all footing and column dowels, and where required for proper alignment of reinforcing.

C. Assemblies:

1. Fabricate and assemble structural steel items in shop in conformance with AISC and AWS D1.1. Shearing, flame cutting, and chipping shall be done carefully and accurately. Cut, drill, or punch holes at right angles to the surface of the metal. Do not make or enlarge holes by burning. Holes shall be clean-cut without torn or ragged edges.
2. Welding of deformed bar anchors and headed stud anchors shall be installed by full-fusion process equivalent to TRW Nelson Stud Welding Division or KSM Welding Services Division, Omark Industries or Tru-Weld Stud Welding, Medina, OH.
3. Welding of reinforcement shall be done in accordance with AWS requirements. Welding shall be performed subject to the observance and testing by Owner's Testing Agency.
4. Galvanizing where required, shall be applied after fabrication and prior to casting concrete.
5. Welding of crossing bars (tack welding) for assembly of reinforcement is not permitted without use of weldable reinforcement and express written consent of SER.

3.2 INSTALLATION OF REINFORCEMENT

A. General:

1. Perform the work of this section in accordance with approved shop drawings, ACI 318 and CRSI recommended practice for “Placing Reinforcing Bars”, for details and methods of reinforcement placement and supports, and as specified.
2. Before placing reinforcement steel, inspect forms for proper fitting and compliance with allowable tolerances.
3. Reinforcement shall be free of form coatings, sealers, powdered and scaled rust, loose mill scale, earth, ice, and other materials which will reduce or destroy bond with concrete.
4. Do not place concrete until the completed reinforcement steel work has been observed and accepted by Owner’s Testing Laboratory.
5. Reinforcement steel is not permitted to be “floated into position”.
6. Bend bars cold.

    a) Do not heat or flame cut bars.
    b) No field bending of bars partially embedded in concrete is permitted, unless specifically approved by the SER and tested by Independent Testing Agency for cracks.

7. Weld only as indicated.

    a) Perform welding per ANSI/AWS D12.1 and/or ANSI/AWS D1.4.
    b) See structural Drawings for additional requirements.

8. Tag reinforcement steel for easy identification.

B. Placement of Reinforcement Bars:

1. Comply with approved shop drawings, ACI 318 and Contract Documents.
2. Accurately position, support and secure reinforcement in a manner to prevent displacement before and during placement of concrete.

    a) Place reinforcement bars within tolerances specified in ACI 117.
    b) Locate and support reinforcement by metal chairs, runners, bolsters, spacers, hangers and other accessories for fastening reinforcing bars in place.

3. If bars are displaced beyond specified tolerance when relocating the bars to avoid interference with other reinforcement or embedded items, immediately notify the Design Professionals for approval prior to concrete placement.
4. Avoid cutting or puncturing vapor retarder during reinforcement placement.

    a) Repair damages before placing concrete.

5. Concrete Coverage: Maintain concrete cover around reinforcement as indicated on Drawings.
6. Bar Supports: Use type specified in this section.
7. Tie Wires: After cutting, turn tie wires to the inside of section and bend so that concrete placement will not force ends to be exposed at face of concrete.

C. At Construction Joints:

1. Reinforcement bars and wire reinforcement shall be continuous through construction joints, unless otherwise indicated on Drawings. See Drawings for scheduled lap splices.

D. At Expansion Joints:

1. Reinforcing bars and wire fabric shall NOT be continuous through expansion joints, unless otherwise indicated on Drawings.

E. Splicing:

1. Unless otherwise indicated on Drawings provide lap splices for bar sizes #11 (ø36) and smaller by lapping ends, placing bars in contact, and tying tightly with wire in accordance with requirements of ACI 318 for lap lengths indicated on Drawings.
2. At all #14 (ø43) and #18 (ø57) bars and where mechanical splices are specifically indicated on Drawings, comply with requirements specified in this Specification section under “Mechanical Splicing Systems”.
3. Do not splice reinforcement except as indicated on structural Drawings.
4. Tension couplers may be used and installed per manufacturer’s specifications where indicated on Drawings or as approved by Engineer.

F. Dowels in Existing Concrete:

1. Install dowels and dowel adhesive in accordance with manufacturer’s recommendations.
2. Minimum embedment length shall be 12 bar diameters, unless noted otherwise.

3.3 INSTALLATION OF POST-INSTALLED ADHESIVE ANCHORS

A. General:

1. Post-installed adhesive anchors shall be installed in accordance with the Manufacturer’s Printed Installation Instructions (MPII).
2. The adhesive anchors shall be supplied as an entire system. The contractor shall provide all equipment required to install the adhesive anchor in accordance with the MPII.

3. Anchors shall be installed in holes drilled with a rotary impact hammer drill with carbide bit. Contractor shall obtain prior written approval from SER before using rock drilling or core drilling installation methods.
4. Anchor holes shall be thoroughly cleaned and dry prior to adhesive injection, in accordance with the MPII. Anchors to be installed in the adhesive shall be clean, oil-free, and free of loose rust, paint, or other coatings.
5. Concrete shall have a minimum compressive strength of 2500 psi (17MPa).
6. Concrete at time of adhesive anchor installation shall have a minimum of 21 days.
7. Concrete temperature at the time of adhesive anchor installation shall be at least equal to manufacture's requirements, or 50° F (10°C) if no requirement exists.
8. Support the anchor and protect it from disturbance or loading for the full cure time stated by the manufacturer at that base material temperature.
9. Unless specified otherwise in the contract documents, anchors shall be installed perpendicular to the concrete surface. Anchors displaced or disturbed prior to the adhesive cure time shall be considered damaged and reported to the SER (see Observations and Corrections section of 03 3000).
10. Locate, by non-destructive means, and avoid all existing reinforcement prior to installation of anchors. If existing reinforcement layout prohibits the installation of anchors as indicated in the drawings the contractor shall immediately notify the Design Professionals.
11. Reinforcement bars or all-threaded bars shall not be bent after being adhesively embedded in hardened, sound concrete, unless written approval is given by the SER.
12. All personnel installing anchors shall be trained by the manufacturer on proper installation techniques. Submit for record certificate from training documentation from the manufacturer for each installer on this Project
13. Installation of adhesive anchors horizontally or upwardly inclined and anchors that are designated with a (CERT) after the anchor call-out, shall be performed by personnel certified by the ACI/CRSI Adhesive Anchor Installer Certification program. Submit for record certificate from ACI-CRSI Adhesive Anchor Installation Certification Program for each certified installer on this Project.

3.4 INSTALLATION OF ACCESSORIES AND EMBEDDED ITEMS

A. Install concrete accessories in accordance with manufacturer's published instructions and Contract Documents.

1. Set and secure embedments, including embedded plates, bearing plates, and anchor rods, per approved setting drawings and in such a manner to prevent movement during placement of concrete and to allow removal of formwork without damage.

2. Tolerances: Anchor rod and other embedded items placement tolerances shall comply with AISC 303, “Code of Standard Practice”, Section 7.5.
3. Inspect locations to receive concrete accessories.
4. Immediately notify the Design Professionals in writing of conditions that will adversely affect the Work or fail to meet Contract Document requirements.
5. Do not place concrete until reinforcement, accessories and other built-in items have been inspected and accepted by Owner’s Testing Agency.

B. Construction and Contraction (Control) Joints:

1. Construction and contraction (control) joints indicated on Drawings are mandatory and must not be omitted.

a) Provide construction joints in accordance with ACI 318.
b) Roughen surface at construction joints as indicated on the drawings.
c) Where specifically indicated on drawings, provide 1-1/2” (40mm) deep key type construction joints at end of each placement for slabs, beams, walls and footings.

i. Bevel forms for easy removal.

2. Provide waterstops in construction joints as indicated on the Contract Documents in sizes to suit joint.
3. Install waterstops to form continuous diaphragm in each joint.
4. Support and protect exposed waterstops during progress of Work.
5. Field-fabricate joints in waterstops according to manufacturer’s printed instructions.

C. Coordinate the installation of pipes, bolts, hangers, anchors, flashing and other embedded items with the work of other trades.

3.5 CORRECTIVE MEASURES

A. Where the Contractor requests that the Design Professionals develop the corrective actions or review corrective actions developed by others, the Design Professional shall be compensated as outlined in Part 3 – CORRECTIVE MEASURES section of Specification 03 3000.

END OF SECTION

SECTION 03 3000

CAST-IN-PLACE CONCRETE

PART 1 - GENERAL

1.1 GENERAL

Work of this Section shall conform to requirements of Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification sections.

1.2 SCOPE

Provide all labor, materials, equipment, services and transportation required to complete all concrete work as shown on Drawings, as specified herein, and as required by the job conditions. This Specification is not intended to address the particular requirements of Architectural Concrete.

1.3 RELATED WORK SPECIFIED IN OTHER SECTIONS

Submittals	Division 1
Quality Control	Division 1
Concrete Reinforcement and Embedded Assemblies	Section 03 2000
Thermal and Moisture Protection	Division 7

1.4 CODES AND STANDARDS

A. Building Code: Concrete work shall conform to the requirements of the Building Code identified on the Structural General Notes, and OSHA requirements, except where more stringent conditions or criteria occur in the standards referenced below and on the Drawings.

B. Standards:

1. ACI 117 – Standard Specifications for Tolerances for Concrete Construction and Materials.
2. ACI 301 – Specifications for Structural Concrete.
3. ACI 318 – Building Code Requirements for Structural Concrete and Commentary.
4. American Concrete Institute “Manual of Concrete Practice”, various committee reports as referenced herein.
5. American Society for Testing and Materials "ASTM Standards in Building Codes", various standards as referenced herein.

6. AASHTO T318 – Standard Method of Test for Water Content of Freshly Mixed Concrete Using Microwave Oven Drying.

C. Definitions:

1. The term “Contract Documents” in this Specification is defined as the design Drawings and the specifications.
2. The term “SER” in this Specification is defined as the Structural Engineer of Record for the structure in its final condition.
3. The term “Design Professionals” in this Specification is defined as the Owner’s Architect and SER.
4. The term “Contractor” in this Specification is defined to include any of the following: General Contractor and their sub-contractors, Construction Manager, Concrete Contractor and their sub-contractors.
5. The term “Testing Agency” in this Specification is defined as an independent testing and inspection service engaged by the Owner for quality assurance observation and testing of concrete construction in accordance with applicable building code provisions and any additional activities listed in the Contract Documents.
6. The terms “for record” and “submit for record” in this Specification are defined as Contractor submittals that do not require a response from the Design Professionals.
7. The term “Working Days” in this Specification is defined as Monday through Friday, excluding federal or state holidays.
8. The term “Delegated Design” in this Specification is defined as a scope of work that meets performance and design criteria established in the Contract Documents and is to be completed by the Contractor’s licensed engineer.

1.5 CONTRACTOR QUALIFICATIONS

A. The work of this section shall be performed by a company specializing in the type of concrete work required for this Project, with a minimum of 5 years of documented successful experience and shall be performed by skilled workmen thoroughly experienced in the necessary crafts.

B. Contractor’s Testing Agency Services: Required as specified in Division 1, and herein.

C. Materials and installed work may require testing and retesting at any time during progress of work, as directed by Design Professionals. Tests, including retesting of rejected materials for installed work will be done at Contractor's expense.

1.6 SUBMITTALS

A. Required Submittals - Where the SUBMITTALS section of this Specification is in conflict with Division 1 Submittals, the more stringent requirements for the Contractor apply. Required submittal items are listed here; see below for detailed requirements. Do not submit items not requested. Reproduction of structural drawings for shop drawings is not permitted.

(1) Submittal Schedule
(2) Mix Designs
(3) Concrete Travel Times to the Project Site
(4) Hot Weather Procedures
(5) Product Data
(6) Concrete Joint Locations
(7) Comprehensive Layout Drawings
(8) Structural Repairs
(9) Patching Defective Concrete Finishes
(10) Conduit and Pipes Embedded in Concrete
(11) Hazardous Materials Notification

1. Submittal Schedule: The contractor shall submit for action a schedule at least twenty (20) working days prior to commencing submittals.

   a) This schedule shall include a list, in order of date to be submitted, of all drawings and other required submittal items scheduled to be submitted. The schedule shall list the proposed submittals for each week, as well as their formats. Once shop drawing submissions have commenced any modification or addition to this schedule must be submitted for action at least twenty (20) working days before the modification or addition is proposed to take place.
   b) If at any time the total number of shop drawings received in any one week period exceeds the amount in the approved schedule by more than 10% for that week, the Design Professionals have the right to add two days to the average turnaround time for each 20% increment in excess of the scheduled quantity for that week's submissions. For example if the weekly total exceeds the schedule by 10% to 20%, two days may be added; if it is exceeded by 21% to 40%, four days may be added. The return dates for subsequent submittals may be extended based on the additional review time stated above.
   c) For the purposes of developing a schedule, assume the following review rate, Shop drawings – 10 full size sheets per week.

2. Mix Designs: Submit for action concrete mix designs for each type and strength of concrete required for this Project at least thirty (30) days before placing concrete.

   a) Mix designs shall be prepared or reviewed by an approved independent Testing Agency retained by the Contractor in accordance with requirements of ACI 301 and ACI 318, sealed and signed by a Professional Engineer licensed in the state where the project is located, and shall be coordinated with design requirements and Contract Documents.
   b) Before submitting to Owner's Testing Agency, submit complete mix design data for each separate mix to be used on the Project in a single submittal.

c) Provide a completed “Concrete Mix Design Submittal Form” (attached to the end of this Specification Section) for each proposed concrete mix.

d) Mix materials shall be from the same production facility that will be used for this Project.

e) Mix Design data shall include but not be limited to the following:

i. Locations on the Project where each mix design is to be used corresponding to Structural General Notes on the Drawings.

ii. Design Compressive Strength: As indicated on the Drawings.

iii. Proportions: ACI 301 and ACI 318.

iv. Gradation and quality of each type of ingredient including fresh (wet) unit weight, aggregates sieve analysis.

v. Water/cementitious material ratio.

vi. Evaluation and classification fly ash in accordance with ASTM D 5759.

vii. Classification of blast furnace slag in accordance with ASTM C 989.

viii. Slump: ASTM C 143.

ix. Air content of freshly mixed concrete by the pressure method, ASTM C 231, or the volumetric method, ASTM C 173.

x. Unit Weight of Concrete: ASTM C 138.

xi. Design strength at 28, 56 or 90 days, as indicated on Contract Documents: ASTM C 39.

(1) Document strength based on basis of previous field experience or trial mixtures per ACI 301. Proportioning by Water-Cement Ratio is not permitted.

(2) Submit strength test records, mix design materials, conditions, and proportions for concrete used for record of tests, standard deviation calculation, and determination of required average compressive strength. Test records to support proposed mixtures shall be no more than 24 months old and use current cement aggregate sources. Test records to establish standard deviation may be older if necessary to have the required number of samples.

(3) If early concrete strengths are required, Contractor shall submit trial mixture results as required.

xii. Manufacturer's product data for each type of admixture.

xiii. Manufacturer’s certification that all admixtures used are compatible with each other.

xiv. All information indicating compliance with Contract Documents including method of placement and method of curing.
xv. Normalweight Concrete: Density per ASTM C 138. Design the mix to produce the strength, modulus of elasticity and density as indicated on the Contract Documents.
xvi. Certification from a qualified testing agency indicating absence of deleterious expansion of concrete due to alkali aggregate reactivity in accordance with ASTM C 33

3. Concrete Travel Times to the Project Site: Submit for record.
4. Hot Weather Procedures: Submit for record written procedures for placement of concrete in hot weather conditions. Hot weather are as defined in the Concrete Placement section of this Specification.
5. Product Data: Submit for action product data clearly marked to indicate locations to be used and all technical information which specifies full compliance with this section and Contract Documents, including published application instructions, product characteristics, compatibility, and limitations for each of the following:

   a) Bonding agents.
   b) Curing compound and liquid sealer densifier. Submit for record to Design Professionals a written statement guaranteeing that the compound will not leave discoloration on concrete to be left exposed, or affect the bond for paint or other applied finishes. Include provision in written statement that in the event of failure of applied finishes to bond to membrane cured concrete, to remove the curing compound and leave suitable surfaces for bonding such finishes.
   c) Absorptive covers and moisture retaining covers.
   d) Vapor Retarder: See Division 7, Thermal and Moisture Protection.
   e) Self-leveling concrete topping.
   f) Grout: Submittal of grout by manufacturers not listed herein must be accompanied by independent certification of ASTM C 1107 compliance without modification of standard methods.
   g) Other products proposed by Contractor

6. Concrete Joint Locations: Submit for action plans indicating locations and details of construction joints, contraction joints, waterstops, sleeves, embedments, etc. that interact with the joints. Contractor to coordinate joint location with reinforcement shop drawings. Reinforcement shop drawings shall indicate additional reinforcement bars where required at construction joints.

7. Comprehensive Layout Drawings: Submit for action comprehensive layout drawings (a single drawing per area/element):

   a) Drawings shall consolidate the work of all trades and shall be coordinated by the Contractor.

b) Drawings shall show concrete accessories and embedded items, including fabrication details of items to be placed (exclusive of reinforcement).
c) Submit with or prior to reinforcement and formwork submittals for same element/area.

8. Preconstruction Survey: Submit for record. Where interface with existing construction occurs, before related shop drawings are prepared survey the existing construction and submit the survey prepared by a professional surveyor employed by the Contractor to the Design Professionals.
9. Structural Repairs: Submit for action procedures, intended locations, and product information. Alterations to design shall be sealed and signed by a Professional Engineer licensed in the state where the project is located.
10. Conduit and Pipes Embedded in Concrete: Submit for action layout of embedded conduit and pipes.
11. Hazardous Materials Notification: Submit for record. In the event no product or material is available that does not contain hazardous materials as determined by the Owner, a "Material Safety Data Sheet" (MSDS) equivalent to OSHA Form 20 shall be submitted for that proposed product or material prior to installation.

B. Submittal Process

1. See Section 01 3300.

C. SER Submittal Review

1. See Section 01 3300.

D. Substitution Request

1. See Section 01 2500.

E. Request for Information (RFI)

1. See Section 01 2600.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Comply with General Conditions and Division 1.

B. Storage:

1. Store materials in accordance with ACI 304R.
2. Store cement in weather-tight buildings, bins or silos that will exclude moisture and contaminates.
3. Store admixtures to avoid contamination, evaporation, damage, and in accordance with manufacturer's temperature and other recommendations.

4. Keep packaged material in original containers with seals unbroken and labels intact until time of use.

C. Handling:

1. Handle fine and coarse aggregates as separate ingredients.
2. Arrange aggregate stockpiles to avoid excessive segregation, and prevent contamination with other materials or with other sizes of like aggregates.
3. Do not use frozen or partially frozen aggregates.
4. Allow sand to drain until it has reached relatively uniform moisture content before use.
5. Protect liquid admixtures from freezing and temperature changes that would adversely affect characteristics, and in accordance with manufacturer's recommendations.

1.8 QUALITY ASSURANCE BY OWNER'S TESTING AGENCY

A. Quality assurance is testing and inspection to assist the Owner in evaluating the Contractor's performance and quality control.

B. Cost: Except as specifically noted otherwise, the testing agencies for quality assurance shall be engaged and paid by the Owner.

C. Coordination with Owner's Testing Agency: The Contractor shall have sole responsibility for coordinating their work with the Owner's Testing Agency to assure that all test and inspection procedures required by the Contract Documents and Public Agencies are provided. The Contractor shall cooperate fully with the Owner's Testing Agency in the performance of their work and shall provide the following:

1. Information as to time of starting field construction and concrete placement schedule, one week prior to the beginning of the work
2. Site File: At least one copy of each approved shop drawing shall be kept available in the Contractor's field office. Drawings not bearing evidence of approval and release for construction by the Design Professionals shall not be kept on the job.
3. Full and ample means of assistance for testing and inspection of material
4. Proper facilities, including scaffolding, temporary work platforms, safety equipment etc., for inspection of the work in shop and field

D. Duties of the Owner's Testing Agency:

1. Reports: The Testing Agency shall prepare daily reports of the concrete work including progress and description/area of work, tests made and results. The daily reports shall be collected and delivered to the Design Professionals, and Owner weekly.
2. Concrete Strength Spreadsheet Log: The Test Agency shall maintain a log that contains the results of all concrete strength tests. The log shall include the results of each test performed, be in electronic spreadsheet

format, and updated and submitted along with concrete test data. See example log attached at the end of this Specification Section.

3. Rejection: The Owner's Testing Agency has the right to reject any material, at any time, when it is determined that the material or workmanship does not conform to the Contract Documents. The Testing Agency shall immediately notify the Owner, Design Professionals, and Contractor of deficiencies.
4. Remedial Work: The Testing Agency shall indicate to the Contractor where remedial work must be performed and will maintain a current list of work not in compliance with the Contract Documents. This list shall be submitted to the Design Professionals and Owner on a weekly basis.
5. Certification: When all work has been approved by the Testing Agency, the Testing Agency shall certify in a letter to the Design Professionals and Owner that the installation is in accordance with the design and Specification requirements.

E. Field Quality Assurance

1. General: The Owner's Testing Agency shall test and inspect concrete materials and operations as Work progresses. Failure to detect any defective work or material shall not in any way prevent later rejection when such defect is discovered nor shall it obligate the Design Professional for final acceptance.
2. All testing shall be in accordance with California Building Code Section 1903, 1913, and 17
3. Owner's Testing Agency is responsible for monitoring concrete placement as follows:

    a) Owner's Testing Agency shall provide qualified personnel at site to monitor concreting operations as follows:

        i. Verify use of required design mix
        ii. Record location of point of concrete discharge of each batch truck tested, cross referenced to grid lines.
        iii. Record temperature of concrete at time of placement.
        iv. Record weather conditions at time of placement, including temperature, wind speed, relative humidity, and precipitation.
        v. Record types and amounts of admixtures added to concrete at the project site.
        vi. Record amount of water added at the site and verify that total water content does not exceed amount specified in the mix design. Addition of water at the site is subject to prior approval by the Design Professional.
        vii. Monitor consistency and uniformity of concrete.
        viii. Monitor preparation for concreting operations, placement of concrete, and subsequent curing period for conformance with Specifications for following procedures:

            (1) Concrete curing.

(2) Hot weather concreting operations.

4. Owner's Testing Agency shall conduct tests of concrete as follows and in accordance with ASTM C 1077:

   a) Testing frequency: Sample sets for all tests listed below of each concrete design mix placed each day shall be taken not less than once a day, nor less than once for each 50 cubic yards. (40 cubic meters) of concrete. Additional tests shall be performed if deemed necessary by the Owner's Testing Agency and Design Professionals. In addition, sample each truckload used for columns, regardless of other frequencies listed above.
   b) Obtain each test sample from different batches selected on a strictly random basis before commencement of concrete placement. Record location in structure of sampled concrete.
   c) Test water content of freshly mixed concrete on a random basis, a minimum of once per 100 cubic yards (75 cubic meters) during placement in accordance with AASHTO T 318.
   d) Conduct slump tests in accordance with ASTM C 143.
   e) Slump indicated in mix designs shall be achieved at point of placement. Correlation between slump at point of initial discharge from truck and point of placement must be established to determine amount of slump loss which occurs between initial discharge and point of placement. Adjustment may be necessary to achieve slump indicated in mix designs at point of placement.
   f) Conduct strength tests of concrete as follows:

      i. Secure sample sets in accordance with ASTM C 172.
      ii. Mold cylinders in accordance with ASTM C 31 and cure under standard moisture and temperature conditions in accordance with ASTM C 31, Section 7 (a). Quantity of cylinders listed below is based on a cylinder size of 4 inch (100mm) diameter x 8 inches (200mm) long. If 6 inch (150mm) diameter by 12 inch (300mm) long cylinders are used, the total quantity of cylinders may be reduced by one with two cylinders instead of three tested at the age designated for determination of f'c.
      iii. Test cylinders in accordance with ASTM C 39. For specified concrete strength of 10,000 psi (70MPa) and above, cylinders shall be ground and not capped.
      iv. For 28 day mixes mold six cylinders. Test two cylinders at seven days and three cylinders at 28 days. The 28 day strength shall be the average of the three 28 day cylinders. One cylinder shall be retained in reserve for later testing if required.
      v. For 56 day mixes mold seven cylinders. Test one cylinder at seven days, two cylinders at 28 days, and three cylinders at 56 days. The 56 day strength shall be the

average of the three 56 day cylinders. One cylinder shall be retained in reserve for later testing if required.

vi. For 90 day mixes mold eight cylinders. Test one cylinder at seven days, one at cylinder at 28 days, two cylinders at 56 days, and three cylinders at 90 days. The 90 day strength shall be the average of the three 90 day cylinders. One cylinder shall be retained in reserve for later testing if required.

vii. When high early strength concrete is required by Contractor, additional cylinders shall be made and tested as required at Contractor's expense.

viii. If one cylinder in a test manifests evidence of improper sampling, molding or other damage, discard cylinder and base test results on that of remaining cylinder.

5. Owner's Testing Agency shall evaluate concrete for conformance with Specifications as follows:

a) Slump:

i. Owner's Testing Agency shall maintain a slump moving average, comprised of the average of all batches or most recent five (5) batches tested, whichever is fewer.

b) Strength test:

i. Owner's Testing Agency shall maintain a compressive strength moving average, comprised of three (3) consecutive strength test results, for each mix design used in Work.

ii. Strength level of concrete will be considered satisfactory provided averages of all sets of three (3) consecutive strength test results (i.e. moving average) equal or exceed specified 28-day strength, and no individual strength test result falls below specified 28-day strength by more than 500 psi (3.5MPa).

iii. If strength tests fail to meet minimum requirements, concrete represented by such tests shall be considered questionable and shall, if deemed appropriate by the SER, be subject to further evaluation by core testing as specified herein or other testing methods.

c) Conduct core tests on questionable concrete in accordance with ACI 318 and ASTM C 42.

i. Location of cores shall be coordinated with Design Professionals so as to least impair strength of structure. Before testing cores, discard and replace any that show evidence of having been damaged subsequent to or during

removal from structure or which have reinforcement present.

ii. Cores from structure exposed to soil or constant moisture in service (e.g., piers.) shall be tested in a fully saturated condition. Cores for all other concrete may be tested dry. Prior to commencement of coring, verify with Design Professionals whether cores are to be tested wet or dry.

iii. Fill core holes with low slump concrete or mortar with a strength equal to or greater than that specified for area cored.

d) Concrete in area represented by core test will be considered adequate if average strength of cores is equal to at least 85% of, and if no single core is less than 75% of specified strength.

6. Floor flatness and levelness tolerance compliance testing is to be performed within 72 hours of concrete placement by Owner's Testing Agency, and prior to the removal of shores and forms.

F. Owner's Testing Agency shall submit for record inspection, observation, and/or test reports to the Owner and Design Professionals, as required herein and shall provide an evaluation statement in each report stating whether or not concrete placement conforms to requirements of Specifications and Drawings and shall specifically note deviations therefrom.

G. Immediately report deficiencies to the Contractor, Owner and Design Professionals.

1.9 QUALITY CONTROL BY CONTRACTOR

A. The Contractor shall provide a program of quality control to ensure that the minimum standards specified herein are attained.

B. The Owner's general review during construction and activities of the Owner' Testing Agency are undertaken to inform the Owner of performance by the Contractor but shall in no way replace or augment the Contractor's quality control program or relieve the Contractor of total responsibility for quality control.

C. The Contractor shall immediately notify the Design Professionals of any deficiencies in the work which are departures from the Contract Documents. The Contractor shall propose corrective actions and their recommendations in writing and submit them for review by the Design Professionals. After proposed corrective action is accepted by the Design Professionals and Owner, the Contractor shall correct the deficiency at no cost to the Owner. Where the Contractor requests that the Design Professionals develop the corrective actions or review corrective actions developed by others, the Design Professional shall be compensated as outlined in the OBSERVATIONS AND CORRECTIONS BY DESIGN PROFESSIONALS section of this Specification.

1.10 OBSERVATIONS AND CORRECTIONS BY DESIGN PROFESSIONALS

A. Observations: The Design Professionals will observe the construction for general compliance with the provisions of the Contract Documents during various phases of construction.

B. Corrections by Design Professionals: See Part 3 - CORRECTIVE MEASURES section of this specification.

1.11 PERMITS AND WARRANTY

A. Permits: The Contractor shall apply for, procure, renew, maintain, and pay for all permits required by City, State, or other governing authorities, necessary to execute work under this Contract. Contractor shall furnish copies of all permits to the Owner and Design Professionals.

B. Warranty: Comply with General Conditions, agreeing to repair or replace specified materials or Work that has failed within the warranty period. Failures include but are not limited to the following:

1. Oily, waxy or loose residue which may interfere with the bonding or discoloration of various applied Architectural finish materials.
2. Discoloration of concrete surfaces scheduled to remain exposed as a finish.
3. Areas which show surface failure or defects.
4. Areas which puddle water.
5. Areas which are not properly prepared to receive Architectural finish materials. If necessary, the Contractor, at his own expense, shall have the Owner’s Testing Agency perform appropriate tests for bond and discoloration.
6. Patches that become crazed, cracked or sound hollow when tapped.
7. Self-leveling concrete topping that has cracked, spalled and/or not performed in accordance with manufacturer's design criteria.

PART 2 - PRODUCTS

2.1 GENERAL

A. Products including but not limited to bonding agents, sealers, epoxy, and methyl methacrylate shall meet the volatile organic compounds (VOC) requirements of CALGreen Section 5.504.4.

B. CONCRETE MATERIALS & PRODUCTION

C. Portland Cement:

1. ASTM C150, Type I or Type II
2. ASTM C150, Type III, High-early Strength Portland Cement may be used subject to review and approval of the SER. The specified 28-day concrete

compressive strength shall occur within 7 days for concrete using Type III Portland Cement.

3. ASTM C150, Type V or Type II/V
4. Provide the same brand of Portland Cement produced in the United States from a single source throughout the project, as required to meet Design Professionals' requirements.
5. Provide Portland Cement that is uniform in color.

D. Aggregates for Normalweight Concrete:

1. ASTM C 33
2. Fine Aggregate: Natural sand, or sand prepared from stone or gravel, clean, hard, durable, uncoated and free from silt, loam and clay.
3. Provide aggregates from a single source throughout the project for exposed concrete.
4. The acceptability of aggregates for the work will depend on proof that their potential alkali reactivity is not deleterious to the concrete.
5. Do not use fine or coarse aggregates that contain substances that cause spalling.
6. Maximum coarse aggregate size shall conform to the requirements as specified in ACI 301 but shall not exceed the following:

   Size no. 57 (25mm max) for footings, drilled piers and caissons
   Size no. 67 (20mm max) for all other locations
   Size no. 467 or 457 for non-reinforced concrete at locations noted on Drawings.

7. Contractor shall furnish concrete with maximum 3/8" (10mm) aggregate at no additional cost to the Owner if areas of high reinforcement density require it for placement and consolidation.

E. Water: ASTM C 94. Clean, and free from injurious amounts of oil, acids, alkali, salts, organic material, or other deleterious materials.

F. Supplementary Cementitious Material

1. Fly Ash:

   a) ASTM C 618, Class C or Class F.
   b) Shall not be used unless part of an approved mix design.
   c) Limit Loss on Ignition to 2.5%

2. Ground Granulated Blast-furnace Slag (GGBFS)

   a) ASTM C 989.
   b) Shall not be used unless part of an approved mix design.

3. For concrete subject to Exposure Class F3 conditions as defined in ACI 318, Table 4.2.1, limit the maximum content of supplementary cementitious materials to values shown in ACI 318, Table 4.4.1.

4. The exact percentages used shall be based on successful test placement on site. Resubmit mix design if percentages change based on test placement.
5. The fly ash or natural pozzolan supplier shall have an effective quality control program in place to guard against contamination of the fly ash and assure compliance with Specifications.
6. Fly ash and GGBFS used shall be from one source throughout the project. Substitution of sources will be acceptable only if testing of concrete mixes containing the substituted material show similar test results and if the color of concrete produced with the substituted material matches the color of previously poured concrete to the satisfaction of the Architect.

G. Ready Mixed Concrete:

1. Shall be batch-mixed and transported in accordance with ASTM C 94.

2.2 CONCRETE MIX DESIGN

A. Concrete Strength:

1. Shall be as indicated on the Structural Drawings

B. Concrete Density (Unit Weight):

1. Shall be as indicated on the Structural Drawings

C. Water-Cementitious Materials (W/cm) Ratio for Normalweight Concrete

1. Absent the above conditions, all concrete with required strength of 4000 psi (28MPa) or higher shall have a maximum W/cm ratio of 0.50.
2. The water-cementitious materials ratio shall not exceed values indicated, including any water added to meet specified slump in accordance with the requirements of ASTM C 94.
3. Weight of fly ash or pozzolanic admixtures shall be included with the weight of cementitious materials used to determine the water-cementitious materials ratio.

D. Slump

1. Concrete design mixes shall be proportioned to meet the following slump limitations. Slump should be measured as described in the Owner's testing agency responsibilities:

a) Concrete with high range or mid-range water-reducing admixture: Concrete slump prior to addition of high range water-reducing admixture shall not exceed 3" (75mm). After addition of water-reducing admixture, the concrete shall have a maximum slump of 9" (225mm) unless otherwise approved by the SER.
b) Concrete without a water-reducing admixture: Slump shall not exceed 4".

E. Chloride Ion Content

1. The total water-soluble chloride ion content of the mix including all constituents shall not exceed the limits defined in ACI 318 4.3 unless corrosion inhibiting admixtures are added to the mixture to offset the additional chloride.
2. If the specified level of water-soluble chloride ion content cannot be maintained, appropriate level of corrosion inhibiting admixture shall be added to the mix in accordance with the manufacturer's recommendation to offset the excess amount of chloride at no additional cost to the Owner.

2.3 ADMIXTURES

A. General:

1. Admixtures specified below can be used only when established in the mix design with Design Professionals' prior written approval.
2. Each admixture approved by Design Professionals shall be used in strict compliance with manufacturer's published instructions.
3. Concrete supplier shall certify all admixtures to be compatible with each other. (See Submittals Section in Part 1)

B. Water-Reducing Admixture:

1. ASTM C 494, Type A
2. Acceptable Product: BASF' "MasterPozzolith 210"
3. Acceptable Product: Euclid Chemical Company "EUCON NW" or "EUCON WR 91"
4. Acceptable Product: W. R. Grace "WRDA' Series, Zyla Series or "Mira" Series
5. Acceptable Product: Sika Corporation "Plastocrete Series"

C. Retarding Admixture:

1. ASTM C 494, Type B
2. Acceptable Product: BASF "Masterset R 100"
3. Acceptable Product: Euclid Chemical Company "EUCON RETARDER 100"
4. Acceptable Product: W. R. Grace "Daratard 17"
5. Acceptable Product: Sika Corporation "Plastiment Series"

D. Non Corrosive Accelerating Admixture:

1. ASTM C 494, Type C
2. Acceptable Product: BASF "POZZUTEC 20" or "Masterset NC 534"
3. Acceptable Product: Euclid Chemical Company "ACCELGUARD 80", "ACCELGUARD NCA" or "ACCELGUARD 90"
4. Acceptable Product: W. R. Grace "Daraset" Series, "Polarset", or "DCI"
5. Acceptable Product: Sika Corporation "Sikaset NC" or "Plastocrete 161 FL" or "Sika Rapid-1"

E. Water-Reducing and Retarding Admixture:

1. ASTM C 494, Type D
2. Acceptable Product: BASF “Masterset R 100”
3. Acceptable Product: Euclid Chemical Company “EUCON RETARDER 75” or “EUCON DS”
4. Acceptable Product: W. R. Grace “Daratard 17” or “Recovery Series”
5. Acceptable Product: Sika Corporation “Plastiment Series”

F. Water-Reducing and Accelerating Admixture:

1. ASTM C 494, Type E
2. Acceptable Product: BASF "Masterset FP 20”
3. Acceptable Product: Euclid Chemical Company “ACCELGUARD 80” or “ACCELGUARD 90”
4. Acceptable Product: W. R. Grace “Libricon NCA”
5. Acceptable Product: Sika Corporation “Sikaset NC” or “Plastocrete 161 FL”

G. Mid-Range Water-Reducing Admixture:

1. ASTM C 494, Type A
2. Acceptable Product: BASF “MasterPolyheed Series”
3. Acceptable Product: W. R. Grace “Daracem” or “Mira”
4. Acceptable Product: Sika Corporation “Sikaplast Series” or “Sikament Series”
5. Acceptable Product: Euclid Chemical Company: “Eucon MR” or “Eucon MRX”

H. High-Range Water-Reducing Admixture:

1. ASTM C 494, Type F
2. Acceptable Product: BASF "PS 1466” or “MasterGlenium Series”
3. Acceptable Product: Euclid Chemical Company “EUCON 37” or “PLASTOL SERIES”
4. Acceptable Product: W. R. Grace “Daracem” or “ADVA” Series
5. Acceptable Product: Sika Corporation “Viscocrete Series” or “Sikament Series”

I. High-Range Water-Reducing and Retarding Admixture:

1. ASTM C 494, Type G
2. Acceptable Product: Euclid Chemical Company “EUCON 537”
3. Acceptable Product: W. R. Grace “Daracem Series” or “Adva Series”

2.4 ADHESIVES

A. Bonding Agent for Cured Concrete (existing concrete damp or dry, at least 28 days old, no surface water):

1. ASTM C 881 Type I and IV, Grade 3, Class B and C.

2. Acceptable Product: BASF "CONCRESIVE PASTE (LPL)", Class C Only
3. Acceptable Product: BASF “CONCRESIVE LIQUID (LPL)”, Class C Only for bonding topping
4. Acceptable Product: Euclid Chemical Company “EUCO #452 Epoxy System”
5. Acceptable Product: Euclid Chemical Company “DURALCRETE LV Series”
6. Acceptable Product: Euclid Chemical Company “FLEXOCRETE System” for bonding topping

B. Bonding Agent for Uncured Concrete: (existing concrete damp or dry, less than 28 days old, no surface water):

1. ASTM C 881, Type II and V, Grade 2, Class B and C.
2. Acceptable Product: Euclid Chemical Company “DURALCRETE MV System”
3. Acceptable Product: Sika Corporation “Sikadur 32 Hi-Mod”

C. Anti-Corrosive Epoxy Cementitious Bonding Compound and Corrosion Protection of Reinforcement (bonding agent for existing concrete saturated surface dry, no surface water):

This adhesive shall be a water-based epoxy/cementitious compound for adhesion and corrosion protection of reinforcing members (20 hour maximum open time).

1. Acceptable Products: Euclid Chemical Company “DURALPREP AC”
2. Acceptable Products: Sika Corporation “ARMATEC 110"

D. Adhesive Between Cured Concrete Elements:

1. ASTM C 881 Type I and IV, Grade 3, Class B and C
2. Acceptable Product Sika Corporation “Sikadur 31 Hi-Mod Gel (1:1 Mix Ratio)

2.5 CURING COMPOUNDS AND SEALERS

A. Interaction with finishes:

1. See architectural Drawings for finish material applied over concrete.
2. Use only curing and sealer compounds that are compatible with finish material.
3. Manufacturer's certification is required.
4. Where finish material is liquid rubberized asphalt, use only strippable type curing compound.

B. Curing and Sealing Compound (VOC Compliant, 350 g/l) :

1. ASTM C1315, Type I, Class A and ASTM C 309, Type 1, Class A or B
2. Water based acrylic, clear, 25% solids curing and sealing compound.

3. Acceptable Product: Euclid Chemical Company "Super Diamond Clear VOX"
4. Acceptable Product: Dayton Superior “Cure & Seal J22WB)
5. Acceptable Product: BASF (Sonneborn) “Kure 1315”
6. Acceptable Product: W.R. Meadows “VOCOMP-25”
7. Acceptable Product: Creteseal “CS2000”

C. Curing Compound-Dissipating/Strippable (VOC Compliant, 350 g/l):

1. ASTM C 309, Type I, Class A or B
2. Water based resin, clear curing compound that begins to dissipate when exposed to UV light and traffic.
3. Acceptable Product: Euclid Chemical Company “Kurez DR VOX” (Dissipating) or “Kurez RC” in combination with “Kurez RC-Off” (Strippable)
4. Acceptable Product: Dayton Superior “Clear Resin Cure J11W"
5. Acceptable Product: W.R. Meadows: “1100 Clear”

2.6 SEALERS

A. Surface Sealer:

1. ASTM C 309, Type I, Class A or B
2. Water based acrylic sealing compound.
3. Acceptable Product: Euclid Chemical Company “DIAMOND CLEAR VOX”
4. Acceptable Product: Dayton Superior “Cure & Seal 309 EF”
5. Acceptable Product: BASF ”MasterKure CC 200WB”
6. Acceptable Product: “W.R. Meadows “VOCOMP 20”

B. Liquid Densifier/Sealer:

1. The liquid densifier compound shall be a silicate based compound that penetrates and chemically hardens concrete surfaces.
2. Acceptable Product: Euclid Chemical Company “Euco Diamond Hard”
3. Acceptable Product: Dayton Superior “Densifier J13”
4. Acceptable Product: BASF ”MasterKure HD 200WB”
5. Acceptable Product: W.R. Meadows “Liqui-Hard”

2.7 MISCELLANEOUS CONCRETE PRODUCTS

A. Nonshrink Grout

1. Provide pre-packaged natural aggregate grout, high-precision, nonshrink, ready-to-use, complying with the following requirements:

   a) See General Notes for grout minimum compressive strength.
   b) Grout shall conform to ASTM C 1107

2. All material used including water, mixer and pre-packaged grout must be initially at the 45°F (7°C) and 90°F (32°C) limits when testing is initiated.
3. Acceptable Product: BASF "MASTERFLOW 928"

4. Acceptable Product: Euclid Chemical Company “HI-FLOW GROUT”
5. Acceptable Product: Five Star Products “Five Star Grout”
6. Acceptable Product: Sika Corporation “Sikagrout 328”

2.8 MISCELLANEOUS PRODUCTS

A. Evaporation Retarder:

1. Acceptable Product: BASF "Masterkure ER50”
2. Acceptable Product: Euclid Chemical Company “Eucobar”
3. Acceptable Product: Sika Corporation “Sika Film”

B. Moisture-Retaining Covers:

Conforming to ASTM C171. A naturally colored, non-woven polypropylene fabric with a 4-mil non-perforated reflective (white) polyethylene coating containing stabilizers to resist degradation from ultraviolet light. Fabric shall exhibit low permeability and high moisture retention.

1. Hydracure S-16 by PNA Construction Technologies, Inc., Matthews, NC
2. Transguard 4000 by Reef Industries (Armorlon Division), Incorporated, Houston TX

C. Sand Cushion: Clean, manufactured or natural sand.

2.9 CONCRETE REPAIR MATERIALS

A. Polymer Repair Mortar

1. The following patching mortars may be used when color match of the adjacent concrete is not required. Prior approval by the Design Professionals is required.
2. Acceptable Products (Horizontal Repairs): Euclid Chemical Company “Thin Top Supreme or Tammspatch II” (for 1/16” (2mm) to 3/8” (10mm) thickness), or “Concrete Top Supreme” (for 3/8” (10mm) to 2” (50mm) thickness).
3. Acceptable Products (Horizontal Repairs): Sika Corporation “Sikatop 121 Plus” or "Sikatop 122 Plus”.
4. Acceptable Products (Vertical and Overhead Repairs): Euclid Chemical Company “Verticoat”, “Verticoat Supreme”, or “Duraltop Gel”
5. Acceptable Products (Vertical and Overhead Repairs): Sika Corporation, “Sikatop 123 Plus”.
6. Acceptable Products (Horizontal, Vertical and Overhead Repairs): BASF, “EMACO 100”

B. High Strength Flowing Repair Mortar

1. For forming and pouring structural members, or large horizontal repairs, provide the flowable one-part, high strength microsilica modified repair mortar with 3/8” (10mm) aggregate.

2. The product shall achieve 9000 psi (62MPa) @ 28-days at a 9-inch (225mm) slump.
3. Acceptable Product: Euclid Chemical Company “Eucocrete”
4. Acceptable Product: BASF “EMACO S” Series
5. Acceptable Product: Sika Corporation “Sika Repair 211 SCC Plus”

C. Repair Topping

1. Latex and microsilica modified cementitious mortar topping, which meets or exceeds the bond strength requirements of ASTM C 1059.
2. Resistance to wear: The finished topping shall show a depth of wear of 0.2 mm (0.0079”) or less when tested at 28 days with a Chaplin Abrasion Tester.
3. Acceptable Products: Euclid Chemical Company, “Thin-Top Supreme or Tammspatch II”
4. Acceptable Product: Sika Corporation “Sika Repair 211 SC Plus”

D. Epoxy Injection:

1. ASTM C881, moisture insensitive maximum viscosity 350 cps at 77°F (25°C).
2. Acceptable Product: BASF “Concresive 1380”
3. Acceptable Product: Euclid Chemical Company “Eucopoxy Injection Resin”
4. Acceptable Product: Sika Corporation “Sikadur 35, LV, LPL”

E. Pressure-Injected Foam Resin:

1. Acceptable Product: DeNeef “HA Sealform”
2. Acceptable Product: 3M “ScotchSeal 5600”
3. Acceptable Product: Sika Corporation “SikaFix HH”

F. Semi Rigid Epoxy:

1. Acceptable Product: METZGER/McGUIRE “MM-80 Semi Rigid Epoxy Joint Filler”

G. Methyl Methacrylate (MMA)

1. Acceptable Product: Transpo Industries, Inc. “T-78 Methyl Methacrylate Polymer Crack Healer/Sealer”

H. Sealant:

1. Silicone or Polyurethane Sealant (as selected based on project requirements.).
2. Joint to be routed and cleaned per manufacturer’s written directions.

PART 3 - EXECUTION

3.1 PREPARATION

A. Subgrade:

1. Dampen subgrades not covered with membrane by sprinkling immediately before placing concrete.

a) Omit when subgrade is already damp.

2. Do not place on water-saturated subgrade unless placing can be done without damage to subgrade (surface is stable) and loading the subgrade does not drive free water to the surface.

B. Forms:

1. Coordinate with Section 03 1000 Concrete Formwork.
2. Remove dirt, sawdust, nails and other foreign material from formed space.
3. Dampen wood forms by sprinkling immediately before placing.
4. Cool metal forms by sprinkling immediately before placing.

C. Concrete Accessories:

1. Coordinate with Section 03 1000 Concrete Formwork.

D. Dewatering:

1. Remove water from concrete formwork.
2. Divert any flowing water to sump and remove by pumping.
3. Refer to Division 1 for additional dewatering requirements.

3.2 MIXING

A. Measurement of Materials: Conforming to ASTM C 94

B. Mixing: All concrete shall be ready-mixed conforming to ASTM C 94 except as follows:

1. Provide concrete materials, proportions and properties as herein specified in lieu of ASTM C 94.
2. Water, beyond that required by the mix design, shall not be added at the Project site. Addition of water at the Project site shall be made only in the presence of the Owner's Testing Agency.
3. Furnish delivery ticket with each load of concrete delivered to the site to the Contractor conforming to the requirements of ASTM C 94.

C. High range water reducing agents (superplasticizer), if added at the batch plant, may be added again at the Project site.

1. If superplasticizers are added at the batch plant, the concrete mix design must account for the delivery time, workability, finishability, and setting time required on the jobsite for proper placing and finishing procedures.
2. If the superplasticizer is redosed at the jobsite in air entrained concrete, air content must be checked after mixing.

D. Discharge of the concrete shall be completed within 1-1/2 hours or before the drum has revolved 300 revolutions, whichever comes first, after the introduction of the mixing water to the cement and aggregates or the introduction of the cement to the aggregates.

3.3 CONCRETE PLACEMENT

A. Prior to Concrete Placement:

1. Mechanical vibrators are required and must be available for placing concrete.
2. Remove debris from space to be occupied with concrete.
3. Notify Design Professionals and Owner’s Testing Agency 48 hours prior to starting concrete placement.
4. Approved mix designs must be maintained on file in Contractor's Field Office.
5. Reinforcement and accessories shall be in proper locations, clean, free of loose scale, dirt or other foreign coatings that may reduce bond to concrete, and in accordance with Section 03 2000 and Drawings.
6. Fog spray forms, reinforcing steel, and subgrade just before pouring concrete.
7. Do not place concrete having a slump outside of allowable slump range.
8. Place concrete before initial set has occurred, but in no event after it has been discharged from the mixer more than 30 minutes. All concrete shall be placed upon clean, damp surfaces, free from puddled water, or upon properly consolidated fills or upon Controlled Low-Strength Material with a strength between 50 and 1200 psi. Placement upon soft mud or dry earth is not permitted.
9. Unless adequate protection is provided, concrete shall not be placed during rain.
10. Rain water shall not be allowed to increase mixing water or to damage the surface finish.
11. At surfaces left exposed to view, do not use equipment in placing and finishing concrete that contain aluminum in the finishing edges that come in contact with the concrete surface.
12. Keep subgrade moisture uniform without puddles or dry areas.

B. For Conduits and Pipes Embedded in Concrete:

1. Provide sleeves for pipes passing vertically through concrete.
2. Do not embed aluminum materials.
3. Do not cut, bend or displace the reinforcement to facilitate placement of embedded pipes and conduits.

C. Pumping: Pumping shall be done in strict accordance with ACI 304.2R.

D. Placing Concrete in Forms:

1. Clean and prepare forms as specified in Section 03 1000/Concrete Formwork.
2. Place concrete continuously without interruption between predetermined construction and contraction joints in walls.
3. Deposit concrete in forms in horizontal layers no deeper than 24” (600mm) and in a manner to avoid inclined construction joints.
4. Where placement consists of several layers, place each layer while preceding layer is still plastic to avoid cold joints.
5. Consolidate placed concrete by mechanical vibrating equipment supplemented by hand-spading, rodding or tamping.

    a) Use equipment and procedures for consolidation of concrete in accordance with ACI 309R.

6. Do not use vibrators to move fresh concrete laterally inside forms from discharge point; shift discharge point as needed.
7. Insert and withdraw vibrators vertically at uniformly spaced locations no farther than the visible effectiveness of the machine.
8. Place vibrators to rapidly penetrate placed layer and at least 6" (150mm) into preceding layer.
9. Do not insert vibrators into lower layers of concrete that have begun to set.
10. At each insertion, limit duration of vibration to time necessary to consolidate concrete and complete embedment of reinforcement and other embedded items without causing segregation of mix.

E. Hot-Weather Placement:

1. Hot weather is defined as air temperature which exceeds 90°F (32°C) or any combination of high temperature, low humidity and/or high wind velocity which causes a rate of evaporation in excess of 0.2 pounds per square feet per hour (1.0 kg/m² per hour) as determined by ACI 305R.
2. When hot weather conditions exist that would impair quality and strength of concrete, place concrete in compliance with ACI 305R and as specified in this section.
3. Cool ingredients before mixing to maintain concrete temperature at time of placement below 90°F (32°C).
4. Mixing water may be chilled, or chopped ice may be used to control temperature, provided water equivalent of ice is calculated to total amount of mixing water.
5. Use of liquid nitrogen to cool concrete is Contractor's option.
6. When concrete placement will occur late in the day and reinforcing steel will be heated by the sun, cover reinforcing steel with water-soaked burlap so that steel temperature will not exceed ambient air temperature immediately before embedding in concrete.

7. When concrete operations must be performed in direct sun, wind, high temperatures, low relative humidity, or other adverse placing conditions, the specified evaporation retarder shall be applied one or more times during the finishing operation to prevent plastic cracking.

3.4 CONCRETE FINISHES

A. General:

1. Comply with recommendations for concrete finishing established by ACI 302.1R and ACI 304R.
2. Comply with dimensional tolerance limitations given by ACI 117.
3. See architectural Drawings for locations of the various finishes listed below.

B. Rough Formed Finish:

1. Acceptable for formed concrete surfaces not exposed-to-view in the finish work or by other construction, unless otherwise indicated.
2. Concrete surface shall have texture imparted by form-facing material used, with tie holes and defective areas repaired and patched, and fins and other projections exceeding 1/4” (6mm) in height rubber down or chipped off.

C. Smooth Formed Finish:

1. Required for formed concrete surfaces exposed to view, or scheduled to be covered with a coating material applied directly to concrete, or a covering material applied directly to concrete, such as waterproofing, dampproofing, veneer plaster, painting, or other similar system, as indicated on architectural Drawings:
2. Surface is an as-cast concrete surface obtained with selected form-facing material, arranged in an orderly and symmetrical manner with a minimum of seams.
3. Repair and patch tie holes and defects. Remove fins and other projections completely.

D. Smooth Rubbed Finish:

1. "Smooth Rubbed" finish shall consist of a finish free of fins, joint marks smoothed off, blemishes removed and surfaces left smooth and unmarred.
2. Provide smooth rubbed finish to scheduled concrete surfaces, as indicated on architectural Drawings, which have received smooth form finish treatment not later than one day after form removal.
3. Moisten concrete surfaces and rub with carborundum brick or other abrasive until a uniform color and texture is produced.

    a) Do not apply cement grout other than that created by the rubbing process.

E. Unformed Surfaces:

1. 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.
2. Continue final surface treatment of formed surfaces uniformly across adjacent unformed surfaces, unless otherwise indicated.

3.5 CURING AND PROTECTION

A. Normal Conditions:

1. Protect concrete from premature drying, excessive hot temperature, and damage.
2. Concrete shall be kept continuously moist and above 50°F (10°C) for seven days (ASTM C 150 Type I cement) or for 10 days (ASTM C 150 Type II cement). High early strength concrete usage shall be maintained over 50o F (10°C) for three days.
3. Concrete and concrete patching materials shall be cured according to manufacturers published recommendations.
4. Begin curing as soon as free water has disappeared from concrete surface and finishing has been completed.
5. Curing Methods: Cure concrete by curing compound, by moist curing, by moisture-retaining cover curing, or by combining these methods, as specified.

    a) Provide moist curing by the following methods:

        i. Keep concrete surface continuously wet by covering with water.
        ii. Use continuous water-fog spray.
        iii. Cover concrete surface with specified absorptive cover, thoroughly saturate cover with water, and keep continuously wet. Place absorptive cover to provide coverage of concrete surfaces and edges, with a 4” (100mm) lap over adjacent absorptive covers.

    b) Provide moisture-retaining cover curing as follows:

        i. Cover concrete surfaces with moisture-retaining cover for curing concrete, placed in widest practicable width with sides and ends lapped at least 3” (75mm) and sealed by waterproof tape or adhesive.

            (1) Immediately repair any holes or tears during curing period using cover material and waterproof tape

6. Curing Formed Surfaces: Cure formed concrete surfaces by leaving forms in place for the full curing period (equivalent to moist curing).

a) If forms are removed prior to completion of full curing period, continue curing by methods specified above for Unformed Surfaces, as applicable.

B. Hot-Weather Protection:

1. When concrete is placed under conditions of hot weather concreting, provide extra protection of the concrete against excessive placement temperatures and excessive drying throughout the placing and curing operations with an evaporation retarder.

a) Apply according to manufacturer's instructions after screeding and bull floating, but before power floating and troweling.

2. Hot weather curing is required if hot weather conditions occur within a 24-hour period after completion of concrete placement.

C. Floor surfaces, wherever indicated by weather conditions, shall be sprinkled during the interval between finishing operation and the start of curing to positively ensure against the possibility of surface drying.

3.6 CONCRETE REPAIRS

A. Perform patching and repairs in accordance with ACI 301.

B. Contractor shall submit patching and repair methods and materials for review by Design Professionals.

C. When complete, all patches and repairs shall match color and texture of adjoining surfaces.

D. At surfaces that are exposed to view, prepare test areas at inconspicuous locations for review by Design Professionals to verify repair color and texture match before proceeding with repair.

E. Apply all patching and repair materials in accordance with manufacturer’s specifications.

F. Repairing Cracks In Formed and Unformed Surfaces:

1. Contractor shall notify Design Professionals of all cracks wider than 0.02” (0.50mm) and all cracks wider than 0.01” (0.25mm) that occur in a group of at least three cracks within twelve inches (300mm), in concrete. If Design Professionals deem repairs necessary, Contractor shall be responsible for repairing all such cracks per Design Professionals recommendation at no expense to the Owner. Repairs will generally require one or more of the following: Epoxy Injection, Semi-Rigid Epoxy, Pressure Injected Foam Resin, Methyl Methacrylate and/or Sealant with joint routed and cleaned. See Concrete Repair Materials section of this Specification for acceptable products

G. Repairing Formed Surfaces

1. Immediately after stripping forms, patch all honeycombing, defective joints, voids, etc. before the concrete is thoroughly dry.
2. Remove all burrs, fins, and ridges before the concrete is thoroughly dry.
3. Remove stains from rust, grease and oils, from release agents, etc.
4. Remove and replace concrete having defective surfaces if defects cannot be repaired to satisfaction of the Design Professionals.

    a) Surface defects, include color and texture irregularities, cracks as defined above, spalls, air bubbles, honeycomb, rock pockets, fins and other projections on the surface, and stains and other discolorations that cannot be removed by cleaning.
    b) Chip away defective areas, honeycomb, rock pockets, voids over 1/4" (6mm) in any dimension and holes left by tie rods and bolts, down to solid concrete but in no case to a depth less than 1" (25mm) and saw-cut edges to prevent feather edging of fill material.

5. Repair concealed formed surfaces, where possible, containing defects that affect the durability of concrete. If defects cannot be repaired, remove and replace concrete.
6. Clean out form tie holes and fill with dry pack mortar or precast cone plugs secured in place with bonding agent.
7. If honeycombing exposes reinforcement, chip to provide clear space at least 3/4" (20mm) wide all around steel to allow proper bond.

H. Repairing Unformed Surfaces:

1. High and Low areas in concrete surfaces which are in excess of specified tolerances shall be leveled or ground-smooth.

    a) Correct high areas by grinding after concrete has cured at least 14 days.
    b) Correct low areas by applying leveling material. Finish leveling material as specified in this section.

2. Repair surfaces containing defects that affect durability of concrete.

    a) Surface defects include crazing, cracks as defined above, spalling, popouts, honeycombs, rock pockets, and other objectionable conditions.

3. Repair defective areas, except random cracks and single holes not exceeding 1" (25mm) in diameter, by cutting out and replacing with fresh concrete.

    a) Remove defective areas with clean, square cuts and expose reinforcing steel with at least 3/4" (20mm) clearance all around.

I. Filling In: Fill in holes and openings left in concrete for passage of work by other trades, unless otherwise shown or directed, after work of other trades is in place.

3.7 EVALUATION AND ACCEPTANCE OF CONCRETE

A. In accordance with ACI 301, except where otherwise specified.

B. If, at any time during construction, the concrete resulting from the approved mix design deviates from Specification requirements for any reason, such as lack of workability, or insufficient strength, the Contractor shall have his laboratory verify the deficiency and modify the mix design, until the specified concrete is obtained. Modified mix to be submitted for approval per Part 1 - SUBMITTALS.

3.8 CORRECTIVE MEASURES

A. Conflicts: The Contractor shall be solely responsible for errors of detailing, fabrication, and placement of reinforcement steel; placement of inserts and other embedded items; and the structural adequacy of all formwork.

B. Compensation for Additional Services: Should additional work by Design Professionals such as design, documentation, meetings and/or site visits be required which are necessitated by failure of the Contractor to perform the work in accordance with the Contract Documents either developing corrective actions or reviewing corrective actions developed by others, the Contractor is responsible for paying for additional work performed by the Design Professionals at their standard firm-wide billing rates plus out-of-pocket expenses incurred at cost + 10%. Additional costs for testing and inspection by the Owner shall also be compensated by the Contractor.

[Balance of page blank; see form on next page]

CONCRETE MIX DESIGN SUBMITTAL FORM

Project: _____

City: _____

General Contractor: _____

Concrete Contractor: _____

Concrete Strength: _____

Use/Location on Job: _____

Supplier's Mix Designation: _____

Design Mix Information	(Please check one):	*Refer to ACI 301 for requirements of data used to substantiate strength calculations.*
Field Experience (Based on Standard Deviation Analysis):		
Trial Mixture Test Data:		
Design Characteristics:		
Density:		Pcf (kg/m3)
Strength:		Psi (MPa) (28 day)
Air:		% (specified)

Materials:	Type/Source	Specific Gravity	Weight (lb)	Absolute Vol. (cu. ft.) (cu. m)
Cement:				
Fly ash:				
Slag (GGBFS)				
Microsilica:				
Coarse Aggregate:				
Fine Aggregate:				
Water:				
Air:				
Other:				
TOTAL:				27.0 cu. ft. (1.0 m3)
Water/Cementitious Material Ratio (lbs. (kg) water / lbs. (kg) cementitious material) =				%

Admixtures:	Manufacturer	ASTM	Dosage (oz/cwt)
Water Reducer:			
Air Entraining Agent:			
High Range Water Reducer			
Non-corrosive Accelerator:			
Other:			

Slump before HRWR: _____ Inches (mm)

Slump after HRWR: _____ Inches (mm)

Standard Deviation Analysis (from experience records):

No. of Test Cylinders Evaluated: _____

Standard Deviation: _____

Required Average Strength f'cr

Average Strength by Tests

Equation Used (ACI Chapter 5)

(Refer to ACI 318 for increased deviation factor when less than 30 tests are available)

TRIAL MIXTURE TEST DATA

Compressive Strength:	Age (days)	Mix #1	Mix #2	Mix #3
	28 [56] [90]	psi (MPa)	psi (MPa)	psi (MPa)
	28 [56] [90]	psi (MPa)	psi (MPa)	psi (MPa)
	28 [56] [90]	psi (MPa)	psi (MPa)	psi (MPa)
	Average	psi (MPa)	psi (MPa)	psi (MPa)
Required Average Strength f'cr				
Average Strength by Tests				
Equation Used (ACI Chapter 5)				

REQUIRED ATTACHMENTS	*Please check*
Coarse Aggregate Gradation Report	
Fine Aggregate Gradation Report	
Fly Ash (or other Supplementary Cementitious Material) Certification	
Concrete Compressive Strength Data or Trial Mixture Test Data	
Admixture Compatibility certification letters	
Chloride Ion Content Certification	
Alkali Aggregate Reactivity Certification	
Shrinkage Test Reports	

SUBMITTED BY:

Name: _____

Address: _____

_____

Phone no.: _____

Main Plant Location: _____

Miles from Project: _____

Secondary Plant Location: _____

Miles from Project: _____

_____

Date: _____

Certification by Concrete Supplier:
Signature: _____

Print Name: _____

PE License Number and Expiration Date (print or stamp) _____

Structural Substitution Request Form – to be completed by Contractor

Project:		
Date:		Substitution Request #
Requesting Contractor:		Pages Attached (including this form)

1. Description of Requested Substitution:

2. Related Drawings and Specification Sections:

3. Rationale or Benefit Anticipated:

4. Effect on Construction Schedule[1] (check one): ☐ NONE ☐ See Attached

5. Effect on Owner's Cost[2] attach data (check one): ☐ CREDIT TO OWNER ☐ EXTRA

6. Effect on Construction Documents[3] (design work anticipated): ☐ NONE ☐ See Attached

7. Requesting Contractor Agrees to Pay for Design Changes (check): ☐ YES ☐ NO ☐ NOT APPLICABLE

8. Effect on Other Trades[4]:

9. Effect of Substitution on Manufacturer's Warranty (check): ☐ NONE ☐ See Attachment

Signature[5]: Date:

Company:

General Contractor Signature[5]: Date:

Notes:
1. Contractor is responsible for means and methods and any problems that may arise from making the requested substitution.
2. This is NOT A CHANGE ORDER FORM. A separate form is required to adjust costs and/or schedules.
3. Contractor is responsible for any design impacts that may arise from this substitution, including redesign efforts.
4. Contractor is responsible for effects on other trades from this substitution;
   General Contractor must review and agree effects on other trades are fairly represented in items 4-9.
5. Signature by a person having authority to legally bind his/her company to the above terms. Otherwise this request is void
6. All items in form must be completed for substitution request to be considered.

Request Review Responses (completed by Architect and/or Engineer(s)):

ACCEPTED	ACCEPTED AS NOTED	REJECTED	INSUFFICIENT DATA TO SUPPORT REQUEST	ENGINEER / ARCH / MEP SIGNATURE	DATE

Engineer/Architect Comments:

EXAMPLE CONCRETE STRENGTH SPREADSHEET LOG

PROJECT:
DATE:
ARCHITECT:
STRUCTURAL ENGINEER:

SPECIMEN I.D.	TICKET NUMBER	PLACEMENT LOCATION	MIX I.D.	CURE TYPE*	DATE TESTED	AGE AT TEST (DAYS)	AVERAGE DIAMETER (IN)	AVERAGE CROSS-SECTIONAL AREA (IN^2)	BREAKING LOAD (LB)	BREAK TYPE **	AVERAGE COMPRESSIVE STRENGTH (PSI)
S0002	1234	First Floor Slabs and Beams	H3651	I, CA, CB	3/8/2106	7	4	12.56	165990	Type 1	13210
						14					
						28					
						56					

*FIELD CURING CONDITIONS: NCB=NO CURING BOX, CB=CURING BOX, I=INSULATED, CO=COOLED, HE=HEATED, CA=CAPPED, IC=ICED, O=OTHER

**BREAK TYPES (AS CLASSIFIED BY ASTM C39):

END OF SECTION

SECTION 05 5000

METAL FABRICATIONS

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. Metal items shop- or field-fabricated from standard metal shapes and plates, including:

a. Miscellaneous framing and supports, for items in other Sections.
b. Walkway.

1.3 REFERENCES

A. See Section 01 4200 "References and Definitions".

B. Codes:

1. California Industrial Relations Code: Title 8.
2. California Building Code (CBC): Title 24 Part 2.
3. California Green Building Standards Code (CALGreen): Title 24 Part 11.

C. Reference Standards:

1. ASTM B26 - Standard Specification for Aluminum-Alloy Sand Castings.
2. ASTM B209 - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate.
3. ASTM B221 - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes.
4. ASTM B632 - Standard Specification for Aluminum-Alloy Rolled Tread Plate.
5. ASTM D1187 - Standard Specification for Asphalt-Base Emulsions for Use as Protective Coatings for Metal.

1.4 ACTION SUBMITTALS

A. Product Data: For items to be installed.

B. Shop Drawings: For fabricated items.

1. Show fabrication and installation details.
2. Show anchorage and accessory items.

C. Qualification Data: For professional engineer.

1.5 COORDINATION

A. Coordinate installation of metal fabrications that are anchored to or that receive other work. 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.

B. Coordinate structural support for fabricated items in this Section.

1.6 QUALITY ASSURANCE

A. Qualifications: See Section 01 4300 "Quality Assurance".

1. Welding Qualifications: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."

a. Qualify procedures and personnel according to the following:

1) AWS D1.1/D1.1M, "Structural Welding Code - Steel."
2) AWS D1.2/D1.2M, "Structural Welding Code - Aluminum."
3) AWS D1.6/D1.6M, "Structural Welding Code - Stainless Steel."

1.7 FIELD CONDITIONS

A. Field Measurements: Verify actual locations of walls and other construction contiguous with metal fabrications by field measurements before fabrication.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes acting on exterior metal fabrications by preventing buckling, opening of joints, overstressing of components, failure of connections, and other detrimental effects.

1. Temperature Change: 120 degrees ambient; 180 degrees F material surfaces.

2.2 MISCELLANEOUS FRAMING AND SUPPORTS

A. General: Provide steel framing and supports not specified in other Sections as needed to complete the Work.

B. Fabricate units from steel shapes, plates, and bars of welded construction unless otherwise indicated. Fabricate to sizes, shapes, and profiles indicated and as necessary to receive adjacent construction.

1. Fabricate units from slotted channel framing where indicated.
2. Furnish inserts for units installed after concrete is placed.

C. Galvanize miscellaneous framing and supports at exterior and interior locations open to the exterior.

2.3 WALKWAYS

A. Aluminum Walkways: Fabricated from aluminum sheet with anti-slip surface.

1. Basis of Design Manufacturer and Product:

a. Grainger, Aluminum Anti-Slip Sheet, Model 108108.
b. Substitutions: See Section 01 2500 "Substitution Procedures".

2. Physical Properties:

a. Thickness: 1/4 inch (8 gauge).
b. Dimensions: 36 inches wide by 120 inches long.
c. Finish: Natural.

2.4 MATERIALS

A. Metal Surfaces, General: Provide materials with smooth, flat surfaces unless otherwise indicated. For metal fabrications exposed to view in the completed Work, provide materials without seam marks, roller marks, rolled trade names, or blemishes.

B. Aluminum:

1. Aluminum Plate and Sheet: ASTM B209, Alloy 6061-T6.
2. Aluminum Extrusions: ASTM B221, Alloy 6063-T6.
3. Aluminum-Alloy Rolled Tread Plate: ASTM B632, Alloy 6061-T6.
4. Aluminum Castings: ASTM B26, Alloy 443.0-F.

2.5 MISCELLANEOUS MATERIALS

A. Bituminous Paint: Cold-applied asphalt emulsion complying with ASTM D1187.

B. Nonshrink, Nonmetallic Grout: Factory-packaged, nonstaining, noncorrosive, nongaseous grout complying with ASTM C1107. Provide grout specifically recommended by manufacturer for interior and exterior applications.

2.6 FABRICATION, GENERAL

A. Shop Assembly: Preassemble items in the shop to greatest extent possible. Disassemble units only as necessary for shipping and handling limitations. Use connections that maintain structural value of joined pieces. Clearly mark units for reassembly and coordinated installation.

B. Cut, drill, and punch metals cleanly and accurately. Remove burrs and ease edges to a radius of approximately 1/32 inch unless otherwise indicated. Remove sharp or rough areas on exposed surfaces.

C. Form bent-metal corners to smallest radius possible without causing grain separation or otherwise impairing work.

D. Form exposed work with accurate angles and surfaces and straight edges.

E. Weld corners and seams continuously to comply with the following:

1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
2. Obtain fusion without undercut or overlap.
3. Remove welding flux immediately.
4. At exposed connections, finish exposed welds and surfaces smooth and blended so no roughness shows after finishing.

F. Form exposed connections with hairline joints, flush and smooth, using concealed fasteners or welds where possible. Where exposed fasteners are required, use Phillips flat-head (countersunk) fasteners unless otherwise indicated. Locate joints where least conspicuous.

G. Fabricate seams and other connections that are exposed to weather in a manner to exclude water. Provide weep holes where water may accumulate.

H. Cut, reinforce, drill, and tap metal fabrications as indicated to receive finish hardware, screws, and similar items.

I. Provide for anchorage of type indicated; coordinate with supporting structure. Space anchoring devices to secure metal fabrications rigidly in place and to support indicated loads.

J. Where units are indicated to be cast into concrete or built into masonry, equip with integrally welded steel strap anchors, 1/8 by 1-1/2 inches, with a minimum 6-inch embedment and 2-inch hook, not less than 8 inches from ends and corners of units and 24 inches on center, unless otherwise indicated.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

A. Cutting, Fitting, and Placement: Perform cutting, drilling, and fitting required for installing metal fabrications. Set metal fabrications accurately in location, alignment, and elevation; with edges and surfaces level, plumb, true, and free of rack; and measured from established lines and levels.

B. Fit exposed connections accurately together to form hairline joints. Weld connections that are not to be left as exposed joints but cannot be shop welded because of shipping size limitations. Do not weld, cut, or abrade surfaces of exterior units that have been hot-dip galvanized after fabrication and are for bolted or screwed field connections.

C. Field Welding: Comply with the following requirements:

1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
2. Obtain fusion without undercut or overlap.
3. Remove welding flux immediately.
4. At exposed connections, finish exposed welds and surfaces smooth and blended so no roughness shows after finishing and contour of welded surface matches that of adjacent surface.

D. Fastening to In-Place Construction: Provide anchorage devices and fasteners where metal fabrications are required to be fastened to in-place construction. Provide threaded fasteners for use with concrete and masonry inserts, toggle bolts, through bolts, lag screws, wood screws, and other connectors.

E. Provide temporary bracing or anchors in formwork for items that are to be built into concrete, masonry, or similar construction.

F. Corrosion Protection: Coat concealed surfaces of aluminum that come into contact with grout, concrete, masonry, wood, or dissimilar metals with the following:

1. Cast Aluminum: Heavy coat of bituminous paint.
2. Extruded Aluminum: Two coats of clear lacquer.

3.2 INSTALLING MISCELLANEOUS FRAMING AND SUPPORTS

A. General: Install framing and supports to comply with requirements of items being supported, including manufacturers' written instructions and requirements indicated on Shop Drawings.

END OF SECTION 05 5000

SECTION 05 5213

PIPE AND TUBE RAILINGS

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. Shop-fabricated steel pipe and tube railings.

1.3 REFERENCES

A. See Section 01 4200 "References".

B. Codes:

1. California Building Code (CBC): Title 24 Part 2.
2. California Green Building Standards Code (CALGreen): Title 24 Part 11.

C. Reference Standards:

1. ASTM A36: Standard Specification for Carbon Structural Steel.
2. ASTM A53: Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless.
3. ASTM A500: Standard Specification for Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes.
4. ASTM A513: Standard Specification for Electric-Resistance-Welded Carbon and Alloy Steel Mechanical Tubing.

1.4 ACTION SUBMITTALS

A. Product Data: For the following:

1. Grout, anchoring cement, and paint products.

B. Shop Drawings: Include plans, elevations, sections, details, and attachments to other work.

1.5 INFORMATIONAL SUBMITTALS

A. Qualification Data: For fabricator.

B. Welding certificates.

C. Mill Certificates: For Type 316 stainless steel, signed by manufacturers of stainless-steel products certifying that products furnished comply with requirements.

D. Paint Compatibility Certificates: From manufacturers of topcoats applied over shop primers certifying that shop primers are compatible with topcoats.

E. Product Test Reports: For pipe and tube railings, for tests performed by a qualified testing agency, according to ASTM E894 and ASTM E935.

F. Evaluation Reports: For post-installed anchors, from ICC-ES.

1.6 QUALITY ASSURANCE

A. Qualifications: See Section 01 4300 "Quality Assurance".

1. Fabricator.

B. Welding Qualifications: Qualify procedures and personnel according to the following:

1. AWS D1.1/D1.1M, "Structural Welding Code - Steel."
2. AWS D1.2/D1.2M, "Structural Welding Code - Aluminum."
3. AWS D1.6/D1.6M, "Structural Welding Code - Stainless Steel."

C. Coordination:

1. Coordinate installation of anchorages for railings. 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.
2. Schedule installation so wall attachments are made only to completed walls. Do not support railings temporarily by any means that do not satisfy structural performance requirements.

1.7 FIELD CONDITIONS

A. Field Measurements: Verify actual locations of walls and other construction contiguous with metal fabrications by field measurements before fabrication.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Structural Performance: Railings, including attachment to building construction, shall withstand the effects of gravity loads and the following loads and stresses within limits and under conditions indicated:

1. Handrails and Top Rails of Guards:

a. Uniform load of 50 lbf/ ft. applied in any direction.
b. Concentrated load of 200 lbf applied in any direction.
c. Uniform and concentrated loads need not be assumed to act concurrently.

2. Infill of Guards:

a. Concentrated load of 50 lbf applied horizontally on an area of 1 sq. ft..
b. Infill load and other loads need not be assumed to act concurrently.

B. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes.

1. Temperature Change: 120 deg F, ambient; 180 deg F, material surfaces.

2.2 METALS, GENERAL

A. Metal Surfaces, General: Provide materials with smooth surfaces, without seam marks, roller marks, rolled trade names, stains, discolorations, or blemishes.

B. Brackets, Flanges, and Anchors: Cast or formed metal of same type of material and finish as supported rails unless otherwise indicated.

1. Provide type of bracket with predrilled hole for exposed bolt anchorage and that provides 1-1/2-inch clearance from inside face of handrail to finished wall surface.

C. Hot-dip galvanize railings for exterior installations and where indicated.

2.3 PIPE AND TUBE RAILINGS

A. Pipe: ASTM A53, Type F or Type S, Grade A, Standard Weight (Schedule 40), unless another grade and weight are required by structural loads.

B. Tubing: ASTM A500 (cold formed) or ASTM A513.

C. Plates, Shapes, and Bars: ASTM A36.

D. Fittings:

1. For galvanized railings, provide hot-dip galvanized fittings, brackets, fasteners, sleeves, and other ferrous components.

2.4 FASTENERS

A. General: Provide the following:

1. Hot-Dip Galvanized Railings: Type 304 stainless-steel or hot-dip zinc-coated steel fasteners complying with ASTM A153 or ASTM F2329 for zinc coating.
2. Provide exposed fasteners with finish matching appearance, including color and texture, of railings.

B. Fasteners for Anchoring Railings to Other Construction: Select fasteners of type, grade, and class required to produce connections suitable for anchoring railings to other types of construction indicated and capable of withstanding design loads.

C. Fasteners for Interconnecting Railing Components:

1. Provide concealed fasteners for interconnecting railing components and for attaching them to other work, unless exposed fasteners are unavoidable or are the standard fastening method for railings indicated.
2. Provide tamper-resistant flat-head machine screws for exposed fasteners unless otherwise indicated.

D. Post-Installed Anchors: Torque-controlled expansion anchors or chemical anchors capable of sustaining, without failure, a load equal to 6 times the load imposed when installed in unit masonry and 4 times the load imposed when installed in concrete, as determined by testing according to ASTM E488, conducted by a qualified independent testing agency.

1. Material for Exterior Locations and Where Stainless Steel Is Indicated:

a. Alloy Group 1 stainless-steel bolts, ASTM F593, and nuts, ASTM F594.

2.5 MISCELLANEOUS MATERIALS

A. Welding Rods and Bare Electrodes: Select according to AWS specifications for metal alloy welded.

B. Galvanizing Repair Paint: High-zinc-dust-content paint complying with SSPC-Paint 20 and compatible with paints specified to be used over it.

C. Bituminous Paint: Cold-applied asphalt emulsion complying with ASTM D1187.

D. Nonshrink, Nonmetallic Grout: Factory-packaged, nonstaining, noncorrosive, nongaseous grout complying with ASTM C1107. Provide grout specifically recommended by manufacturer for interior and exterior applications.

E. Anchoring Cement: Factory-packaged, nonshrink, nonstaining, hydraulic-controlled expansion cement formulation for mixing with water at Project site to create pourable anchoring, patching, and grouting compound.

1. Water-Resistant Product: At exterior locations and where indicated, provide formulation that is resistant to erosion from water exposure without needing protection by a sealer or waterproof coating and that is recommended by manufacturer for exterior use.

2.6 FABRICATION

A. General: Fabricate railings to comply with requirements indicated for design, dimensions, member sizes and spacing, details, finish, and anchorage, but not less than that required to support structural loads.

B. Shop assemble railings to greatest extent possible to minimize field splicing and assembly. Disassemble units only as necessary for shipping and handling limitations. Clearly mark units for reassembly and coordinated installation. Use connections that maintain structural value of joined pieces.

C. Cut, drill, and punch metals cleanly and accurately. Remove burrs and ease edges to a radius of approximately 1/32 inch unless otherwise indicated. Remove sharp or rough areas on exposed surfaces.

D. Form work true to line and level with accurate angles and surfaces.

E. Fabricate connections that are exposed to weather in a manner that excludes water. Provide weep holes where water may accumulate.

F. Cut, reinforce, drill, and tap as indicated to receive finish hardware, screws, and similar items.

G. Connections: Fabricate railings with either welded or nonwelded connections unless otherwise indicated.

H. Welded Connections for Steel and Stainless Steel: Cope components at connections to provide close fit, or use fittings designed for this purpose. Weld all around at connections, including at fittings.

1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
2. Obtain fusion without undercut or overlap.
3. Remove flux immediately.

4. At exposed connections, finish exposed surfaces smooth and blended so no roughness shows after finishing and welded surface matches contours of adjoining surfaces.

I. Nonwelded Connections: Connect members with concealed mechanical fasteners and fittings. Fabricate members and fittings to produce flush, smooth, rigid, hairline joints.

1. Fabricate splice joints for field connection using an epoxy structural adhesive if this is manufacturer's standard splicing method.

J. Form Changes in Direction as Follows:

1. By radius bends of radius indicated or by inserting prefabricated elbow fittings of radius indicated.

K. For changes in direction made by bending, use jigs to produce uniform curvature for each repetitive configuration required. Maintain cross section of member throughout entire bend without buckling, twisting, cracking, or otherwise deforming exposed surfaces of components.

L. Close exposed ends of railing members with prefabricated end fittings.

M. Provide wall returns at ends of wall-mounted handrails unless otherwise indicated. Close ends of returns unless clearance between end of rail and wall is 1/4 inch or less.

N. Brackets, Flanges, Fittings, and Anchors: Provide wall brackets, flanges, miscellaneous fittings, and anchors to interconnect railing members to other work unless otherwise indicated.

1. At brackets and fittings fastened to plaster or gypsum board partitions, provide crush-resistant fillers or other means to transfer loads through wall finishes to structural supports and prevent bracket or fitting rotation and crushing of substrate.

O. Provide inserts and other anchorage devices for connecting railings to concrete or masonry work. Fabricate anchorage devices capable of withstanding loads imposed by railings. Coordinate anchorage devices with supporting structure.

P. For railing posts set in concrete, provide stainless-steel sleeves not less than 6 inches long with inside dimensions not less than 1/2 inch greater than outside dimensions of post, with metal plate forming bottom closure.

Q. Toe Boards: Where indicated, provide toe boards at railings around openings and at edge of open-sided floors and platforms. Fabricate to dimensions and details indicated.

2.7 FINISHES

A. Galvanized Finish: Minimum G60.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

A. Install pipe and tube railings according to approved shop drawings.

B. Fit exposed connections together to form tight, hairline joints.

C. Perform cutting, drilling, and fitting required for installing railings. Set railings accurately in location, alignment, and elevation; measured from established lines and levels and free of rack.

1. Do not weld, cut, or abrade surfaces of railing components that are coated or finished after fabrication and that are intended for field connection by mechanical or other means without further cutting or fitting.
2. Set posts plumb within a tolerance of 1/16 inch in 3 feet.
3. Align rails so variations from level for horizontal members and variations from parallel with rake of steps and ramps for sloping members do not exceed 1/4 inch in 12 feet.

D. Control of Corrosion: Prevent galvanic action and other forms of corrosion by insulating metals and other materials from direct contact with incompatible materials.

1. Coat, with a heavy coat of bituminous paint, concealed surfaces of aluminum that are in contact with grout, concrete, masonry, wood, or dissimilar metals.

E. Adjust railings before anchoring to ensure matching alignment at abutting joints.

F. Fastening to In-Place Construction: Use anchorage devices and fasteners where necessary for securing railings and for properly transferring loads to in-place construction.

3.2 RAILING CONNECTIONS

A. Welded Connections: Use fully welded joints for permanently connecting railing components. Comply with requirements for welded connections in "Fabrication" Article whether welding is performed in the shop or in the field.

B. Nonwelded Connections: Use mechanical or adhesive joints for permanently connecting railing components. Seal recessed holes of exposed locking screws using plastic cement filler colored to match finish of railings.

C. Expansion Joints: Install expansion joints at locations indicated but not farther apart than required to accommodate thermal movement. Provide slip-joint internal sleeve extending 2 inches beyond joint on either side, fasten internal sleeve securely to one side, and locate joint within 6 inches of post.

3.3 ANCHORING POSTS

A. Use metal sleeves preset and anchored into concrete for installing posts. After posts are inserted into sleeves, fill annular space between post and sleeve with nonshrink, nonmetallic grout or anchoring cement, mixed and placed to comply with anchoring material manufacturer's written instructions.

B. Form or core-drill holes not less than 5 inches deep and 3/4 inch larger than OD of post for installing posts in concrete. Clean holes of loose material, insert posts, and fill annular space between post and concrete with nonshrink, nonmetallic grout or anchoring cement, mixed and placed to comply with anchoring material manufacturer's written instructions.

C. Leave anchorage joint exposed with 1/8-inch buildup, sloped away from post.

3.4 ATTACHING RAILINGS

A. Anchor railing ends at walls with round flanges anchored to wall construction and welded to railing ends or connected to railing ends using nonwelded connections.

B. Anchor railing ends to metal surfaces with flanges bolted to metal surfaces and welded to railing ends or connected to railing ends using nonwelded connections.

C. Secure wall brackets and railing end flanges to building construction.

3.5 CLEANING

A. Clean by washing thoroughly with clean water and soap and rinsing with clean water.

B. Galvanized Surfaces: Clean field welds, bolted connections, and abraded areas, and repair galvanizing to comply with ASTM A780.

3.6 PROTECTION

A. Protect finishes of railings from damage during construction period with temporary protective coverings approved by railing manufacturer. Remove protective coverings at time of Substantial Completion.

END OF SECTION 05 5213

SECTION 06 1000

ROUGH CARPENTRY

PART 1 - GENERAL

1.1 DESCRIPTION

A. Section Includes: Provision of all lumber framing, rough hardware and blocking as indicated in the contract drawings.

1.2 REFERENCES

A. Requirements of GENERAL CONDITIONS and DIVISION NO. 1 apply to all Work in this Section.

B. The following published specifications, standards, tests, or recommended methods of trade, industry, or governmental organizations apply to Work in this Section (latest editions apply).

1. California Code of Regulations. Title 24, 2019 edition, also known as California Building Code (CBC) with DSA Amendments.

2. (APA) - American Plywood Association, “Guide to Plywood Grades.”

3. (PS) - United States Product Standard, PS-1 and PS-2 “Construction and Industrial Plywood.”

4. (UL) - Underwriters’ Laboratories, Inc., “Fire Hazard Classification, FR-S.”

5. (WCLIB) - West Coast Lumber Inspection Bureau, “Standard Grading Rules No. 17.”

6. (WWPA) - Western Wood Products Association, “Grading Rules for Lumber.”

7. (AWPA) - American Wood Preservers Association Standards.

   a. T1 – “Processing and Treatment Standard”

   b. U1 – “User Specification for Treated Wood”

8. (AF&PA) - American Forest and Paper Association, “National Design Specification for Wood Construction.” “Special Design Provisions for Wood & Seismic.”.

9. (ASTM) - American Society of Testing and Materials.

1.3 SUBMITTALS

A. Shop Drawings of all specially fabricated rough hardware.

B. Samples only as requested by the architect.

1.4 PRODUCT DELIVERY, STORAGE AND HANDLING

A. Provide proper facilities for handling and storage of materials to prevent damage to edges, ends, and surfaces.

B. Keep materials dry. Where necessary, stack materials off ground on level flat forms, fully protected from weather.

1.5 JOB CONDITIONS

A. Environmental Requirements: Maintain uniform moisture content of lumber at not more than 19-percent during and after installation.

B. New lumber adjacent and connected to existing lumber shall have a moisture content of not more than 15 percent at the time of installation.

C. Sequencing, Scheduling: Coordinate details with other Work supporting, adjoining or fastening to rough carpentry Work.

PART 2 - PRODUCTS

2.1 MATERIAL

A. Rough Carpentry:

1. Sills on Concrete: Douglas Fir with Preservative Treatment.

2. Lumber (Wood Framing): Material grade shall be as shown on the drawings.

3. Plywood: Provide thickness, grade, and panel identification index shown on drawings. For plywood thickness 15/32 or greater provide a minimum of 5 ply.

B. Rough Hardware: All exterior hardware shall be hot-dipped galvanized.

1. Nails: Common wire per ASTM F1667, typical; hot-dipped zinc-coated galvanized, stainless steel, silicon bronze, or copper at exposed conditions, fire-retardant-treated, and preservative-treated lumber.

2. Expansion Bolts: Reverse cone, self-wedging, expansion type, Tightening of nut or increased tension on bolt shank shall act to force wedges outward to create positive increased resistance to withdrawal, Simpson Strong-Bolt, Hilti Kwik-Bolt TZ, or equal product substituted per Section 01630.

3. Metal Framing Connectors: Fabricate from hot-dipped galvanized steel (G90 coating). Connectors in contact with preservative-treated lumber shall have G185 hot dipped galvanized coating per ASTM A653. Connectors in contact with fire-treated lumber shall be manufactured with Type 316L stainless steel. Connectors shall be at least 16-gauge material, 1/8-inch plate materials where welded, unless otherwise shown or specified, punched for nailing. Nails and nailing shall conform to the manufacturer's instructions, including coating and material where applicable, with a nail provided for each punched nail hole. Use maximum nail size listed by manufacturer. Manufactured by Simpson Company or equal product substituted per Division 1.

4. Miscellaneous Hardware: Provide all common screws, bolts, fastenings, washers and nuts required to complete rough carpentry Work.

5. Bolts and sill bolts in wood shall be ASTM A307 with standard cut threads; full diameter bolts (no rolled or "upset" threads permitted) per ANSI/ASME standard B18.2.1.

6. Fasteners used for attachment of exterior wall coverings shall be hot-dipped zinc-coated galvanized steel, mechanically deposited zinc-coated steel, stainless steel, silicon bronze, or copper. The coating weights for hot-dipped zinc-coated fasteners shall be in accordance with ASTM A153. The coating weights for mechanically deposited zinc-coated fasteners shall be in accordance with ASTM B695, Class 55 minimum.

2.2 TREATMENTS

A. Fire-Retardant Treatment: Furnish in accordance with AWPA Standards T1, U1, and P17, "Fire Retardant Formulations."

B. Preservative Treatment: Furnish in accordance with AWPA Standards T1 and U1. Preservatives with an ammonia base, including Ammoniacal Copper Zinc Arsenate (ACZA) are not permitted.

2.3 FABRICATION

A. Preparation:

1. Verify measurements at job site.

2. Verify details and dimensions of equipment and fixtures integral with finish carpentry for proper fit and accurate alignment.

3. Coordinate details with other work supporting, adjoining, or fastening to casework.

B. Lumber:

1. Air- or kiln-dry to maximum 19-percent moisture content at time of surfacing.

2. Furnish surfaced four sides, S4S, unless otherwise noted.

3. Size to conform with rules of governing standard. Sizes shown are nominal unless otherwise noted.

C. Wood Treatments:

1. Fire-Retardant Treatment:

a. Treat in accordance with AWPA Standards T1 and U1 and approved manufacturer's recommendations. Verify AWPA Use Category with proposed application prior to selected preservative. Fire treated lumber shall conform to the requirements of CBC Section 2303.2.

2. Preservative Treatment:

a. Treat lumber and plywood sheathing that is:

i. In contact with concrete and masonry less than six feet above the ground.

ii. Exposed to weather permanently.

iii. Where specified in the Contract Documents.

b. Treat in accordance with AWPA Standards T1 and U1. Verify AWPA Use Category with proposed application prior to selecting preservative.

c. Treated lumber shall be marked per CBC Section 2303.1.8.1.

d. After Treatment and prior to shipping, air- or kiln-dry lumber to maximum 19-percent moisture content.

2.4 SOURCE QUALITY CONTROL

A. Lumber shall bear grade-trademark or be accompanied by certificate of compliance of appropriate grading agency.

B. Plywood shall bear APA grade-trademark.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas to receive rough carpentry Work and verify following:

1. Completion of installation of building components to receive rough carpentry Work.

2. That surfaces are satisfactory to receive Work.

3. That spacing, direction, and details of supports are correct to accommodate installation of blocking, backing, stripping, furring and nailers.

4. That all anchor rods are properly installed.

3.2 INSTALLATION

A. Cutting: Perform all cutting, boring, and similar Work required.

B. Studs, Joists, Beams, and Posts: Install all members true to line. No wood shingle shims are permitted. Place joists with crown up; maximum 1/4-inch crown permitted.

C. Nail joints in accordance with applicable requirements of the CBC Table 2304.9.3.2 unless otherwise shown or specified. Predrill where nails tend to split wood. Nails into preservative-treated lumber shall be hot-dipped galvanized.

D. Bolt holes to be 1/16-inch oversize. Threads shall not bear on wood. Use standard malleable iron washers against wood. Carriage bolts require washers under the nut only.

E. Provide blocking, grounds, nailers, stripping, and backing as shown and as required to secure other Work.

F. Adjoining sheathing panel edges shall bear and be attached to the framing members. Nails shall be placed not less than 3/8-inch from the panel edge.

G. Plywood flooring shall be field glued with adhesive meeting APA specification AFG-01 applied in accordance with the manufacturer's recommendations. Apply continuous line of glue on joists and in groove of tongue and groove panels.

H. Protect preservative-treated and fire-treated lumber per APWA Standard M4, "Standard for the Care of Preservative-Treated Wood Products."

I. Where wood is cut, sawed, planed, bored or marred after preservative or fire-retardant treatment, apply two heavy brush coats of same material used in treatment.

J. Nail heads shall be driven flush with plywood surface. Overdriven nails (nails which fracture the outer ply layer) shall be replaced one for one.

K. Screws (Wood or Lag): Screws shall be screwed and not driven into place. Screw holes for the unthreaded portion shall be predrilled to the same diameter and depth of shank. Holes for threaded portion shall be predrilled less than or

equal to the diameter of the root of the thread. Provide standard cut washers under head of lag screws.

L. Sheathing used for diaphragms and shear walls that are part of the seismic-force-resisting system shall be applied directly to framing members. Sheathing is permitted to be fastened over solid limber planking or laminated decking, provided the sheathing panel joints do not align with the planking or decking joints.

3.3 CLEANING AND ADJUSTING EXPOSED TIMBER

A. Remove damaged or otherwise disfigured portions and replace with new prior to the Owner's acceptance.

B. Wash finished Work in strict accordance with product manufacturer's directions and ensure that washed surfaces do not differ from clean unwashed surfaces. Any difference will be considered unsatisfactory work.

3.4 FIELD QUALITY CONTROL

A. The Owner's Testing Agency shall:

1. Inspect erected timber framing as required to establish conformity of work with Drawings.

2. Inspect all timber connectors per CBC Section 1705A.5.3.

B. Machine Nailing: Use of machine nailing is subject to a satisfactory jobsite demonstration for each project and the approval of the Project Inspector, the Structural Engineer and DSA. The approval is subject to continued satisfactory performance. If the nail heads penetrate the outer ply more than would be normal for a hand-held hammer, or if minimum allowable edge distances are not maintained, the performance will be deemed unsatisfactory and machine nailing shall be discontinued.

END OF SECTION

SECTION 07 5423

THERMOPLASTIC-POLYOLEFIN (TPO) ROOFING

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. Thermoplastic-polyolefin (TPO) roof system.

1.3 REFERENCES

A. See Section 01 4200 "References".

B. Codes:

1. California Building Code (CBC): Title 24 Part 2.
2. California Energy Code, Title 24 Part 6.
3. California Green Building Standards Code (CALGreen): Title 24 Part 11.

C. Reference Standards:

1. ASTM D471 - Standard Test Method for Rubber Property—Effect of Liquids.
2. ASTM D751 - Standard Test Methods for Coated Fabrics
3. ASTM D1079 - Standard Terminology Relating to Roofing and Waterproofing.
4. ASTM D1149 - Standard Test Methods for Rubber Deterioration—Cracking in an Ozone Controlled Environment.
5. ASTM D2137 - Standard Test Methods for Rubber Property—Brittleness Point of Flexible Polymers and Coated Fabrics.
6. ASTM D6878 - Standard Specification for Thermoplastic Polyolefin Based Sheet Roofing.
7. ASTM D7635 - Standard Test Method for Measurement of Thickness of Coatings Over Fabric Reinforcement.
8. ASTM E108 - Standard Test Methods for Fire Tests of Roof Coverings.
9. NFPA 276 - Standard Method of Fire Test for Determining the Heat Release Rate of Roofing Assemblies with Combustible Above-Deck Roofing Components.
10. NRCA - Roofing and Waterproofing Manual.
11. SMACNA Architectural Sheet Metal Manual.
12. UL 1256 - Standard for Fire Test of Roof Deck Constructions.

D. Definitions:

1. Roofing Terminology: Refer to ASTM D1079; glossary of NRCA's "The NRCA Roofing and Waterproofing Manual"; and the Roof Consultants Institute “Glossary of Roofing Terms” for definition of terms related to roofing work in this Section.
2. Sheet Metal Terminology and Techniques: SMACNA Architectural Sheet Metal Manual.

1.4 ACTION SUBMITTALS

A. Product Data: For each item to be installed.

1. Submit specifications, installation instructions and general recommendations from manufacturers of single ply roofing system materials, for types of roofing required.

B. Shop Drawings: For roofing system. Include plans, sections, details, and attachments to other Work.

1. Flashings and membrane terminations.
2. Sheet layout with perimeter and corner defined.

C. Samples: Manufacturer's standard sample size of the following:

1. TPO membrane, in color specified.

D. Installer Certificates: Signed by roofing system manufacturer certifying that Installer is approved, authorized, or licensed by manufacturer to install roofing system.

E. Manufacturer Certificates: Signed by roofing manufacturer certifying that roofing system complies with requirements specified in "Performance Requirements" Article.

F. Qualification Data: For Installer and manufacturer.

G. Product Test Reports: Based on evaluation of comprehensive tests performed by manufacturer and witnessed by a qualified testing agency, for components of roofing system.

H. Research/Evaluation Reports: For components of membrane roofing system.

I. Maintenance Data: For roofing system to include in maintenance manuals.

J. Warranties: Special warranties specified in this Section.

1.5 QUALITY ASSURANCE

A. Qualifications:

1. Installer Qualifications: A qualified firm that is approved, authorized, or licensed by roofing system manufacturer to install manufacturer's product and that is eligible to receive manufacturer's warranty.
2. Manufacturer Qualifications: A qualified manufacturer that has UL listing and FMG approval for membrane roofing system identical to that used for this Project.

B. Fire-Test-Response Characteristics: Provide membrane roofing materials with the fire-test-response characteristics indicated as determined by testing identical products per test method below by UL, FMG, or another testing and inspecting agency acceptable to authorities having jurisdiction. Materials shall be identified with appropriate markings of applicable testing and inspecting agency.

C. Preinstallation Meeting:

1. Review methods and procedures related to roofing system including, but not limited to, the following:

a. Review methods and procedures related to roofing installation, including manufacturer's written instructions.
b. Examine deck substrate conditions and finishes for compliance with requirements, including flatness and fastening.
c. Review structural loading limitations of roof deck during and after roofing.
d. Review Flashings, special roofing details, roof drainage, roof penetrations, equipment curbs, and condition of other construction that will affect roofing system.
e. Review roof observation and repair procedures after roofing installation.

1.6 DELIVERY, STORAGE AND HANDLING

A. Deliver roofing materials to Project site in original containers with seals unbroken and labeled with manufacturer's name, product brand name and type, date of manufacture, and directions for storing and mixing with other components.

B. Store liquid materials in their original undamaged containers in a clean, dry, protected location and within the temperature range required by roofing system manufacturer. Protect stored liquid material from direct sunlight.

C. Discard and legally dispose of liquid material that cannot be applied within its stated shelf life.

D. Handle and store roofing materials and place equipment in a manner to avoid permanent deflection of deck.

1.7 PROJECT CONDITIONS

A. Weather Limitations: Proceed with installation only when existing and forecasted weather conditions permit roofing system to be installed according to manufacturer's written instructions and warranty requirements.

1.8 WARRANTY:

A. Special Project Warranty: Submit roofing Installer's warranty, signed by Installer, covering the Work of this Section, including all components of roofing system, for the following warranty period.

1. Warranty Period: Two years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. General Performance: Installed roofing and base flashings shall withstand specified uplift pressures, thermally induced movement, and exposure to weather without failure due to defective manufacture, fabrication, installation, or other defects in construction. Roof system and flashings shall remain watertight.

1. Accelerated Weathering: Roof membrane shall withstand 2,000 hours of exposure when tested according to ASTM G152, ASTM G154, or ASTM G155.
2. Impact Resistance: Roof membrane shall resist impact damage when tested according to ASTM D3746, ASTM D4272, or the "Resistance to Foot Traffic Test" in FM Approvals 4470.

B. Material Compatibility: Roofing materials shall be compatible with one another and adjacent materials under conditions of service and application required, as demonstrated by roof membrane manufacturer based on testing and field experience.

C. ENERGY STAR Listing: Roofing system shall be listed on the DOE's ENERGY STAR "Roof Products Qualified Product List" for low-slope roof products.

D. Exterior Fire-Test Exposure: ASTM E108 or UL 790, Class A; for application and roof slopes indicated; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.

E. Fire-Resistance Ratings: Comply with fire-resistance-rated assembly designs indicated. Identify products with appropriate markings of applicable testing agency.

F. Cool Roof: Membrane must be listed on Cool Roof Rating Council’s website.

1. Web: www.coolroofs.org.

2.2 THERMOPLASTIC POLYOLEFIN (TPO) ROOF ASSEMBLY

A. Source Limitations: Obtain components for roofing system from roof membrane manufacturer or manufacturers approved by roof membrane manufacturer.

B. Assembly, excluding auxiliary materials:

1. Substrate.

a. Refer to Structural drawings and specifications.

2. Parapet sheathing.
3. Thermoplastic polyolefin (TPO) roofing membrane.

a. Application: Mechanically-fastened.

2.3 THERMOPLASTIC POLYOLEFIN (TPO) ROOFING MEMBRANE

A. TPO Sheet: ASTM D6878, internally fabric- or scrim-reinforced and smooth-backed.

B. Subject to compliance with requirements, acceptable manufacturers include:

1. Carlisle.
2. Firestone Building Products.
3. Genflex.
4. GAF.
5. Johns Manville.
6. Mule-Hide Products.
7. Tremco.
8. Versico.
9. Substitutions: See Section 01 2500 "Substitution Procedures".

C. Physical Properties:

1. Overall Thickness (ASTM D751): 60 mils, nominal.
2. Color: Grey.
3. Coating over Scrim (ASTM D7635): 0.021 inches.
4. Fleeceback: No.
5. Breaking Strength (ASTM D751, Grab Method): 390 lbf (pound-force).
6. Tearing Strength (ASTM D751): 120 lbf.
7. Brittleness Point (ASTM D2137): Pass.
8. Ozone Resistance, No Cracks (ASTM D1149): Pass.
9. Water Absorption (ASTM D471): Less than 3 percent.
10. Puncture Resistance (FTM 101C, Method 2031): 300.

2.4 AUXILIARY ROOFING MATERIALS

A. General: Auxiliary materials recommended by roofing system manufacturer for intended use and compatible with membrane roofing.

B. Fire Resistant Slip Sheet: For installation within roofing assemblies to meet Class A fire rating.

C. Membrane Adhesive: As recommended by membrane manufacturer for particular substrate and project conditions, formulated to withstand design uplift force.

D. Sheet Flashing: Manufacturer's standard sheet flashing of same material, type, reinforcement, thickness, and color as TPO sheet.

E. TPO-clad Metal: Manufacturer’s standard, as required for complete assembly installation.

F. Metal Termination Bars: Manufacturer's standard, predrilled stainless steel or aluminum bars, approximately 1 by 1/8 inch thick; with anchors.

G. Fasteners: Factory-coated steel fasteners and metal or plastic plates complying with corrosion-resistance provisions in FM Approvals 4470, designed for fastening roofing components to substrate, and acceptable to roofing system manufacturer.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with conditions affecting performance of roofing system.

B. Verify that deck is securely fastened with no projecting fasteners and with no adjacent units in excess of 1/16 inch out of plane relative to adjoining deck.

C. Ensure that the roof deck elevations, slopes, drains, and overflows have been verified to be in conformance with the Drawings.

D. Examine decks for inadequate anchorage, moisture and unevenness which would affect quality installation of roofing materials.

E. Do not proceed with installation of roofing until defects are corrected. Proceeding with the work signifies that the contractor accepts the substrate, surfaces & conditions and any problems related to the substrate shall be repaired to the satisfaction of the Architect without any additional cost to the Owner.

3.2 PREPARATION

A. Clean substrate of dust, debris, moisture, and other substances detrimental to roofing installation according to roofing system manufacturer's written instructions. Remove sharp projections.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.3 INSTALLATION OF ROOFING, GENERAL

A. Install roofing system according to roofing system manufacturer's written instructions and approved shop drawings.

B. Complete terminations and base flashings and provide temporary seals to prevent water from entering completed sections of roofing system at end of workday or when rain is forecast. Remove and discard temporary seals before beginning work on adjoining roofing.

C. Install fire resistant slip sheet to maintain Class A fire rating.

3.4 MECHANICALLY-FASTENED ROOF MEMBRANE INSTALLATION

A. Mechanically fasten roof membrane over area to receive roofing according to roofing system manufacturer's written instructions.

B. Unroll roof membrane and allow to relax before installing.

C. Start installation of roofing in presence of roofing system manufacturer's technical personnel.

D. Accurately align roof membrane, and maintain uniform side and end laps of minimum dimensions required by manufacturer. Stagger end laps.

E. Mechanically fasten or adhere roof membrane securely at terminations, penetrations, and perimeter of roofing.

F. Apply roof membrane with side laps shingled with slope of roof deck where possible.

G. In-Seam Attachment: Secure one edge of TPO sheet using fastening plates or metal battens centered within seam, and mechanically fasten TPO sheet to roof deck.

H. Seams: Clean seam areas, overlap roof membrane, and hot-air weld side and end laps of roof membrane and sheet flashings to ensure a watertight seam installation.

1. Test lap edges with probe to verify seam weld continuity. Apply lap sealant to seal cut edges of roof membrane and flashing sheet.

2. Verify field strength of seams a minimum of twice daily, and repair seam sample areas.
3. Repair tears, voids, and lapped seams in roof membrane that do not comply with requirements.

I. Spread sealant bed over deck-drain flange at roof drains, and securely seal roof membrane in place with clamping ring.

3.5 FLASHING INSTALLATION

A. Install sheet flashings and preformed flashing accessories, and adhere to substrates according to roofing system manufacturer's written instructions.

B. Apply bonding adhesive to substrate and underside of sheet flashing at required rate, and allow to partially dry. Do not apply to seam area of flashing.

C. Flash penetrations and field-formed inside and outside corners with cured or uncured sheet flashing.

D. Clean seam areas, overlap, and firmly roll sheet flashings into the adhesive. Hot-air weld side and end laps to ensure a watertight seam installation.

E. Terminate and seal top of sheet flashings and mechanically anchor to substrate through termination bars.

F. Flashings for Roof Fixtures: All flashings for pipes, conduits, scuppers, equipment supports, pitch dams, pitch pockets, etc. shall be installed to conform to the drawings and the requirements of the roofing membrane manufacturer's details.

3.6 PROTECTING AND CLEANING

A. Protect membrane roofing system from damage and wear during remainder of construction period. When remaining construction will not affect or endanger roofing, inspect roofing for deterioration and damage, describing its nature and extent in a written report, with copies to Architect and Owner.

B. Correct deficiencies in or remove membrane roofing system that does not comply with requirements, repair substrates, and repair or reinstall membrane roofing system to a condition free of damage and deterioration at time of Substantial Completion and according to warranty requirements.

C. Clean overspray and spillage from adjacent construction using cleaning agents and procedures recommended by manufacturer of affected construction.

END OF SECTION 07 5423

SECTION 07 6200

SHEET METAL FLASHING AND TRIM

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawing and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Fabricated sheet metal items, including flashings and other items noted on the drawings.

B. Reference Standards:

1. AAMA 611: Voluntary Specification for Anodized Architectural Aluminum.
2. AAMA 620: Voluntary Specifications for High Performance Organic Coatings on Coil Coated Architectural Aluminum Substrates.
3. AAMA 621: Voluntary Specifications for High Performance Organic Coatings on Coil Coated Architectural Hot Dipped Galvanized (HDG) and Zinc-Aluminum
4. ASTM A653: Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.
5. ASTM A666: Standard Specification for Annealed or Cold-Worked Austenitic Stainless Steel Sheet, Strip, Plate, and Flat Bar.
6. ASTM B32: Standard Specification for Solder Metal.
7. ASTM B209: Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate.
8. ASTM D4586: Standard Specification for Asphalt Roof Cement, Asbestos-Free.
9. SMACNA (ASMM): Architectural Sheet Metal Manual.

C. Definitions:

1. Bonderized (Phosphatized) Steel: Galvanized G90 steel that is put through a phosphate bath and then receives a layer of Chromate. The resulting dull finish provides excellent adhesion for other materials.

1.3 ACTION SUBMITTALS

A. Product Data: For manufactured products.

B. Shop Drawings: Indicate material profile, jointing pattern, jointing details, fastening methods, flashings, terminations, and installation details.

1.4 INFORMATIONAL SUBMITTAL

A. Fabricator and Installer Qualifications.

1.5 QUALITY ASSURANCE

A. Qualifications: See Section 01 4300 "Quality Assurance".

1. Fabricator.
2. Installer.

B. Perform work in accordance with SMACNA (ASMM) and CDA A4050 requirements and standard details, except as otherwise indicated.

1. Maintain one copy of each document on site.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Stack material to prevent twisting, bending, and abrasion, and to provide ventilation. Slope metal sheets to ensure drainage.

B. Prevent contact with materials that could cause discoloration or staining.

PART 2 - PRODUCTS

2.1 SHEET MATERIALS

A. Galvanized Steel: ASTM A653, with G90/Z275 zinc coating; minimum 24 gage, (0.0239 inch) thick base metal.

1. Provide bonderized (phosphatized) steel for the following:

a. Paint System: See Section 09 9113 "Exterior Painting". Refer to Architectural drawings for locations of painted flashings and trim.

B. Pre-Finished Galvanized Steel: ASTM A653, with G90/Z275 zinc coating; minimum 24 gage, (0.0239) inch thick base metal, with factory-applied PVDF coil coating.

1. 70 Percent PVDF Fluoropolymer, Two-Coat: Fluoropolymer finish containing not less than 70 percent polyvinylidene difluoride (PVDF) resin by weight in color coat, AAMA 621.
2. Color: As selected by Architect from manufacturer's standard colors.

C. Stainless Steel: ASTM A666, 28 gage, (0.0156 inch) thick; smooth No. 4 - Brushed finish.

2.2 ACCESSORIES

A. Fasteners: Galvanized steel, with soft neoprene washers.

B. Primer: Zinc chromate type.

C. Protective Backing Paint: Zinc molybdate alkyd.

D. Plastic Cement: ASTM D4586, Type I.

E. Solder: ASTM B32; Sn50 type.

2.3 FABRICATION

A. Form sections true to shape, accurate in size, square, and free from distortion or defects.

B. Form pieces in longest possible lengths.

C. Hem exposed edges on underside 1/2 inch; miter and seam corners.

D. Form material with flat lock seams, except where otherwise indicated; at moving joints, use sealed lapped, bayonet-type or interlocking hooked seams.

E. Fabricate corners from one piece with minimum 18 inch long legs; seam for rigidity, seal with sealant.

F. Fabricate flashings to allow toe to extend 2 inches over roofing gravel. Return and brake hemmed edges.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify roofing termination and base flashings are in place, sealed, and secure.

3.2 PREPARATION

A. Install starter and edge strips, and cleats before starting installation.

B. Back paint concealed metal surfaces with protective backing paint to a minimum dry film thickness of 15 mil.

3.3 INSTALLATION

A. Secure flashings in place using concealed fasteners, and use exposed fasteners only where permitted.

B. Apply plastic cement compound between metal flashings and felt flashings.

C. Fit flashings tight in place; make corners square, surfaces true and straight in planes, and lines accurate to profiles.

D. Solder metal joints for full metal surface contact, and after soldering wash metal clean with neutralizing solution and rinse with water.

END OF SECTION 07 6200

SECTION 07 7123

MANUFACTURED GUTTERS AND DOWNSPOUTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawing and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Gutters.
2. Downspouts.

1.3 REFERENCES

A. Codes:

1. California Building Code (CBC): Title 24 Part 2.
2. California Green Building Standards Code (CALGreen): Title 24 Part 11.

B. Reference Standards:

1. ASTM A653: Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.
2. ASTM B209: Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate.
3. SMACNA: Architectural Sheet Metal Manual (ASMM).

1.4 ACTION SUBMITTALS

A. Product Data: Provide data on prefabricated components.

B. Samples: Submit two samples, 8 inch long illustrating component design, finish, color, and configuration.

1.5 ADMINISTRATIVE REQUIREMENTS

A. Conform to ASMM for sizing components for rainfall intensity determined by a storm occurrence of 1 in 5 years.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Stack material to prevent twisting, bending, or abrasion, and to provide ventilation. Slope to drain.

B. Do not store in contact with other materials that might cause staining, denting, or other surface damage. Store roof specialties away from uncured concrete and masonry.

PART 2 - PRODUCTS

2.1 REGULATORY REQUIREMENTS

A. Conform to applicable code for size and method of rain water discharge.

2.2 PERFORMANCE REQUIREMENTS

A. General Performance: Roof specialties shall withstand exposure to weather and resist thermally induced movement without failure, rattling, leaking, or fastener disengagement due to defective manufacture, fabrication, installation, or other defects in construction.

B. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes to prevent buckling, opening of joints, hole elongation, overstressing of components, failure of joint sealants, failure of connections, and other detrimental effects. Provide clips that resist rotation and avoid shear stress as a result of thermal movements. Base calculations on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.

1. Temperature Change (Range): 120 deg F, ambient; 180 deg F, material surfaces.

2.3 COMPONENTS

A. Gutters: Manufactured in uniform section lengths not exceeding 12 feet, with matching corner units, ends, outlet tubes, and other accessories. Elevate back edge atleast 1 inch above front edge. Furnish flat-stock gutter straps, gutter brackets, expansion joints, and expansion-joint covers fabricated from same metal as gutters.

1. Profile: As shown on Architectural drawings.
2. Galvanized Steel: Nominal 0.028-inch thickness.

B. Downspouts: Plain rectangular complete with machine-crimped elbows, manufactured from the following exposed metal. Furnish with metal hangers, from same material as downspouts, and anchors.

1. Galvanized Steel: Nominal 0.028-inch thickness.

C. Anchors and Supports: Profiled to suit gutters and downspouts.

1. Anchoring Devices: Type recommended by fabricator.
2. Gutter Supports: Brackets.
3. Downspout Supports: Brackets.

D. Fasteners: Same material and finish as gutters and downspouts, with soft neoprene washers.

2.4 FABRICATION

A. Form gutters and downspouts of profiles and size indicated.

B. Fabricate with required connection pieces.

C. Form sections square, true, and accurate in size, in maximum possible lengths, free of distortion or defects detrimental to appearance or performance. Allow for expansion at joints.

D. Hem exposed edges of metal.

E. Fabricate gutter and downspout accessories; seal watertight.

2.5 MATERIALS

A. Galvanized Steel Sheet: ASTM A653, G90 coating.

2.6 ACCESSORIES

A. Gutter Guard: Steel expanded metal mesh, pressure fit into gutters and held in place by stainless steel clips.

1. Acceptable manufacturers and products include, but are not limited to:

a. Amerimax Home Products.
b. Substitutions: See Section 01 2500 "Substitution Procedures".

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine walls, roof edges, and parapets for suitable conditions for roof specialties.

B. Verify that substrate is sound, dry, smooth, clean, sloped for drainage where applicable, and securely anchored.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Paint concealed metal surfaces and surfaces in contact with dissimilar metals with protective backing paint to a minimum dry film thickness of 15 mil.

3.3 INSTALLATION, GENERAL

A. Install components in accordance with manufacturer's instructions. Anchor securely in place, with provisions for thermal and structural movement. Use fasteners, solder, protective coatings, separators, underlayments, sealants, and other miscellaneous items as required to complete roof-specialty systems.

1. Provide uniform, neat seams with minimum exposure of solder and sealant.
2. Do not use graphite pencils to mark metal surfaces.

B. Metal Protection: Protect metals against galvanic action by separating dissimilar metals from contact with each other or with corrosive substrates by painting contact surfaces with bituminous coating or by other permanent separation as recommended by manufacturer.

3.4 ROOF-EDGE DRAINAGE-SYSTEM INSTALLATION

A. General: Install components to produce a complete roof-edge drainage system according to manufacturer's written instructions. Coordinate installation of roof perimeter flashing with installation of roof-edge drainage system.

B. Gutters: Join and seal gutter lengths. Allow for thermal expansion. Attach gutters to firmly anchored gutter supports spaced not more than 24 inches apart. Attach ends with rivets and solder to make watertight. Slope to downspouts.

1. Install gutter with expansion joints at locations not exceeding 50 feet apart. Install expansion-joint caps.
2. Install continuous leaf guards on gutters with noncorrosive fasteners, removable for cleaning gutters.

C. Downspouts: Join sections with manufacturer's standard telescoping joints. Provide hangers with fasteners designed to hold downspouts securely to walls and 1 inch away from walls; locate fasteners at top and bottom and at approximately 60 inches on center.

1. Provide elbows at base of downspouts at grade to direct water away from building.
2. Connect downspouts to underground drainage system indicated.

D. Connect downspouts to storm sewer system. Seal connection watertight.

E. Do not install sealants at temperatures below 40 degrees F.

3.5 CLEANING AND PROTECTION

A. Clean exposed metal surfaces of substances that interfere with uniform oxidation and weathering.

B. Clean and neutralize flux materials. Clean off excess solder and sealants.

C. Remove temporary protective coverings and strippable films as components are installed. On completion of installation, clean finished surfaces, including removing unused fasteners, metal filings, pop rivet stems, and pieces of flashing. Maintain roof specialties in a clean condition during construction.

D. Replace components that have been damaged or that cannot be successfully repaired by finish touchup or similar minor repair procedures.

END OF SECTION 07 7123

SECTION 09 9113

EXTERIOR PAINTING

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 surface preparation and the application of paint systems on the following exterior substrates:

1. Concrete.
2. Steel.
3. Galvanized steel.
4. Wood.

1.3 REFERENCES

A. Codes:

1. California Building Code (CBC): Title 24 Part 2.
2. California Green Building Standards Code (CALGreen), Title 24 Part 11.

B. Reference Standards:

1. ASTM D523: Standard Test Method for Specular Gloss.
2. Master Painters Institute (MPI): Architectural Painting Specification Manual.

C. Definitions:

1. Master Painters Institute (MPI) gloss levels, according to ASTM D 523:

a. MPI Gloss Level 1: Not more than five units at 60 degrees and 10 units at 85 degrees.
b. MPI Gloss Level 2: Not more than 10 units at 60 degrees and 10 to 35 units at 85 degrees.
c. MPI Gloss Level 3: 10 to 25 units at 60 degrees and 10 to 35 units at 85 degrees.
d. MPI Gloss Level 4: 20 to 35 units at 60 degrees and not less than 35 units at 85 degrees.
e. MPI Gloss Level 5: 35 to 70 units at 60 degrees.

f. MPI Gloss Level 6: 70 to 85 units at 60 degrees.
g. MPI Gloss Level 7: More than 85 units at 60 degrees.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product. Include preparation requirements and application instructions.

1. Include printout of current "MPI Approved Products List" for each product category specified, with the proposed product highlighted.

B. Samples for Initial Selection: For each type of topcoat product.

C. Samples for Verification: For each type of paint system and each color and gloss of topcoat.

1. Submit Samples on rigid backing, 8 inches square.
2. Apply coats on Samples in steps to show each coat required for system.
3. Label each coat of each Sample.
4. Label each Sample for location and application area.

1.5 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials, from the same product run, that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Paint: 5 percent, but not less than 1 gallon of each material and color applied.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Store materials not in use in tightly covered containers in well-ventilated areas with ambient temperatures continuously maintained at not less than 45 deg F.

1. Maintain containers in clean condition, free of foreign materials and residue.
2. Remove rags and waste from storage areas daily.

1.7 FIELD CONDITIONS

A. Apply paints only when temperature of surfaces to be painted and ambient air temperatures are between 50 and 95 deg F.

B. Do not apply paints in snow, rain, fog, or mist; when relative humidity exceeds 85 percent; at temperatures less than 5 deg F above the dew point; or to damp or wet surfaces.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Basis of Design Manufacturer: Kelly-Moore.

B. Subject to compliance with requirements, acceptable manufacturers that may be incorporated into the Work include, but are not limited to:

1. Behr Pro.
2. Benjamin Moore.
3. Dunn Edwards.
4. PPG Paints.
5. Sherwin Williams.
6. Substitutions: See Section 01 2500 "Substitution Procedures".

2.2 PAINT, GENERAL

A. MPI Standards: Products shall comply with MPI standards indicated and shall be listed in its "MPI Approved Products Lists."

B. Material Compatibility:

1. Materials for use within each paint system shall be compatible with one another and substrates indicated, under conditions of service and application as demonstrated by manufacturer, based on testing and field experience.
2. For each coat in a paint system, products shall be recommended in writing by topcoat manufacturers for use in paint system and on substrate indicated.

C. Colors: As shown on the Construction Drawings or as otherwise selected by Architect or Interior Designer from manufacturer's full range.

D. Refer to Drawings for level of finish gloss for each substrate. If information is not provided on the Drawings, Interior Designer or Architect to select.

2.3 PAINT SYSTEMS

A. Concrete Substrates, Nontraffic Surfaces:

1. Water-Based Light Industrial Coating System:

a. Prime Coat: Primer, alkali resistant, water based, MPI #3.

1) Sherwin-Williams, PrepRite ProBlock Interior / Exterior Latex Primer / Sealer B51W00620.

b. Intermediate Coat: Light industrial coating, exterior, water based, matching topcoat.
c. Topcoat: Light industrial coating, exterior, water based (MPI Gloss Level 3), MPI #161.

1) Sherwin-Williams, Pro Industrial DTM Acrylic Egg-Shell B66W01251.

2) Topcoat: Light industrial coating, exterior, water based, semi-gloss (MPI Gloss Level 5), MPI #163. Semi-Gloss B66W01151.

d. Topcoat: Light industrial coating, exterior, water based, gloss (MPI Gloss Level 6), MPI #164.

1) Sherwin-Williams, Pro Industrial DTM Acrylic Gloss B66W01051.

2. Self-Cleaning Light Industrial System:

a. Self-Priming Base Coat:

1) Sherwin-Williams, Loxon Self-Cleaning Acrylic LX13W0051.

b. Topcoat:

1) Sherwin-Williams, Loxon Self-Cleaning Acrylic LX13W0051.

B. Steel Substrates:

a. Water-Based Light Industrial Coating System

1) Sherwin-Williams, Pro Industrial DTM

b. Prime Coat: Primer, zinc rich, inorganic, MPI #19.

1) Sherwin-Williams, Zinc Clad XI B69V11/B69D11.

c. Prime Coat: Primer, rust inhibitive, water based, MPI #107.

1) Sherwin-Williams, Pro Industrial Pro-Cryl Universal Primer B66W01310 .

d. Prime Coat: Shop primer specified in Section where substrate is specified.
e. Intermediate Coat: Light industrial coating, exterior, water based, matching topcoat.
f. Topcoat: Light industrial coating, exterior, water based (MPI Gloss Level 3), MPI #161.

1) Sherwin-Williams, Pro Industrial DTM Acrylic Egg-Shell, B66W01251.

g. Topcoat: Light industrial coating, exterior, water based, semi-gloss (MPI Gloss Level 5), MPI #163.

1) Sherwin-Williams Pro Industrial DTM Semi-Gloss B66W01151.

h. Topcoat: Light industrial coating, exterior, water based, gloss (MPI Gloss Level 6), MPI #164.

1) Sherwin-Williams, Pro Industrial DTM Acrylic Gloss B66W01051.

C. Galvanized Steel Substrates:

1. Water-Based Light Industrial Coating System:

a. Prime Coat: Primer, galvanized, water based, MPI #134.

1) Sherwin-Williams, Pro Industrial DTM Acrylic Primer/Finish B66W00011.

b. Intermediate Coat: Light industrial coating, exterior, water based, matching topcoat.
c. Topcoat: Light industrial coating, exterior, water based (MPI Gloss Level 3), MPI #161.

1) Sherwin-Williams, Pro Industrial DTM Acrylic Egg-Shell B66W01251.

d. Topcoat: Light industrial coating, exterior, water based, semi-gloss (MPI Gloss Level 5), MPI #163.

1) Sherwin-Williams, Pro Industrial DTM Semi-Gloss B66W01151.

e. Topcoat: Light industrial coating, exterior, water based, gloss (MPI Gloss Level 6), MPI #164.

1) Sherwin-Williams, Pro Industrial DTM Acrylic Gloss B66W01051.

D. Wood Substrates: Exposed framing.

1. Latex over Latex Primer System:

a. Prime Coat: Primer, latex for exterior wood, MPI #6.

1) Sherwin-Williams, Exterior Latex Wood Primer B42.

b. Intermediate Coat: Latex, exterior, matching topcoat.
c. Topcoat: Latex, exterior, flat (MPI Gloss Level 1), MPI #10.

1) Sherwin-Williams, A-100 A6.

d. Topcoat: Latex, exterior, low sheen (MPI Gloss Level 3-4), MPI #15.

1) Sherwin-Williams, A-100 A82.

e. Topcoat: Latex, exterior, semi-gloss (MPI Gloss Level 5), MPI #11.

1) Sherwin-Williams, A-100 A8.

f. Topcoat: Latex, exterior, gloss (MPI Gloss Level 6), MPI #119.

1) Sherwin-Williams, Solo A76.

E. Wood Substrates: Wood trim, architectural woodwork, doors, windows, wood board siding, and wood fences.

1. Water-Based Light Industrial Coating System:

a. Prime Coat: Primer, alkyd for exterior wood, MPI #6.

1) Sherwin-Williams, Exterior Latex Wood Primer B28.

b. Intermediate Coat: Light industrial coating, exterior, water based, matching topcoat.
c. Topcoat: Light industrial coating, exterior, water based, semi-gloss (MPI Gloss Level 5), MPI #163.

1) Sherwin-Williams, Pro Industrial DTM Semi-Gloss B66W01151.

d. Topcoat: Light industrial coating, exterior, water based, gloss (MPI Gloss Level 6), MPI #164.

1) Sherwin-Williams, Pro Industrial DTM Acrylic Gloss B66W01051.

F. Wood Substrates: Wood-based panel products.

1. Latex over Latex Primer System:

a. Prime Coat: Primer, latex for exterior wood, MPI #6.

1) Sherwin-Williams, Exterior Latex Wood Primer B28.

b. Intermediate Coat: Latex, exterior, matching topcoat.
c. Topcoat: Latex, exterior, flat (MPI Gloss Level 1), MPI #10.

1) Sherwin-Williams, A-100 A6.

d. Topcoat: Latex, exterior, low sheen (MPI Gloss Level 3-4), MPI #15.

1) Sherwin-Williams, A-100 A82.

e. Topcoat: Latex, exterior, semi-gloss (MPI Gloss Level 5), MPI #11.

1) Sherwin-Williams, A-100 A8.

f. Topcoat: Latex, exterior, gloss (MPI Gloss Level 6), MPI #119.

1) Sherwin-Williams, Solo A76.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates and conditions, with Applicator present, for compliance with requirements for maximum moisture content and other conditions affecting performance of the Work.

B. Maximum Moisture Content of Substrates: When measured with an electronic moisture meter as follows:

1. Concrete: 12 percent.
2. Wood: 15 percent.

C. Verify suitability of substrates, including surface conditions and compatibility, with existing finishes and primers.

D. Proceed with coating application only after unsatisfactory conditions have been corrected.

1. Application of coating indicates acceptance of surfaces and conditions.

3.2 PREPARATION

A. Comply with manufacturer's written instructions and recommendations in "MPI Architectural Painting Specification Manual" applicable to substrates and paint systems indicated.

B. Remove hardware, covers, plates, and similar items already in place that are removable and are not to be painted. If removal is impractical or impossible because of size or weight of item, provide surface-applied protection before surface preparation and painting.

1. After completing painting operations, use workers skilled in the trades involved to reinstall items that were removed. Remove surface-applied protection.

C. Clean substrates of substances that could impair bond of paints, including dust, dirt, oil, grease, and incompatible paints and encapsulants.

1. Remove incompatible primers and re-prime substrate with compatible primers or apply tie coat as required to produce paint systems indicated.

D. Concrete Substrates: Remove release agents, curing compounds, efflorescence, and chalk. Do not paint surfaces if moisture content or alkalinity of surfaces to be painted exceeds that permitted in manufacturer's written instructions.

E. Steel Substrates: Remove rust, loose mill scale, and shop primer if any. Clean using methods recommended in writing by paint manufacturer.

F. Shop-Primed Steel Substrates: Clean field welds, bolted connections, and areas where shop paint is abraded. Paint exposed areas with the same material as used for shop priming to comply with SSPC-PA 1 for touching up shop-primed surfaces.

G. Galvanized-Metal Substrates: Remove grease and oil residue from galvanized sheet metal by mechanical methods to produce clean, lightly etched surfaces that promote adhesion of subsequently applied paints.

H. Wood Substrates:

1. Scrape and clean knots. Before applying primer, apply coat of knot sealer recommended in writing by topcoat manufacturer for exterior use in paint system indicated.
2. Sand surfaces that will be exposed to view and dust off.
3. Prime edges, ends, faces, undersides, and backsides of wood.
4. After priming, fill holes and imperfections in the finish surfaces with putty or plastic wood filler. Sand smooth when dried.

APPLICATION

I. Apply paints according to manufacturer's written instructions and recommendations in "MPI Architectural Painting Specification Manual."

1. Use applicators and techniques suited for paint and substrate indicated.
2. Paint surfaces behind movable items same as similar exposed surfaces. Before final installation, paint surfaces behind permanently fixed items with prime coat only.
3. Paint both sides and edges of exterior doors and entire exposed surface of exterior door frames.
4. Paint entire exposed surface of window frames and sashes.
5. Do not paint over labels of independent testing agencies or equipment name, identification, performance rating, or nomenclature plates.
6. Primers specified in painting schedules may be omitted on items that are factory primed or factory finished if acceptable to topcoat manufacturers.

J. Tint undercoats same color as topcoat but tint each undercoat a lighter shade to facilitate identification of each coat if multiple coats of same material are to be applied. Provide sufficient difference in shade of undercoats to distinguish each separate coat.

K. If undercoats or other conditions show through topcoat, apply additional coats until cured film has a uniform paint finish, color, and appearance.

L. Apply paints to produce surface films without cloudiness, spotting, holidays, laps, brush marks, roller tracking, runs, sags, ropiness, or other surface imperfections. Cut in sharp lines and color breaks.

3.3 FIELD QUALITY CONTROL

A. Dry Film Thickness Testing: Owner may engage the services of a qualified testing and inspecting agency to inspect and test paint for dry film thickness.

1. Contractor shall touch up and restore painted surfaces damaged by testing.
2. If test results show that dry film thickness of applied paint does not comply with paint manufacturer's written recommendations, Contractor shall pay for testing and apply additional coats as needed to provide dry film thickness that complies with paint manufacturer's written recommendations.

3.4 CLEANING AND PROTECTION

A. At end of each workday, remove rubbish, empty cans, rags, and other discarded materials from Project site.

B. After completing paint application, clean spattered surfaces. Remove spattered paints by washing, scraping, or other methods. Do not scratch or damage adjacent finished surfaces.

C. Protect work of other trades against damage from paint application. Correct damage to work of other trades by cleaning, repairing, replacing, and refinishing, as approved by Architect, and leave in an undamaged condition.

D. At completion of construction activities of other trades, touch up and restore damaged or defaced painted surfaces.

END OF SECTION 09 9113

SECTION 10 1467

SIGNAGE

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. Tactile signage.
2. Exterior building signage.

1.3 REFERENCES

A. See Section 01 4200 "References".

B. Codes:

1. California Building Code (CBC): Title 24 Part 2.

C. Reference Standards:

1. ADA Standards - Americans with Disabilities Act (ADA) Standards for Accessible Design.
2. FED-STD-595C - Colors Used in Government Procurement.

a. Superceded by Aerospace Material Specification Standard 595: Colors Used in U.S. Government Procurement.

D. Definitions:

1. Pictogram: A pictorial symbol that represents activities, facilities, or concepts.

1.4 SUBMITTALS, GENERAL

A. See Section 01 3300 "Submittal Procedures".

B. See Section 01 6116 "Material Contaminant Restrictions" for additional submittals.

1.5 ACTION SUBMITTALS

A. Product Data: For each item to be installed.

1.6 COORDINATION

A. Furnish templates for placement of sign-anchorage devices embedded in permanent construction by other installers.

1.7 DELIVERY, STORAGE, AND HANDLING

A. See Section 01 6000 "Product Requirements".

B. Packaging Waste Management: See Section 01 7419 "Construction Waste Management and Disposal".

1.8 WARRANTY

A. Special Warranty: Manufacturer agrees to repair or replace components of signs that fail in materials or workmanship within specified warranty period.

1. Failures include, but are not limited to, the following:

a. Deterioration of finishes beyond normal weathering.
b. Deterioration of embedded graphic image.
c. Separation or delamination of sheet materials and components.

2. Warranty Period: Five years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 REGULATORY REQUIREMENTS

A. Signage to comply with accessibility requirements of CBC and ADA.

1. See Section 01 6119 Product Accessibility Requirements for features required of materials or products to meet accessibility criteria.

B. International Symbol of Accessibility (11B-703.7.2.1):

1. Colors: White symbol on a blue background.

a. Color blue to approximate FS 15090, FED-STD-595C.

2.2 PRODUCTS

A. Tactile Signage: Acrylic signage with tactile lettering, braille, and pictogram.

B. Manufacturers: Subject to compliance with requirements, acceptable manufacturers include, but are not limited to:

1. Accent Signage Systems.
2. ADA Sign Depot.
3. Apco.
4. ASI Sign Systems.
5. Best Sign Systems.
6. Kroy Sign Systems.
7. Office Sign Company.
8. Vomar Products.
9. Substitutions: See Section 01 2500 "Substitution Procedures".

C. Physical Properties:

1. Produce smooth, even, level sign panel surfaces, constructed to remain flat under installed conditions within a tolerance of plus or minus 1/16 inch measured diagonally.

D. Exterior Building Signage: Painted aluminum. Verify mounting, type, text and colors in field.

2.3 MATERIALS

A. Acrylic Sheet: ASTM D4802, category as standard with manufacturer for each sign, Type UVF (UV filtering).

B. Exterior Buiding Signage: Painted Aluminum.

2.4 FINISH

A. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

B. Appearance of Finished Work: Noticeable variations in same piece are not acceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

2.5 ACCESSORIES

A. Fasteners and Anchors: Manufacturer's standard as required for secure anchorage of signs, noncorrosive and compatible with each material joined, and complying with the following:

1. Use concealed fasteners and anchors unless indicated to be exposed.

2. Two-Face Tape: Manufacturer's standard high-bond, foam-core tape, 0.045 inch thick, with adhesive on both sides.
3. Adhesive: As recommended by sign manufacturer.

    a. See Section 01 6116 "Material Contaminant Restrictions", for maximum allowable VOC content.

4. Sign Mounting Fasteners:

    a. Concealed Studs: Concealed (blind), threaded studs welded or brazed to back of sign material or screwed into back of sign assembly unless otherwise indicated.
    b. Through Fasteners: Exposed metal fasteners matching sign finish, with type of head indicated, and installed in predrilled holes.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify that sign surfaces are clean and free of materials or debris that would impair installation.

3.2 INSTALLATION

A. General: Install signs using mounting methods indicated and according to manufacturer's written instructions.

1. Install signs in location on walls according to accessibility requirements.
2. Install exterior buiding signage at locations indicated on the drawings.
3. Install signs level, plumb, true to line, and at locations and heights indicated, with sign surfaces free of distortion and other defects in appearance.
4. Install signs so they do not protrude or obstruct according to CBC requirements.

3.3 ADJUSTING AND CLEANING

A. Remove and replace damaged or deformed signs and signs that do not comply with specified requirements. Replace signs with damaged or deteriorated finishes or components that cannot be successfully repaired by finish touchup or similar minor repair procedures.

B. Remove temporary protective coverings andstrippable films as signs are installed.

C. On completion of installation, clean exposed surfaces of signs according to manufacturer's written instructions, and touch up minor nicks and abrasions in finish. Maintain signs in a clean condition during construction and protect from damage until acceptance by Owner.

END OF SECTION 10 1467

SECTION 10 8113

BIRD CONTROL DEVICES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawing and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Products to restrict birds from landing and nesting at select exterior locations.

1.3 REFERENCES

A. See Section 01 4200 "References".

B. Codes:

1. California Building Code (CBC): Title 24 Part 2.
2. California Green Building Standards Code (CALGreen): Title 24 Part 11.

1.4 ACTION SUBMITTALS

A. Product Data: For each item to be installed.

B. Shop Drawings:

1. Show locations, sizes, and types of bird control devices.
2. Show attachment methods and spacing of fasteners, as applies.

C. Manufacturer’s Installation Instructions.

1.5 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data.

B. Warranty Documentation.

1.6 COORDINATION

A. Bird Spikes: Coordinate the appropriate width and placement of spikes on each surface with manufacturer.

B. Bird Netting: Coordinate the appropriate opening size to effectively deter birds within the Project region with manufacturer.

1.7 SITE CONDITIONS

A. Field Measurements: Verify actual dimensions by field measurement. Show recorded measurements on shop drawings.

1.8 WARRANTY

A. Manufacturer's Warranty:

1. Bird Spikes: Ten year warranty against defects, U.V. degradation, and finish degradation.
2. Bird Netting:

a. Ten years for black netting.
b. Three years for stone and white netting.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Subject to compliance with requirements, acceptable manufacturers include, but are not limited to:

1. Bird B Gone.
2. Bird Barrier.
3. Bird-X.
4. Grainger.
5. Nixalite.
6. Substitutions: See Section 01 2500 "Substitution Procedures".

2.2 BIRD SPIKES

A. Bird Spikes, General: Installed on horizontal surfaces to prevent birds from landing.

B. Metal Bird Spikes: Continuous base with sharp metal needles projecting at various angles.

1. Basis of Design Manufacturer and Product:

a. Bird B Gone, Stainless Steel Bird Spikes.
b. Substitutions: See Section 01 2500 "Substitution Procedures".

2. Physical Properties:

a. Base Type: Polycarbonate.
b. Spike Material: Stainless steel.
c. Spike Array Width: As recommended by manufacturer for location and horizontal surface width.
d. Strip Length: 2 feet.
e. Anchorage:

1) Wood: #8 wood screws.
2) Metal, Masonry, and Concrete: Adhesive.
3) Pipes and Poles: U.V.-resistant cable ties and adhesive.

2.3 BIRD NETTING

A. Polyethylene Bird Netting: U.V.-stabilized, knotted polyethylene netting; installed in orientation shown on drawings to prevent birds from accessing unwanted areas. Flame-resistant, rot-proof, non-conductive, and stable in sub-zero temperatures.

1. Basis of Design Manufacturer and Product:

a. Bird B Gone, Heavy Duty 12/6 Bird Net 2000.
b. Substitutions: See Section 01 2500 "Substitution Procedures".

2. Physical Properties:

a. Material: 12/1000 inch diameter polyethylene monofilaments, wound as bundle of 6 monofilaments with between 610 and 630 twists per meter.
b. Net Opening Size: As recommended by manufacturer for bird species typical for Project location.
c. Break Strength (ISO 1806): 40 pounds minimum.
d. Color: Black.
e. Hardware: Manufacturer's stainless steel.
f. Anchorage: Manufacturer's, typical.

1) Solid Steel: Eye bolts with lock nuts at corner attachments. Multipurpose cable brackets with powder-actuated fire-in-pins for intermediate attachments.
2) Masonry and Concrete: Net bolts at corner attachments. One of the following for intermediate attachments: open or closed net loop, net spike, split pin with anchor rivet, or multipurpose cable bracket.

2.4 MISCELLANEOUS MATERIALS

A. Adhesives / Sealants: See Section 01 6116 "Material Contaminant Restrictions", for maximum allowable VOC content.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates and conditions, with Installer present, for compliance with requirements.

3.2 PREPARATION

A. Prepare substrates as required by manufacturer to receive products of this Section.

1. Clean all surfaces of bird droppings, nesting materials, rust, peeling paint, and other debris.
2. Remove or repair items that may damage or compromise function of bird control devices.

3.3 INSTALLATION

A. Comply with manufacturer's written instructions and approved shop drawings.

B. Bird Spikes Installation:

1. Install to cover the entire depth of surfaces to be protected, not just the perimeter.
2. Follow contours and angles closely. Cut to fit properly.
3. Space materials in accordance with manufacturer's recommendations.

C. Bird Netting Installation:

1. Secure tightly to substrate, at the entire perimeter. Confirm there are no loose portions of perimeter or fasteners.
2. Install netting to conceal fasteners where possible.

3.4 ADJUSTING

A. Visually inspect finished installation, and adjust bird control devices as necessary.

END OF SECTION 10 8113

SECTION 22 0000

PLUMBING BASIC REQUIREMENTS

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Work included in 22 00 00, Plumbing Basic Requirements applies to Division 22, Plumbing work to provide materials, labor, tools, permits, incidentals, and other services to provide and make ready for Owner's use of plumbing systems for proposed project.

B. Contract Documents include, but are not limited to, Specifications including Division 00, Procurement and Contracting Requirements and Division 01, General Requirements, Drawings, Addenda, Owner/Architect Agreement, and Owner/Contractor Agreement. Confirm requirements before commencement of work.

C. Definitions:

1. Provide: To furnish and install, complete and ready for intended use.

2. Furnish: Supply and deliver to project site, ready for unpacking, assembly and installation.

3. Install: Includes unloading, unpacking, assembling, erecting, installation, applying, finishing, protecting, cleaning and similar operations at project site as required to complete items of work furnished.

4. Approved or Approved Equivalent: To possess the same performance qualities and characteristics and fulfill the utilitarian function without any decrease in quality, durability or longevity. For equipment/products defined by the Contractor as "equivalent", substitution requests must be submitted to Engineer for consideration, in accordance with Division 01, General Requirements, and approved by the Engineer prior to submitting bids for substituted items.

5. Authority Having Jurisdiction (AHJ): Indicates reviewing authorities, including local fire marshal, Owner's insurance underwriter, Owner's Authorized Representative, and other reviewing entity whose approval is required to obtain systems acceptance.

1.2 RELATED SECTIONS

A. Contents of Section applies to Division 22, Plumbing Contract Documents.

B. Related Work:

1. Additional conditions apply to this Division including, but not limited to:

a. Specifications including Division 00, Procurement and Contracting Requirements and Division 01, General Requirements.

b. Drawings

c. Addenda

d. Owner/Architect Agreement

e. Owner/Contractor Agreement

f. Codes, Standards, Public Ordinances and Permits

1.3 REFERENCES AND STANDARDS

A. References and Standards per Division 00, Procurement and Contracting Requirements, Division 01, General Requirements, individual Division 22, Plumbing Sections and those listed in this Section.

B. Codes to include latest adopted editions, including current amendments, supplements and local jurisdiction requirements in effect as of the date of the Contract Documents, of/from:

1. State of California:

a. CBC - California Building Code

b. CEC - California Electrical Code

c. CEC T24 - California Energy Code Title 24

d. CFC - California Fire Code

e. CMC - California Mechanical Code

f. CPC - California Plumbing Code

g. CSFM - California State Fire Marshal

h. DSA - Division of State Architect Regulations and Requirements

C. Reference standards and guidelines include but are not limited to the latest adopted editions from:

1. ABA - Architectural Barriers Act

2. ADA - Americans with Disabilities Act

3. AHRI - Air-Conditioning Heating & Refrigeration Institute

4. ANSI - American National Standards Institute

5. ASCE - American Society of Civil Engineers

6. ASHRAE - American Society of Heating, Refrigerating and Air-Conditioning Engineers

7. ASHRAE Guideline 0, the Commissioning Process
8. ASME - American Society of Mechanical Engineers
9. ASPE - American Society of Plumbing Engineers
10. ASSE - American Society of Sanitary Engineering
11. ASTM - ASTM International
12. AWWA - American Water Works Association
13. CFR - Code of Federal Regulations
14. CGA - Compressed Gas Association
15. CISPI - Cast Iron Soil Pipe Institute
16. ETL - Electrical Testing Laboratories
17. EPA - Environmental Protection Agency
18. FM - FM Global
19. IAPMO - International Association of Plumbing and Mechanical Officials
20. GAMA - Gas Appliance Manufacturers Association
21. HI - Hydraulic Institute Standards
22. ISO - International Organization for Standardization
23. MSS - Manufacturers Standardization Society
24. NEC - National Electric Code
25. NEMA - National Electrical Manufacturers Association
26. NFGC - National Fuel Gas Code
27. NFPA - National Fire Protection Association
28. NRCA - National Roofing Contractors Association
29. NSF - National Sanitation Foundation
30. OSHA - Occupational Safety and Health Administration
31. SMACNA - Sheet Metal and Air Conditioning Contractors' National Association, Inc.
32. TEMA - Tubular Exchanger Manufacturers Association

33. TIMA - Thermal Insulation Manufacturers Association

34. UL - Underwriters Laboratories Inc.

D. See Division 22, Plumbing individual Sections for additional references.

1.4 SUBMITTALS

A. See Division 01, General Requirements for Submittal Procedures as well as specific individual Division 22, Plumbing Sections.

B. Provide drawings in format and software release equal to the design documents. Drawings to be the same sheet size and scale as the Contract Documents.

C. In addition:

1. "No Exception Taken" constitutes that review is for general conformance with the design concept expressed in the Contract Documents for the limited purpose of checking for conformance with information given. Any action is subject to the requirements of the Contract Documents. Contractor is responsible for the dimensions and quantity and will confirm and correlate at the job site, fabrication processes and techniques of construction, coordination of the work with that of all other trades, and the satisfactory performance of the work.

2. Provide product submittals and shop drawings in electronic format only. Electronic format must be submitted via zip file via e-mail. For electronic format, provide one file per division containing one bookmarked PDF file with each bookmark corresponding to each Specification Section. Arrange bookmarks in ascending order of Specification Section number. Individual submittals sent piecemeal in a per Specification Section method will be returned without review or comment. All transmissions/submissions to be submitted to Architect. At Contractor's option, two separate submittals may be provided, consisting of underground work and building work. Deviations will be returned without review.

3. Product Data: Provide Manufacturer's descriptive literature for products specified in Division 22, Plumbing Sections.

4. Identify/mark each submittal in detail. Note what differences, if any, exist between the submitted item and the specified item. Failure to identify the differences will be considered cause for disapproval. If differences are not identified and/or not discovered during the submittal review process, Contractor remains responsible for providing equipment and materials that meet the Specifications and Drawings.

a. Label submittal to match numbering/references as shown in Contract Documents and schedules. Highlight and label applicable information to individual equipment or cross out/remove extraneous data not applicable to submitted model. Clearly note options and accessories to be provided, including field installed items. Highlight connections by/to other trades.

b. Include technical data, installation instructions and dimensioned drawings for products, fixtures, equipment and devices installed, furnished or provided. Reference Division 22, Plumbing Sections for specific items required in product data submittal outside of these requirements.

c. Provide pump curves, operation characteristics, capacities, ambient noise criteria, etc. for equipment.

d. For vibration isolation of equipment, list make and model selected with operating load and deflection. Indicate frame type where required. Submit manufacturer's product data.

e. See Division 22, Plumbing Sections for additional submittal requirements outside of these requirements.

5. Maximum of two reviews of complete submittal package. Arrange for additional reviews and/or early review of long-lead items; Bear costs of additional reviews at Engineer's hourly rates. Incomplete submittal packages/submittals will be returned to contractor without review.

6. Resubmission Requirements: Make corrections or changes in submittals as required, and in consideration of Engineer’s comments. Identify Engineer’s comments and provide an individual response to each of the Engineer’s comments. Cloud changes in the submittals and further identify changes which are in response to Engineer’s comments.

7. Structural/Seismic: Provide weights, dimensions, mounting requirements and like information required for mounting, seismic bracing, and support. Indicate manufacturer's installation and support requirements to meet ASCE 7-10 requirements for non-structural components. Provide engineered seismic drawings and equipment seismic certification. Equipment Importance Factor as specified in Division 01 and in Structural documents.

8. Trade Coordination: Include physical characteristics, electrical characteristics, device layout plans, wiring diagrams, and connections as required per Division 22, Plumbing Coordination Documents. For equipment with electrical connections, furnish copy of approved submittal for inclusion in Division 26, Electrical submittals.

9. Make provisions for openings in building for admittance of equipment prior to start of construction or ordering of equipment.

10. Substitutions and Variation from Basis of Design:

a. The Basis of Design designated product establishes the qualities and characteristics for the evaluation of any comparable products by other listed acceptable manufacturers if included in this Specification or included in an approved Substitution Request as judged by the Design Professional.

b. If substitutions and/or equivalent equipment/products are being proposed, it is the responsibility of parties concerned, involved in, and furnishing the substitute and/or equivalent equipment to verify and compare the characteristics and requirements of

that furnished to that specified and/or shown. If greater capacity and/or more materials and/or more labor is required for the rough-in, circuitry or connections than for the item specified and provided for, then provide compensation for additional charges required for the proper rough-in, circuitry and connections for the equipment being furnished. No additional charges above the Base Bid, including resulting charges for work performed under other Divisions, will be allowed for such revisions. Coordinate with the requirements of "Submittals". For any product marked "or approved equivalent", a substitution request must be submitted to Engineer for approval prior to purchase, delivery or installation.

11. Shop Drawings: Provide coordinated Shop Drawings which include physical characteristics of all systems, equipment and piping layout plans, and control wiring diagrams. Reference individual Division 22, Plumbing Sections for additional requirements for Shop Drawings outside of these requirements.

    a. Provide Shop Drawings indicating sanitary and storm cleanout locations and type to Architect for approval prior to installation.

    b. Provide Shop Drawings indicating access panel locations, size and elevation for approval prior to installation.

12. Samples: Provide samples when requested by individual Sections.

13. Resubmission Requirements:

    a. Make any corrections or change in submittals when required. Provide submittals as specified. The engineer will not be required to edit and/or interpret the Contractor's submittals. Indicate changes for the resubmittal in a cover letter with reference to page(s) changed and reference response to comment. Cloud changes in the submittals.

        1) Resubmit for review until review indicates no exception taken or "make corrections as noted".

        2) When submitting drawings for Engineers re-review, clearly indicate changes on drawings and "cloud" any revisions. Submit a list describing each change.

14. Record Drawings:

    a. Maintain at site at least one set of drawings for recording “As-constructed” conditions. Indicate on Drawings changes to original documents by referencing revision document, and include buried elements, location of cleanouts, and location of concealed mechanical items. Include items changed by field orders, supplemental instructions, and constructed conditions.

    b. Record Drawings are to include equipment and fixture/connection schedules that accurately reflect "as constructed or installed" for project.

c. At completion of project, input changes to original project on CAD Drawings and make one set of black-line drawings created from CAD Files in version/release equal to contract drawings. Submit CAD disk and drawings upon substantial completion.

d. Provide Invert elevations and dimensioned locations for water services, building waste, and storm drainage piping below grade extending to 5-feet outside building line.

e. See Division 22, Plumbing individual Sections for additional items to include in record drawings.

1.5 QUALITY ASSURANCE

A. Regulatory Requirements: Work and materials installed to conform with all local, State and Federal codes, and other applicable laws and regulations. Where code requirements are at variance with Contract Documents, meet code requirements as a minimum requirement and include costs necessary to meet these in Contract. Machinery and equipment are to comply with OSHA requirements, as currently revised and interpreted for equipment manufacturer requirements. Install equipment provided per manufacturer recommendations.

B. Whenever this Specification calls for material, workmanship, arrangement or construction of higher quality and/or capacity than that required by governing codes, higher quality and/or capacity take precedence.

C. Drawings are intended to be diagrammatic and reflect the Basis of Design manufacturers equipment. They are not intended to show every item in its exact dimensions, or details of equipment or proposed systems layout. Verify actual dimensions of systems (i.e., piping) and equipment proposed to assure that systems and equipment will fit in available space. Contractor is responsible for design and construction costs incurred for equipment other than Basis of Design, including, but not limited to, architectural, structural, electrical, HVAC, fire sprinkler, and plumbing systems.

D. Manufacturer's Instructions: Follow manufacturer's written instructions. If in conflict with Contract Documents, obtain clarification. Notify Engineer/Architect, in writing, before starting work.

E. Items shown on Drawings are not necessarily included in Specifications or vice versa. Confirm requirements in all Contract Documents.

F. Provide products that are UL listed.

G. All potable water system components, devices, material, or equipment containing a weighted average of greater than 0.25 percent lead are prohibited, and shall be certified in accordance with current editions of the Safe Drinking Water Act (SDWA), NSF 61 & NSF 372. Endpoint devices used to dispense water for drinking shall meet the requirements of NSF 61.

1.6 WARRANTY

A. Provide written warranty covering the work for a period of one year from date of Substantial Completion in accordance with Division 00, Contracting and Procurement Requirements, Division 01, General Requirements, Section 22 00 00, Plumbing Basic Requirements and individual Division 22, Plumbing Sections.

B. Sections under this Division can require additional and/or extended warranties that apply beyond basic warranty in Division 01, General Requirements and the General Conditions. Confirm requirements in all Contract Documents.

1.7 COORDINATION DOCUMENTS

A. Prior to construction, coordinate installation and location piping with architectural and civil requirements, and other trades and provide access requirements.

B. Advise Architect in the event a conflict occurs in location or connection of equipment. Bear costs resulting from failure to properly coordinate installation or failure to advise Architect of conflict.

1.8 WORK INCLUDED

A. Furnish and install sleeves, inserts and anchorage required for the installation, which are embedded in work of other trades. Sleeve, wrap and seal piping in concrete.

PART 2 - PRODUCTS

2.1 STANDARDS OF MATERIALS AND WORKMANSHIP

A. Base contract upon furnishing materials as specified. Materials, equipment, and fixtures used for construction are to be new, latest products as listed in manufacturer's printed catalog data and are to be UL approved or have adequate approval or be acceptable by State, County, and City authorities.

B. Names and manufacturer's names denote character and quality of equipment desired and are not to be construed as limiting competition.

C. Hazardous Materials:

1. Comply with local, State of California, and Federal regulations relating to hazardous materials.

2. Comply with Division 00, Procurement and Contracting Requirements and Division 01, General Requirements for this project relating to hazardous materials.

3. Do not use any materials containing a hazardous substance. If hazardous materials are encountered, do not disturb; immediately notify Owner and Architect. Hazardous materials will be removed by Owner under separate contract.

PART 3 - EXECUTION

3.1 ACCESSIBILITY AND INSTALLATION

A. Confirm Accessibility and Installation requirements in Division 00, Procurement and Contracting Requirements, Division 01, General Requirements, Section 22 00 00, Plumbing Basic Requirements and individual Division 22, Plumbing Sections.

B. Earthwork:

1. Confirm Earthwork requirements in Contract Documents. In absence of specific requirements, comply with individual Division 22, Plumbing Sections and the following:

a. Perform excavation, dewatering, shoring, bedding, and backfill required for installation of work in this Division in accordance with the provisions of related earthwork Sections/divisions. Contact utilities and locate existing utilities prior to excavation. Repair any work damaged during excavation or backfilling.

b. Excavation: Do not excavate under footings, foundation bases, or retaining walls.

c. Provide protection of underground systems. Review the project Geotechnical Report for references to corrosive or deleterious soils which will reduce the performance or service life of underground systems materials.

C. Pipe Installation:

1. Provide installation of piping systems coordinated to account for expansion and contraction of piping materials and building as well as anticipated settlement or shrinkage of building. Install work to prevent damage to piping, equipment, and building and its contents. Provide piping offsets, loops, expansion joints, sleeves, anchors or other means to control pipe movement and minimize forces on piping. Verify anticipated settlement and/or shrinkage of building with Project Structural Engineer. Verify construction phasing, type of building construction products and rating for coordinating installation of piping systems.

2. Include provisions for servicing and removal of equipment without dismantling piping.

3.2 REVIEW AND OBSERVATION

A. Confirm Review and Observation requirements in Division 00, Procurement and Contracting Requirements, Division 01, General Requirements, Section 22 00 00, Plumbing Basic Requirements and individual Division 22, Plumbing Sections.

B. Notify Architect, in writing, at following stages of construction so that they may, at their option, visit site for review and construction observation:

1. Underground piping installation prior to backfilling.

2. When main systems, or portions of, are being tested and ready for inspection by AHJ.

C. Bear responsibility and cost to make piping accessible, to expose concealed lines, or to demonstrate acceptability of the system. If Contractor fails to notify Architect at times prescribed above, costs incurred by removal of such work are the responsibility of the Contractor.

D. Final Punch:

1. Prior to requesting a final punch visit from the Engineer, request from Engineer the Plumbing Precloseout Checklist, complete the checklist confirming completion of systems' installation, and return to Engineer. Request a final punch visit from the Engineer, upon Engineer's acceptance that the plumbing systems are ready for final punch.

2. Costs incurred by additional trips required due to incomplete systems will be the responsibility of the Contractor.

3.3 CUTTING AND PATCHING

A. Confirm Cutting and Patching requirements in Division 01, General Requirements. In absence of specific requirements, comply with individual Division 22, Plumbing Sections and the following:

1. Restore new or existing work that is cut and/or damaged to original condition. Patch and repair specifically where existing items have been removed. This includes repairing and painting walls, ceilings, etc. where existing piping and devices are removed as part of this project. Where alterations disturb lawns, paving, and walks, surfaces to be repaired, refinished and left in condition matching existing prior to commencement of work.

2. Additional work required by lack of proper coordination will be provided at no additional cost to the Owner.

3.4 DELIVERY, STORAGE AND HANDLING

A. Confirm requirements in Division 00, Procurement and Contracting Requirements and Division 01, General Requirements. In absence of specific requirements, comply with individual Division 22, Plumbing Sections and the following:

1. Handle materials delivered to project site with care to avoid damage. Store materials on site inside building or protected from weather, dirt and construction dust. Insulation and lining that becomes wet from improper storage and handling to be replaced before installation. Products and/or materials that become damaged due to water, dirt and/or dust as a result of improper storage to be replaced before installation.

2. Protect pipe to avoid damage. Close pipe openings with caps or plugs.

3.5 DEMONSTRATION

A. Confirm Demonstration requirements in Division 00, Procurement and Contracting Requirements, Division 01, General Requirements, Section 22 00 00, Plumbing Basic Requirements and individual Division 22, Plumbing Sections.

B. Upon completion of work and test systems, demonstrate to Owner's Authorized Representative, Architect and Engineer that equipment furnished and installed or connected under provisions of these Specifications functions in manner required. Provide field instruction to Owner's Maintenance Staff as specified in Division 01, General Requirements, Section 22 00 00, Plumbing Basic Requirements and individual Division 22, Plumbing Sections.

3.6 CLEANING

A. Confirm cleaning requirements in Division 00, Procurement and Contracting Requirements, Division 01, General Requirements, Section 22 00 00, Plumbing Basic Requirements and individual Division 22, Plumbing Sections.

B. Upon completion of installation, thoroughly clean, removing temporary labels and traces of foreign substances. Throughout work, remove construction debris and surplus materials accumulated during work.

3.7 INSTALLATION

A. Confirm installation requirements in Division 00, Procurement and Contracting Requirements, Division 01, General Requirements, Section 22 00 00, Plumbing Basic Requirements and individual Division 22, Plumbing Sections.

B. Provide miscellaneous supports/metals required for installation of piping.

3.8 ACCEPTANCE

A. Confirm requirements in Division 00, Procurement and Contracting Requirements and Division 01, General Requirements. In absence of specific requirements, comply with individual Sections in Division 22, Plumbing and the following:

1. System cannot be considered for acceptance until work is completed and demonstrated to Architect that installation is in strict compliance with Specifications, Drawings and manufacturer's installation instructions, particularly in reference to following:

a. Cleaning

b. Record Drawings

B. Reference State of California requirements for specific testing procedures and documentation requirements. Comply with State and local governmental standards and requirements for testing, and completion and submittal of appropriate forms as required by Title 24 and local governmental agencies related to this work.

3.9 FIELD QUALITY CONTROL

A. Confirm Field Quality Control requirements in Division 00, Procurement and Contracting Requirements, Division 01, General Requirements, Section 22 00 00, Plumbing Basic Requirements and individual Division 22, Plumbing Sections.

B. Tests:

1. Conduct tests of systems to demonstrate compliance with requirements specified. Reference individual Specification Sections for required tests. Document tests and include in operation and maintenance manuals.

2. During site evaluations by Architect or Engineer, provide appropriate personnel with tools to remove and replace trims, covers, and devices so that proper evaluation of installation can be performed.

END OF SECTION 22 0000

SECTION 22 0523

GENERAL-DUTY VALVES FOR PLUMBING PIPING

PART 1 - GENERAL

1.1 SUMMARY

A. Work Included:

1. Valves, General

2. Ball Valves

1.2 RELATED SECTIONS

A. Contents of Division 22, Plumbing and Division 01, General Requirements apply to this Section.

1.3 REFERENCES AND STANDARDS

A. References and Standards as required by Section 22 00 00, Plumbing Basic Requirements and Division 01, General Requirements.

1.4 SUBMITTALS

A. Submittals as required by Section 22 00 00, Plumbing Basic Requirements and Division 01, General Requirements.

1.5 QUALITY ASSURANCE

A. Quality assurance as required by Section 22 00 00, Plumbing Basic Requirements and Division 01, General Requirements.

B. In addition, meet the following:

1. California Standard AB 1953 and/or NSF/ANSI 372 for potable water services. Valves must be 3rd-party certified.

2. ISO 9001 Certified.

3. IAPMO Certified for Low Lead.

C. Source Limitations for Valves: Obtain each type of valve from a single source and from a single manufacturer.

D. Model numbers indicated as Basis-of-Design indicate valve characteristics. All valves are to meet code Low Lead/Lead Free Standards.

1.6 WARRANTY

A. Warranty of materials and workmanship as required by Section 22 00 00, Plumbing Basic Requirements and Division 01, General Requirements.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Source Limitations for Valves: Obtain each type of valve from a single source and from a single manufacturer.

B. Valves, General:

1. Apollo
2. Armstrong
3. ASCO
4. Cla-Val
5. Conbraco
6. Crane
7. Clow
8. Griswold
9. Hammond
10. Hays
11. Jenkins
12. Josam
13. Kennedy
14. Milwaukee
15. Mueller
16. Nibco
17. Red-White Valve
18. Smith

19. Stockham

20. Tour Anderson

21. Wade

22. Watts

23. Wilkins

24. Zurn

25. Or approved equivalent.

C. Ball Valves:

1. See Valves General above.

2. NSF Valves:

a. Clow

b. Kennedy

c. Nibco

d. Or approved equivalent.

2.2 VALVES - GENERAL

A. General:

1. Sizes: Unless otherwise indicated, provide valves of same size as upstream pipe size.

2. Valve Identification: Manufacturer's name (or trademark) and pressure rating clearly marked on valve body.

B. Valve-End Connections:

1. Solder Joint: With sockets according to ASME B16.18.

2. Threaded: With thread according to ASME B1.20.1.

C. Building Service:

1. Shutoff and Isolation Valves:

a. Pipe Sizes 3-inches and Smaller: Ball Valve.

2.3 BALL VALVES

A. All ball valves on brazed piping are to be three-piece.

B. 2-1/2 Inches and Smaller: MSS SP-110, 400-600 PSI, two-piece full port ball configuration, bronze body, extended soldered ends for copper pipe and threaded ends for iron pipe, lead-free brass or stainless steel ball, lead-free brass stem, Teflon seat, extended steel handle. Apollo 77CLF 100 Series two-piece.

PART 3 - EXECUTION

3.1 GENERAL INSTALLATION REQUIREMENTS

A. Prepare valves for shipping as follows:

1. Protect internal parts against rust and corrosion.

2. Protect threads and weld ends.

3. Set ball valves open to minimize exposure of functional surfaces.

B. Use the following precautions during storage:

1. Maintain valve end protection.

2. Store valves indoors and maintain at higher than ambient dew-point temperature. If outdoor storage is necessary, store valves off the ground in watertight enclosures.

C. Inspect the shipping container before unpacking to look for damage that could have occurred during transport, and report it to the transportation company immediately. After visual inspection, remove the valve from the shipping container. Make sure the faces are free of any scratches and that there is not any obvious damage to the actuator assembly or valve body.

D. Make sure to note the valve's model number during the unpacking process. The model number will need to be provided when purchasing replacement parts.

E. Purge and clean all piping to be connected to valve.

F. Install per manufacturer's recommendations.

G. Determine that the valve and its plumbing piping is adequately supported when installed. If a valve is not adequately supported, this could prevent the valve from operating and sealing correctly. Be sure that all mating flanges are in line and parallel to minimize straining on joints and valve body.

H. Do not attempt to repair defective valves; replace with new valves.

I. Seats: Renewable seats, except where otherwise indicated.

J. When soldering, use paste flux that are approved by the manufacturer for use with lead free alloys.

K. Valve Adjusting and Cleaning:

1. Inspect valves for leaks. Adjust or replace packing to stop leaks. Replace valve if leak persists.

3.2 BALL VALVES

A. See General Installation Requirements above.

END OF SECTION 22 0523

SECTION 22 1000

PLUMBING PIPING

PART 1 - GENERAL

1.1 SUMMARY

A. Work Included:

1. Sanitary, Drainage (Rain/Stormwater) DWV Piping, Buried Within 5-feet of Building
2. Sanitary, Drainage (Rain/Stormwater) DWV Piping, Above Grade
3. Water Piping, Buried Within 5-feet of Building
4. Cold Domestic Water Above Grade
5. Condensate Piping
6. Cleanouts

1.2 RELATED SECTIONS

A. Contents of Division 22, Plumbing and Division 01, General Requirements apply to this Section.

1.3 REFERENCES AND STANDARDS

A. References and Standards as required by Section 22 00 00, Plumbing Basic Requirements and Division 01, General Requirements.

B. In addition, meet the following:

1. NSF 61, Annex G.
2. California Standard AB 1953.
3. Steel pipe to conform to ASTM and ANSI Standards as specified in this Section.
4. Copper piping to conform to ASTM B88, B306 and B208 and the standards of Copper Development Association (CDA), and American Welding Society, (AWS).
5. Cast Iron Piping to conform to standards of ASTM A-74, CISPI 301 and FM 1680.
6. Manufacturer's Standards Society (MSS) for valving and support reference standard.
7. American Water Works Association (AWWA) for Valving Assembly Standards.
8. American Society of Sanitation Engineers (ASSE) for Valving Standards.
9. American National Standards Institute (ANSI) for Piping Standards.

10. NFPA Standard 51B - "Fire Prevention in Use of Cutting and Welding Processes".

11. Crosslinked polyethylene (PEX) pipe conforming to ASTM F876, F877 and CSA B1375, or DIN 16892 and 16893.

1.4 SUBMITTALS

A. Submittals as required by Section 22 00 00, Plumbing Basic Requirements and Division 01, General Requirements.

1.5 QUALITY ASSURANCE

A. Quality assurance as required by Section 22 00 00, Plumbing Basic Requirements and Division 01, General Requirements.

1.6 WARRANTY

A. Warranty of materials and workmanship as required by Section 22 00 00, Plumbing Basic Requirements and Division 01, General Requirements.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. See component manufacturers listed in individual articles below.

B. Uponor

C. Cerro

D. Tyler

E. ADS

F. Charlotte

G. Elkhart

H. Enfield

I. Fuseseal

J. Spears

K. Nibco

L. Orion

M. American-USA

N. Sioux Chief

O. Viega

P. Mueller

Q. Or approved equivalent.

R. Cleanouts:

1. J.R. Smith

2. Zurn

3. Wade

4. Watts

5. Sioux Chief

6. Or approved equivalent.

S. Firestopping Penetrations in Fire Rated Wall Floor Assemblies:

1. Hilti

2. Proset

3. Or approved equivalent.

2.2 GENERAL

A. Provide pipe, tube and fittings of the same type, fitting requirements, grade, class and the size and weight indicated or required for each service, as indicated in other Division 22, Plumbing Specifications. Where type, grade, or class is not indicated, provide proper selection as determined by installer for installation requirements, and comply with governing regulations and industry standards.

B. Manufactured materials delivered, new to the project site and stored in their original containers.

C. Product Marking: Furnish each item with legible markings indicating name brand and manufacturer, manufacturing process, heat number and markings as required per ASTM and UL/FM Standards.

2.3 SANITARY, DRAINAGE (RAIN/STORMWATER) DWV PIPING, BURIED WITHIN 5-FEET OF BUILDING

A. Cast Iron Pipe: ASTM A888/CISPI 301 hubless.

1. Fittings: Cast iron.

2. Coupling Assembly:

a. Heavy Duty: ASTM C1540, Clamp-All Hi-Torq 125, Husky SD 4000, Mission HeavyWeight couplings.

B. Copper Tube: ASTM B 306, DWV

1. Fittings: ASME B16.29, wrought copper.

2. Joints: ASTM B32, ASTM B-828 and alloy Sn50 solder.

3. Flux: ASTM B813-91, water soluble.

2.4 SANITARY, DRAINAGE (RAIN/STORMWATER) DWV PIPING, ABOVE GRADE

A. Cast Iron Pipe: ASTM A888/CISPI 301 hubless.

1. Fittings: Cast iron.

2. Coupling Assembly:

a. Standard Duty: ASTM C1277 or CISPI 310.

B. Copper Tube: ASTM B 306, DWV

1. Fittings: ASME B16.29, wrought copper.

2. Joints: ASTM B32, alloy Sn50 solder.

2.5 WATER PIPING, BURIED WITHIN 5-FEET OF BUILDING

A. Copper Pipe: ASTM B88, hard drawn, Type K (A).

1. Fittings: ASME B16.18, cast copper alloy or ASME B16.22 wrought copper and bronze.

2. Joints: Brazed - BCuP2.

2.6 COLD DOMESTIC WATER ABOVE GRADE

A. Copper Tube: 2-1/2-inches and smaller. ASTM B88 (ASTM B88M), Type L (B), Drawn.

1. Fittings: ASME B16.18 copper.

2. Joints: ASTM B32, alloy Sn95 solder.

2.7 CONDENSATE PIPING

A. Copper Tube: ASTM B 88 (ASTM B898M), Type K (A), L (B), or M (C).

1. Fittings: ASME B16.29, wrought copper.

2. Joints: ASTM B32, alloy Sn50 solder.

B. Use chemical resistant piping for drainage of condensate from combustion fuel sources (such as condensing boilers and water heaters), as noted in this Section for area of application.

2.8 CLEANOUTS

A. Locate cleanouts as shown on Drawings and as required by local code. Cleanouts same size as pipe except that greater than 4-inches will not be required. Plastic components not allowed, except unless specifically noted.

B. Types:

1. Parking, Drives and Concrete Floor Cleanouts (Heavy Load): J. R. Smith 4100 with round heavy-duty nickel bronze top, taper thread and ABS plug with standard screws.

2. Outside Area Walks: J. R. Smith 4020-U with round heavy-duty nickel bronze top, taper thread, ABS plug and top secured with vandalproof screws. Install in 18- by 18- by 6-inch deep concrete pad flush with grade.

PART 3 - EXECUTION

3.1 GENERAL INSTALLATION REQUIREMENTS

A. Underground Piping Systems:

1. Examination: Verify that excavations are to required grade, dry, and not over-excavated.

2. Perform necessary excavation and backfill required for installation of plumbing work. Repair piping or other work at no expense to Owner.

3. Water: Keep excavations free of standing water. Re-excavate and fill back excavations damaged or softened by water or frost to original level with sand, crushed rock or other approved material at no expense to Owner.

4. Tests: During progress of work for compacted fill, Owner reserves right to request compaction tests made under direction of testing laboratory.

5. Trench Excavation: Excavate trenches to necessary depth and width, removing rocks, unstable soil (muck, peat), roots and stumps. Excavation material is classified as "base fill" and "native." Base fill excavation material consisting of placed crushed rock may be used as backfill above "Pipe Zone." Remove and dispose off site native excavation material. Adequate width of trench for proper installation of piping or conduit.

6. Support Foundations:

a. Foundations: Excavate trenches located in unstable ground areas below elevation required for installation of piping to depth which is determined by Architect as appropriate for conditions encountered. Place and compact approved foundation

material in excavation up to "Bedding Zone." Dewatering, placement, compaction and disposal of excavated materials to conform to requirements contained in other Specification Sections or Drawings.

b. Over-Excavations: Where trench excavation exceeds required depths, provide, place and compact suitable bedding material to proper grade or elevation at no additional cost to Owner.

c. Foundation Material: Where native material has been removed, place and compact necessary foundation material to form base for replacement of required thickness of bedding material.

	Class A		**Class B**	
Material Passing	**Min.**	**Max.**	**Min.**	**Max.**
3/4-inch Square Opening	**27**	**47**	**0**	**1**

d. Bedding Material: Full bed piping on sand, pea gravel, or 3/4-inch minus crushed rock. Place minimum 4-inch deep layer of sand, pea gravel, or crushed rock on leveled trench bottom for this purpose. Remove bedding to necessary depth for piping bells and couplings to maintain contact of pipe on bedding for its entire length. Provide additional bedding in excessively wet, unstable, or solid rock trench bottom conditions as required to provide firm foundation.

7. Backfilling:

a. Following installation and successful completion of required tests, backfill piping in lifts.

1) In "Pipe Zone" place backfill material and compact in lifts not to exceed 6-inches in depth to height of 12-inches above top of pipe. Place backfill material to obtain contact with entire periphery of pipe, without disturbing or displacing pipe.

2) Place and compact backfill above "Pipe Zone" in layers not to exceed 12-inches in depth.

b. Backfill Material:

1) Backfill Material in "Pipe Zone": 3/4-inch minus crushed rock, sand or pea gravel.

2) Crushed rock, fill sand or other backfill material approved elsewhere in Specifications may be used above "Pipe Zone."

8. Compaction of Trench Backfill:

a. Where compaction of trench backfill material is required, use one of following methods or combination thereof:

1) Mechanical tamper,

2) Vibratory compactor, or

3) Other approved methods appropriate to conditions encountered.

b. Architect to have right to change methods and limits to better accommodate field conditions. Compaction sufficient to attain 95 percent of maximum density at optimum moisture content unless noted otherwise on Drawings or elsewhere in Specifications. Water "puddling" or "washing" is prohibited.

B. General Installation:

1. Work performed by experienced journeyman plumbers. No exceptions.

2. Provide access panels for concealed valves, shock arrestors, trap primers and the like.

3. Install pipes and pipe fittings in accordance with recognized industry practices and manufacturer's recommendations.

4. Align piping accurately at connections, within 3/32-inch misalignment tolerance. Comply with ANSI B31 Code for Pressure Piping.

C. Testing:

1. General:

a. Provide temporary equipment for testing, including pumps, compressors, tanks, and gauges, as required. Test piping systems before insulation (if any) is installed and remove or disengage control devices before testing. Where necessary, test sections of each piping system independently, but do not use piping valves to isolate sections where test pressures exceed local valve operating pressure rating. Fill each section with water, compressed air, or nitrogen and pressurize for the indicated pressure and time.

b. Notify Architect and local Plumbing Inspector 2 days before tests.

c. Drainage, Waste and Vent Piping: Test in accordance with governing plumbing code or as follows: Test drainage and venting systems, with necessary openings plugged, to permit system to be filled with water and subjected to water pressure of minimum of 5 PSI head. System to hold water without water level drop greater than 1/2 pipe diameter of largest nominal pipe size within 24-hour period. Test system in sections if minimum head cannot be maintained in each section. 5 PSI head to be minimum pressure at highest joint.

d. Water Piping: Eliminate air from system. Fill and test at 125 PSIG or minimum 1-1/2 times static pressure at connection to serving utility main for period of two hours with no loss in pressure.

e. Send test results to Architect for review and approval and include in Operation and Maintenance Manual.

2. Testing of Pressurized Systems:

a. Test each pressurized piping system at 150 percent of operating pressure indicated, but not less than 125 PSIG test pressure.

b. Observe each test section for leakage at end of test period. Test fails if leakage is observed or if pressure drop exceeds 2 percent of test pressure.

3. Test cold domestic water piping systems upon completion of rough-in and before connection to fixtures at hydrostatic pressure of 125 PSIG.

D. Corrosive Soil Conditions:

1. Wrap steel, iron, copper or other metal piping materials/fittings with Protecto Wrap 200, 30 mils or greater. Maintain a 1/2-inch overlap and install per manufacturer's recommendations.

2. Provide epoxy coated cast iron pipe and fittings for drainage systems.

3. Obtain and review project soils report for verification of requirements concerning corrosive soils.

E. Protection:

1. Keep pipe openings closed by means of plugs or caps to prevent entrance of foreign matter. Protect piping, ductwork, fixtures, equipment and apparatus against dirty water, chemical or mechanical damage both before and after installation. Restore to its original condition or replace fixtures, equipment or apparatus damaged prior to final acceptance of work.

F. Cut piping squarely, free of rough edges and reamed to full bore. Insert piping fully into fittings.

G. Provide joints of type indicated in each piping system.

H. Thread pipe in accordance with ANSI/ASME B1.20.1. Cut threads full and clean using sharp dies. Ream threaded ends to remove burrs and restore full inside diameter. Remove excess cutting oil from piping prior to assembly. Apply pipe joint compound, or pipe joint tape (Teflon) where recommended by pipe/fitting manufacturer, on male threads at each joint and tighten joint to leave not more than 3 threads exposed.

3.2 SANITARY, DRAINAGE (RAIN/STORMWATER) DWV PIPING, BURIED WITHIN 5-FEET OF BUILDING

A. Excavation and Backfill:

1. See 3.01,A. above.

B. Drainage, Waste and Vent Piping: Test in accordance with governing plumbing code or as follows: Test drainage and venting systems, with necessary openings plugged, to permit system to be filled with water and subjected to water pressure of minimum of 5 PSI head. System to hold water without water level drop greater than 1/2 pipe diameter of largest nominal pipe size within 24-hour period. Test system in sections if minimum head cannot be maintained in each section. 5 PSI head to be minimum pressure at highest joint.

C. Corrosive Soil Conditions:

1. Wrap steel, iron, copper or other metal piping materials/fittings with Protecto Wrap 200, 30 mils or greater. Maintain a 1/2-inch overlap and install per manufacturer's requirements.

2. Provide epoxy coated cast iron pipe and fittings for drainage systems.

D. Cast-Iron Joints: Comply with coupling manufacturer's Cast Iron Soil Pipe Institute Standards and installation instructions.

E. Sanitary and Storm Drainage:

1. Grade piping at a uniform pitch of 2 percent unless otherwise noted on Drawings.

2. Indirect Waste or Drain Piping: Extend piping to discharge as shown on Drawings. Maintain minimum air gap. Provide traps on indirect waste or drain piping exceeding 60-inches.

3.3 SANITARY, DRAINAGE (RAIN/STORMWATER) DWV PIPING, ABOVE GRADE

A. Drainage, Waste and Vent Piping: Test in accordance with governing plumbing code or as follows: Test drainage and venting systems, with necessary openings plugged, to permit system to be filled with water and subjected to water pressure of minimum of 5 PSI head. System to hold water without water level drop greater than 1/2 pipe diameter of largest nominal pipe size within 24-hour period. Test system in sections if minimum head cannot be maintained in each section. 5 PSI head to be minimum pressure at highest joint.

B. Solder copper tube and fitting joints with lead free nickel/silver bearing solder meeting ASTM Std. B-32, in accordance with IAPMO Is 3-93, ASTM B-828 and Copper Development Association recommended procedures. Clean joints by other than chemical means prior to assembly. "Shock" cooling is prohibited. Fluxes to be water soluble for copper and brass potable water applications, and meeting CDA standard test method 1.0 and ASTM B813-91. Apply solder until a full fillet is present around the joint. Do not apply solder and flux in such excessive quantities as to run down interior of pipe. Lead solder or corrosion flux not to be present at the jobsite.

C. Cast-Iron Joints: Comply with coupling manufacturer's Cast Iron Soil Pipe Institute Standards and installation instructions.

D. Sanitary and Storm Drainage:

1. Grade piping at a uniform pitch of 2 percent unless otherwise noted on Drawings.

2. Indirect Waste or Drain Piping: Extend piping to discharge as shown on Drawings. Maintain minimum air gap. Provide traps on indirect waste or drain piping exceeding 60-inches.

3.4 WATER PIPING, BURIED WITHIN 5-FEET OF BUILDING

A. Excavation and Backfill:

1. See 3.01,A. above.

B. Water Piping: Eliminate air from system. Fill and test at 125 PSIG or minimum 1-1/2 times static pressure at connection to serving utility main for period of two hours with no loss in pressure.

C. Domestic Water:

1. "Piping" to include pipes, fittings, nipples, valves and accessories connected thereto.

2. Run piping generally parallel to the axis of the building, arranged to conform to the building requirements and to suit the necessities of clearance for other mechanical ducts, flues, conduits and work of other trades, and as close to ceiling or other construction as practical, free of unnecessary traps or bends.

3. Grade water supply piping for complete drainage of the system.

4. Use unions for piping connections to equipment.

5. Provide sufficient elbows, swings and offsets to permit free expansion and contraction.

6. Ream or file each pipe to remove burrs. Inspect each length of pipe and each fitting for workmanship and clear passageways.

7. Cover, cap or otherwise protect open ends of piping during construction to prevent damage to threads or flanges and prevent entry of foreign matter. Disinfect and sterilize water supply piping as specified. Furnish written report on final water quality results.

8. Install exposed connections to equipment with special care, showing no tool marks or threads at fittings and piping. No bowed or bent piping permitted.

9. Make ferrous to non-ferrous connections with dielectric fittings.

10. Use extra heavy pipe for nipples, where unthreaded portion is less than 1-1/2-inches. Use no close nipples. Use only shoulder-type nipples.

D. Sterilization of Domestic Water System:

1. General: Upon completion of tests and necessary replacements, thoroughly flush and disinfect domestic water piping.

2. Method: After thoroughly flushing system with water to remove sediment, fill system with a solution containing 50 parts per million of chlorine for not less than 24 hours or 200 parts per million of chlorine for not less than 3 hours. After retention, drain, reflush and return system to service.

3. Certification: Provide copy of domestic water chlorination certificate in each operations and maintenance manual.

4. Provide water line disinfections performed by a licensed contractor with training in potable water line disinfections.

5. Provide water line disinfections performed by a D1 Water Operator licensed in the State of California.

3.5 COLD DOMESTIC WATER ABOVE GRADE

A. Water Piping: Eliminate air from system. Fill and test at 125 PSIG or minimum 1-1/2 times static pressure at connection to serving utility main for period of two hours with no loss in pressure.

B. Testing of Pressurized Systems:

1. Test each pressurized piping system at 150 percent of operating pressure indicated, but not less than 125 PSIG test pressure.

2. Observe each test section for leakage at end of test period. Test fails if leakage is observed or if pressure drop exceeds 2 percent of test pressure.

C. Test cold domestic water piping systems upon completion of rough-in and before connection to fixtures at hydrostatic pressure of 125 PSIG.

D. Solder copper tube and fitting joints with lead free nickel/silver bearing solder meeting ASTM Std. B-32, in accordance with IAPMO Is 3-93, ASTM B-828 and Copper Development Association recommended procedures. Clean joints by other than chemical means prior to assembly. "Shock" cooling is prohibited. Fluxes to be water soluble for copper and brass potable water applications, and meeting CDA standard test method 1.0 and ASTM B813-91. Apply solder until a full fillet is present around the joint. Do not apply solder and flux in such excessive quantities as to run down interior of pipe. Lead solder or corrosion flux not to be present at the jobsite.

E. Domestic Water:

1. "Piping" to include pipes, fittings, nipples, valves and accessories connected thereto.

2. Run piping generally parallel to the axis of the building, arranged to conform to the building requirements and to suit the necessities of clearance for other mechanical ducts,

flues, conduits and work of other trades, and as close to ceiling or other construction as practical, free of unnecessary traps or bends.

3. Grade water supply piping for complete drainage of the system. Install hose bibbs at low points.

4. Use unions for piping connections to equipment.

5. Provide sufficient elbows, swings and offsets to permit free expansion and contraction.

6. Ream or file each pipe to remove burrs. Inspect each length of pipe and each fitting for workmanship and clear passageways.

7. Cover, cap or otherwise protect open ends of piping during construction to prevent damage to threads or flanges and prevent entry of foreign matter. Disinfect and sterilize water supply piping as specified. Furnish written report on final water quality results.

8. Install exposed connections to equipment with special care, showing no tool marks or threads at fittings and piping. No bowed or bent piping permitted.

9. Make ferrous to non-ferrous connections with dielectric fittings.

F. Sterilization of Domestic Water System:

1. General: Upon completion of tests and necessary replacements, thoroughly flush and disinfect domestic water piping.

2. Method: After thoroughly flushing system with water to remove sediment, fill system with a solution containing 50 parts per million of chlorine for not less than 24 hours or 200 parts per million of chlorine for not less than 3 hours. After retention, drain, reflush and return system to service.

3. Certification: Provide copy of domestic water chlorination certificate in each operations and maintenance manual.

4. Provide water line disinfections performed by a licensed contractor with training in potable water line disinfections.

5. Provide water line disinfections performed by a D1 Water Operator licensed in the State of California.

3.6 CONDENSATE PIPING

A. See plan.

3.7 CLEANOUTS

A. Install in aboveground piping and building drain piping as indicated, as required by code; at each change in direction of piping greater than 135 degrees; at minimum intervals of 100-feet; and at base of each vertical soil or waste stack. Install floor and wall cleanout covers for

concealed piping. Select type to match adjacent building finish. Provide shop drawings to Architect to coordinate locations and types of cleanouts with Architect prior to installation.

B. Drainage, Waste and Vent Piping: Test in accordance with governing plumbing code or as follows: Test drainage and venting systems, with necessary openings plugged, to permit system to be filled with water and subjected to water pressure of minimum of 5 PSI head. System to hold water without water level drop greater than 1/2 pipe diameter of largest nominal pipe size within 24-hour period. Test system in sections if minimum head cannot be maintained in each section. 5 PSI head to be minimum pressure at highest joint.

C. Corrosive Soil Conditions:

1. Wrap steel, iron, copper or other metal piping materials/fittings with Protecto Wrap 200, 30 mils or greater. Maintain a 1/2-inch overlap and install per manufacturer's requirements.

2. Provide epoxy coated cast iron pipe and fittings for drainage systems.

D. Cast-Iron Joints: Comply with coupling manufacturer's Cast Iron Soil Pipe Institute Standards and installation instructions.

END OF SECTION 22 1000

SECTION 26 0000

ELECTRICAL BASIC REQUIREMENTS

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Work included in 26 00 00, Electrical Basic Requirements applies to Division 26, Electrical work to provide materials, labor, tools, permits, incidentals, and other services to provide and make ready for Owner's use of electrical systems for proposed project.

B. Contract Documents include, but are not limited to, Specifications including Division 00, Procurement and Contracting Requirements and Division 01, General Requirements, Drawings, Addenda, Owner/Architect Agreement, and Owner/Contractor Agreement. Confirm requirements before commencement of work.

C. Definitions:

1. Provide: To furnish and install, complete and ready for intended use.

2. Furnish: Supply and deliver to project site, ready for unpacking, assembly and installation.

3. Install: Includes unloading, unpacking, assembling, erecting, installation, applying, finishing, protecting, cleaning and similar operations at project site as required to complete items of work furnished.

4. Approved or Approved Equivalent: To possess the same performance qualities and characteristics and fulfill the utilitarian function without any decrease in quality, durability or longevity. For equipment/products defined by the Contractor as "equivalent", substitution requests must be submitted to Engineer for consideration, in accordance with Division 01, General Requirements, and approved by the Engineer prior to submitting bids for substituted items.

5. Authority Having Jurisdiction (AHJ): Indicates reviewing authorities, including local fire marshal, Owner's insurance underwriter, Owner's Authorized Representative, and other reviewing entity whose approval is required to obtain systems acceptance.

1.2 RELATED SECTIONS

A. Contents of Section applies to Division 26, Electrical Contract Documents.

B. Related Work:

1. Additional conditions apply to this Division including, but not limited to:

a. Specifications including Division 00, Procurement and Contracting Requirements and Division 01, General Requirements.

b. Drawings

c. Addenda

d. Owner/Architect Agreement

e. Owner/Contractor Agreement

f. Codes, Standards, Public Ordinances and Permits

1.3 REFERENCES AND STANDARDS

A. References and Standards per Division 00, Procurement and Contracting Requirements and Division 01, General Requirements, individual Division 26, Electrical Sections and those listed in this Section.

B. Codes to include latest adopted editions, including current amendments, supplements and local jurisdiction requirements in effect as of the date of the Contract Documents, of/from:

1. State of California:

a. CBC - California Building Code

b. CEC - California Electrical Code

c. CEC T24 - California Energy Code Title 24

d. CFC - California Fire Code

e. CMC - California Mechanical Code

f. CPC - California Plumbing Code

g. CSFM - California State Fire Marshal

h. DSA - Division of State Architect Regulations and Requirements

C. Reference standards and guidelines include but are not limited to the latest adopted editions from:

1. ABA - Architectural Barriers Act

2. ADA - Americans with Disabilities Act

3. ANSI - American National Standards Institute

4. APWA - American Public Works Association

5. ASCE - American Society of Civil Engineers

6. ASHRAE Guideline 0, the Commissioning Process

7. ASTM - ASTM International
8. CFR - Code of Federal Regulations
9. EPA - Environmental Protection Agency
10. ETL - Electrical Testing Laboratories
11. FCC - Federal Communications Commission
12. FM - FM Global
13. IBC - International Building Code
14. IEC - International Electrotechnical Commission
15. IEEE - Institute of Electrical and Electronics Engineers
16. IES - Illuminating Engineering Society
17. ISO - International Organization for Standardization
18. MSS - Manufacturers Standardization Society
19. NEC - National Electric Code
20. NECA - National Electrical Contractors Association
21. NEMA - National Electrical Manufacturers Association
22. NETA - National Electrical Testing Association
23. NFPA - National Fire Protection Association
24. OSHA - Occupational Safety and Health Administration
25. UL - Underwriters Laboratories Inc.

D. See Division 26, Electrical individual Sections for additional references.

1.4 SUBMITTALS

A. See Division 01, General Requirements for Submittal Procedures as well as individual Division 26, Electrical Sections.

B. Provide drawings in format and software release equal to the design documents. Drawings to be the same sheet size and scale as the Contract Documents.

C. In addition:

1. "No Exception Taken" constitutes that review is for general conformance with the design concept expressed in the Contract Documents for the limited purpose of checking for conformance with information given. Any action is subject to the requirements of the Contract Documents. Contractor is responsible for the dimensions and quantity and will confirm and correlate at the job site, fabrication processes and techniques of construction, coordination of the work with that of all other trades, and the satisfactory performance of the work.

2. Provide product submittals and shop drawings in electronic format only. Electronic format must be submitted via zip file via e-mail. For electronic format, provide one file per division containing one bookmarked PDF file with each bookmark corresponding to each Specification Section. Arrange bookmarks in ascending order of Specification Section number. Individual submittals sent piecemeal in a per Specification Section method will be returned without review or comment. All transmissions/submissions to be submitted to Architect. Deviations will be returned without review.

    a. Provide separate submittals for power system study (per Specification Section 26 05 73) and electrical equipment (for example, switchboards and panelboards).

    b. Provide separate submittals for lighting control cutsheets, and for lighting control shop drawings.

3. Product Data: Provide manufacturer's descriptive literature for products specified in Division 26, Electrical Sections.

4. Identify/mark each submittal in detail. Note what differences, if any, exist between the submitted item and the specified item. Failure to identify the differences will be considered cause for disapproval. If differences are not identified and/or not discovered during the submittal review process, Contractor remains responsible for providing equipment and materials that meet the specifications and drawings.

    a. Label submittal to match numbering/references as shown in Contract Documents. Highlight and label applicable information to individual equipment or cross out/remove extraneous data not applicable to submitted model. Clearly note options and accessories to be provided, including field installed items. Highlight connections by/to other trades.

    b. Include technical data, installation instructions and dimensioned drawings for products, fixtures, equipment and devices installed, furnished or provided. Reference individual Division 26, Electrical specification Sections for specific items required in product data submittal outside of these requirements.

    c. See Division 26, Electrical individual Sections for additional submittal requirements outside of these requirements.

5. Maximum of two reviews of complete submittal package. Arrange for additional reviews and/or early review of long-lead items; Bear costs of these additional reviews at Engineer's hourly rates. Incomplete submittal packages/submittals will be returned to contractor without review.

6. Resubmission Requirements: Make corrections or changes in submittals as required, and in consideration of Engineer's comments. Identify Engineer's comments and provide an individual response to each of the Engineer's comments. Cloud changes in the submittals and further identify changes which are in response to Engineer's comments.

7. Structural/Seismic: Provide weights, dimensions, mounting requirements and like information required for mounting, seismic bracing, and support. Indicate manufacturer's installation and support requirements to meet ASCE 7-10 requirements for non-structural components. Provide engineered seismic drawings and equipment seismic certification. Equipment Importance Factor as specified in Division 01 and in Structural documents.

8. Trade Coordination: Include physical characteristics, electrical characteristics, device layout plans, wiring diagrams, and connections as required per Division 26, Electrical Coordination Documents. For equipment with electrical connections, furnish copy of approved submittal for inclusion in Division 26, Electrical submittals. Electric motors are supplied and installed by Division 23 unless otherwise specified. During shop drawing stage of the project, verify correct disconnect sizes, conductor sizes, etc., and bring any discrepancies to the attention of the Mechanical trade. Be responsible for any modifications to electrical equipment or installations as a result of equipment incompatibility discovered after shop drawing review.

9. Make provisions for openings in building for admittance of equipment prior to start of construction or ordering of equipment.

10. Substitutions and Variation from Basis of Design:

    a. The Basis of Design designated product establishes the qualities and characteristics for the evaluation of any comparable products by other listed acceptable manufacturers if included in this Specification or included in an approved Substitution Request as judged by the Design Professional.

    b. If substitutions and/or equivalent equipment/products are being proposed, it is the responsibility of parties concerned, involved in, and furnishing the substitute and/or equivalent equipment to verify and compare the characteristics and requirements of that furnished to that specified and/or shown. If greater capacity and/or more materials and/or more labor is required for the rough-in, circuitry or connections than for the item specified and provided for, then provide compensation for additional charges required for the proper rough-in, circuitry and connections for the equipment being furnished. No additional charges above the Base Bid, including resulting charges for work performed under other Divisions, will be allowed for such revisions. Coordinate with the requirements of "Submittals". For any product marked "or approved equivalent", a substitution request must be submitted to Engineer for approval prior to purchase, delivery or installation.

11. Shop Drawings: Provide coordinated shop drawings which include physical characteristics of all systems, device layout plans, and control wiring diagrams. Reference individual Division 26, Electrical specification Sections for additional requirements for shop drawings outside of these requirements.

a. Provide Shop Drawings indicating access panel locations, size and elevation for approval prior to installation.

12. Samples: Provide samples when requested by individual Sections.

13. Resubmission Requirements:

    a. Make any corrections or change in submittals when required. Provide submittals as specified. The engineer will not be required to edit and/or interpret the Contractor's submittals. Indicate changes for the resubmittal in a cover letter with reference to page(s) changed and reference response to comment. Cloud changes in the submittals.

    b. Resubmit for review until review indicates no exception taken or "make corrections as noted".

14. Operation and Maintenance Manuals, Owner's Instructions:

    a. Submit, at one time, electronic files (PDF format) of manufacturer's operation and maintenance instruction manuals and parts lists for equipment or items requiring servicing. Submit data when work is substantially complete and in same order format as submittals. Include name and location of source parts and service for each piece of equipment.

        1) Include copy of approved submittal data along with submittal review letters received from Engineer. Data to clearly indicate installed equipment model numbers. Delete or cross out data pertaining to other equipment not specific to this project.

        2) Include copy of manufacturer's standard Operations and Maintenance for equipment. At front of each tab, provide routine maintenance documentation for scheduled equipment. Include manufacturer's recommended maintenance schedule and highlight maintenance required to maintain warranty. Furnish list of routine maintenance parts, including part numbers, sizes, quantities, relevant to each piece of equipment.

        3) Include Warranty per Division 00, Procurement and Contracting Requirements and Division 01, General Requirements, Section 26 00 00, Electrical Basic Requirements and individual Division 26, Electrical Sections.

        4) Include product certificates of warranties and guarantees.

        5) Include copy of complete parts list for equipment. Include available exploded views of assemblies and sub assemblies.

        6) Include commissioning reports.

        7) Include copy of startup and test reports specific to each piece of equipment.

8) Engineer will return incomplete documentation without review. Engineer will provide one set of review comments in Submittal Review format. Contractor must arrange for additional reviews; Contractor to bear costs for additional reviews at Engineer's hourly rates.

b. Thoroughly instruct Owner in proper operation of equipment and systems. Where noted in individual Sections, training will include classroom instruction with applicable training aids and systems demonstrations. Field instruction per Section 26 00 00, Electrical Basic Requirements, Demonstration.

c. Copies of certificates of code authority inspections, acceptance, code required acceptance tests, letter of conformance and other special guarantees, certificates of warranties, specified elsewhere or indicated on Drawings.

15. Record Drawings:

a. Maintain at site at least one set of drawings for recording "As-constructed" conditions. Indicate on drawings changes to original documents by referencing revision document, and include buried elements, location of conduit, and location of concealed electrical items. Include items changed by field orders, supplemental instructions, and constructed conditions.

b. Record Drawings are to include equipment and fixture/connection schedules that accurately reflect "as constructed or installed" for project.

c. At completion of project, input changes to original project on CAD Drawings and make one set of black-line drawings created from CAD Files in version/release equal to contract drawings. Submit CAD disk and drawings upon substantial completion.

d. See Division 26, Electrical individual Sections for additional items to include in record drawings.

1.5 QUALITY ASSURANCE

A. Regulatory Requirements: Work and materials installed to conform with all local, State and Federal codes, and other applicable laws and regulations. Where code requirements are at variance with Contract Documents, meet code requirements as a minimum requirement and include costs necessary to meet these in Contract. Machinery and equipment are to comply with OSHA requirements, as currently revised and interpreted for equipment manufacturer requirements. Install equipment provided per manufacturer recommendations.

B. Whenever this Specification calls for material, workmanship, arrangement or construction of higher quality and/or capacity than that required by governing codes, higher quality and/or capacity take precedence.

C. Drawings are intended to be diagrammatic and reflect the Basis of Design manufacturer's equipment. They are not intended to show every item in its exact dimensions, or details of equipment or proposed systems layout. Verify actual dimensions of systems (i.e. distribution equipment, duct banks, light fixtures, etc.) and equipment proposed to assure that systems and

equipment will fit in available space. Contractor is responsible for design and construction costs incurred for equipment other than Basis of Design, including, but not limited to, architectural, structural, electrical, HVAC, fire sprinkler, and plumbing systems.

D. Manufacturer's Instructions: Follow manufacturer's written instructions. If in conflict with Contract Documents, obtain clarification. Notify Engineer/Architect, in writing, before starting work.

E. Items shown on Drawings are not necessarily included in Specifications or vice versa. Confirm requirements in all Contract Documents.

F. Provide products that are UL listed.

1.6 WARRANTY

A. Provide written warranty covering the work for a period of one year from date of Substantial Completion in accordance with Division 00, Procurement and Contracting Requirements and Division 01, General Requirements, Section 26 00 00, Electrical Basic Requirements and individual Division 26, Electrical Sections.

B. Sections under this Division can require additional and/or extended warranties that apply beyond basic warranty under Division 01, General Requirements and the General Conditions. Confirm requirements in all Contract Documents.

1.7 COORDINATION DOCUMENTS

A. Prepare and submit coordinated layout drawings (composite drawings), prior to construction, to coordinate installation and location of HVAC equipment, ductwork, grilles, diffusers, piping, plumbing equipment/fixtures, fire sprinklers, plumbing, lights, cable tray and electrical services with architectural and structural requirements, and other trades (including plumbing, fire protection, electrical, ceiling suspension, and tile systems), and provide maintenance access requirements. Coordinate with submitted architectural systems (i.e roofing, ceiling, finishes) and structural systems as submitted, including footings and foundation. Identify zone of influence from footings and ensure systems are not routed within the zone of influence. Unless otherwise required by Division 00, Procurement and Contracting Requirements or Division 01, General Requirements, Division 23, HVAC to combine information furnished by other trades into master coordination documents.

B. Prepare Drawings as follows:

1. Drawings in CAD Format. CAD format release equal to design documents. Drawings to be same sheet size and scale as Contract Drawings and indicate location, size and elevation above finished floor of equipment and distribution systems.

2. Review and revise, as necessary, section cuts in Contract Drawings after verification of field conditions.

3. Incorporate Addenda items and change orders.

4. Provide additional coordination as requested by other trades.

C. Advise Architect in event conflict occurs in location or connection of equipment. Bear costs resulting from failure to properly coordinate installation or failure to advise Architect of conflict.

D. Verify in field exact size, location, and clearances regarding existing material, equipment and apparatus, and advise Architect of discrepancies between that indicated on Drawings and that existing in field prior to installation related thereto.

E. Submit final Coordination Drawings with changes as Record Drawings at completion of project.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Articles, fixtures, and equipment of a kind to be standard product of one manufacturer.

2.2 STANDARDS OF MATERIALS AND WORKMANSHIP

A. Base contract upon furnishing materials as specified. Materials, equipment, and fixtures used for construction are to be new, latest products as listed in manufacturer's printed catalog data and are to be UL approved or have adequate approval or be acceptable by state, county, and city authorities. Equipment/fixture supplier is responsible for obtaining State, County, and City acceptance on equipment/fixtures that are not UL approved or are not listed for installation.

B. Names and manufacturer's names denote character and quality of equipment desired and are not to be construed as limiting competition.

C. Hazardous Materials:

1. Comply with local, State of California, and Federal regulations relating to hazardous materials.

2. Comply with Division 00, Procurement and Contracting Requirements and Division 01, General Requirements for this project relating to hazardous materials.

3. Do not use any materials containing a hazardous substance. If hazardous materials are encountered, do not disturb; immediately notify Owner and Architect. Hazardous materials will be removed by Owner under separate contract.

PART 3 - EXECUTION

3.1 ACCESSIBILITY AND INSTALLATION

A. Confirm Accessibility and Installation requirements in Division 00, Procurement and Contracting Requirements, Division 01, General Requirements, Section 26 00 00, Electrical Basic Requirements and individual Division 26, Electrical Sections.

B. Install equipment requiring access (i.e., junction boxes, light fixtures, power supplies, motors, etc.) so that they may be serviced, reset, replaced or recalibrated by service people with normal

service tools and equipment. Do not install equipment in passageways, doorways, scuttles or crawlspaces which would impede or block the intended usage.

C. Install equipment and products complete as directed by manufacturer's installation instructions. Obtain installation instructions from manufacturer prior to rough-in of equipment and examine instructions thoroughly. When requirements of installation instructions conflict with Contract Documents, request clarification from Architect prior to proceeding with installation. This includes proper installation methods, sequencing, and coordination with other trades and disciplines.

D. Earthwork:

1. Confirm Earthwork requirements in Contract Documents. In the absence of specific requirements, comply with individual Division 26, Electrical Sections and the following:

a. Perform excavation, dewatering, shoring, bedding, and backfill required for installation of work in this Division in accordance with related earthwork Sections. Contact utilities and locate existing utilities prior to excavation. Repair any work damaged during excavation or backfilling.

b. Excavation: Do not excavate under footings, foundation bases, or retaining walls.

c. Provide protection of underground systems. Review the project Geotechnical Report for references to corrosive or deleterious soils which will reduce the performance or service life of underground systems materials.

E. Firestopping:

1. Confirm requirements in Division 07, Thermal and Moisture Protection. In the absence of specific requirements, comply with individual Division 26, Electrical Sections and the following:

a. Coordinate location and protection level of fire and/or smoke rated walls, ceilings, and floors. When these assemblies are penetrated, seal around piping and equipment with approved firestopping material. Install firestopping material complete as directed by manufacturer's installation instructions. Meet requirements of ASTM E814, Standard Test Method for Fire Tests of Through-Penetration Fire Stops.

F. Plenums:

1. In plenums, provide plenum rated materials that meet the requirements to be installed in plenums. Immediately notify Architect/Engineer of discrepancy.

G. Start up equipment, in accordance with manufacturer's start-up instructions, and in presence of manufacturer's representative. Test controls and demonstrate compliance with requirements. Replace damaged or malfunctioning controls and equipment.

H. Provide miscellaneous supports/metals required for installation of equipment and conduit.

3.2 SEISMIC CONTROL

A. Confirm Seismic Control requirements in Division 01, General Requirements, Structural documents, and individual Division 26 Electrical Sections.

B. General:

1. Earthquake resistant designs for Electrical (Division 26) equipment and distribution, i.e. power distribution equipment, generators, UPS, etc. to conform to regulations of jurisdiction having authority.

2. Restraints which are used to prevent disruption of function of piece of equipment because of application of horizontal force to be such that forces are carried to frame of structure in such a way that frame will not be deflected when apparatus is attached to a mounting base and equipment pad, or to structure in normal way, utilizing attachments provided. Secure equipment and distribution systems to withstand a force in direction equal to value defined by jurisdiction having authority.

3. Provide stamped shop drawings from licensed Structural Engineer of seismic bracing and seismic movement assemblies for conduit and equipment. Submit shop drawings along with equipment submittals.

4. Provide stamped shop drawings from licensed Structural Engineer of seismic flexible joints for conduit crossing building expansion or seismic joints. Submit shop drawings along with seismic bracing details.

5. Provide means to prohibit excessive motion of electrical equipment during earthquake.

3.3 REVIEW AND OBSERVATION

A. Confirm Review and Observation requirements in Division 00, Procurement and Contracting Requirements, Division 01, General Requirements, Section 26 00 00, Electrical Basic Requirements and individual Division 26, Electrical Sections.

B. Notify Architect, in writing, at following stages of construction so that they may, at their option, visit site for review and construction observation:

1. Underground conduit installation prior to backfilling.

2. Prior to covering walls.

3. Prior to ceiling cover/installation.

4. When main systems, or portions of, are being tested and ready for inspection by AHJ.

C. Final Punch:

1. Prior to requesting a final punch visit from the Engineer, request from Engineer the Electrical Precloseout Checklist, complete the checklist confirming completion of systems'

installation, and return to Engineer. Request a final punch visit from the Engineer, upon Engineer's acceptance that the electrical systems are ready for final punch.

2. Costs incurred by additional trips required due to incomplete systems will be the responsibility of the Contractor.

3.4 CONTINUITY OF SERVICE

A. Confirm requirements in Division 00, Procurement and Contracting Requirements and Division 01, General Requirements. In the absence of specific requirements in Division 01, General Requirements, comply with individual Division 26, Electrical Sections and the following:

1. During remodeling or addition to existing structure, while existing structure is occupied, present services to remain intact until new construction, facilities or equipment is installed.

2. Prior to changing over to new service, verify that every item is thoroughly prepared. Install new wiring, and wiring to point of connection.

3. Coordinate transfer time to new service with Owner. If required, perform transfer during off-peak hours. Once changeover is started, pursue to its completion to keep interference to a minimum.

a. If overtime is necessary, there will be no allowance made by Owner for extra expense for such overtime or shift work.

4. No interruption of services to any part of existing facilities will be permitted without express permission in each instance from Owner. Requests for outages must state specific dates, hours and maximum durations, with outages kept to these specific dates, hours and maximum durations. Obtain written permission from Owner for any interruption of power, lighting or signal circuits and systems.

a. Organize work to minimize duration of power interruption.

b. Coordinate utility service outages with utility company.

3.5 CUTTING AND PATCHING

A. Confirm requirements in Division 00, Procurement and Contracting Requirements and Division 01, General Requirements. In the absence of specific requirements in Division 01, General Requirements, comply with individual Division 26, Electrical Sections and the following:

1. Proposed floor cutting/core drilling/sleeve locations to be approved by Project Structural Engineer. Submit proposed locations to Architect/Project Structural Engineer. Where slabs are of post tension construction, perform x-ray scan of proposed penetration locations and submit scan results including proposed penetration locations to Project Structural Engineer/Architect for approval. Where slabs are of waffle type construction, show column cap extent and cell locations relative to proposed penetration(s).

2. Cutting, patching and repairing for work specified in this Division including plastering, masonry work, concrete work, carpentry work, and painting included under this Section

will be performed by skilled craftsmen of each respective trade in conformance with appropriate Division of Work.

3. Additional openings required in building construction to be made by drilling or cutting. Use of jack hammer is specifically prohibited. Patch openings in and through concrete and masonry with grout.

4. Restore new or existing work that is cut and/or damaged to original condition. Patch and repair specifically where existing items have been removed. This includes repairing and painting walls, ceilings, etc. where existing conduit and devices are removed as part of this project. Where alterations disturb lawns, paving, and/or walks, surfaces to be repaired, refinished and left in condition matching existing prior to commencement ofwork.

5. Additional work required by lack of proper coordination will be provided at no additional cost to the Owner.

3.6 EQUIPMENT SELECTION AND SERVICEABILITY

A. Replace or reposition equipment which is too large or located incorrectly to permit servicing, at no additional cost to Owner.

3.7 DELIVERY, STORAGE AND HANDLING

A. Confirm requirements in Division 00, Procurement and Contracting Requirements and Division 01, General Requirements. In the absence of specific requirements, comply with individual Division 26, Electrical Sections and the following:

1. Handle materials delivered to project site with care to avoid damage. Store materials on site inside building or protected from weather, dirt and construction dust. Products and/or materials that become damaged due to water, dirt, and/or dust as a result of improper storage and handling to be replaced before installation.

2. Protect equipment to avoid damage. Close conduit openings with caps or plugs. Keep motors and bearings in watertight and dustproof covers during entire course of installation.

3. Protect bus duct and similar items until in service.

3.8 DEMONSTRATION

A. Confirm Demonstration requirements in Division 00, Procurement and Contracting Requirements, Division 01, General Requirements, and individual Division 26, Electrical Sections.

1. Also confirm Demonstration requirements in Section 26 08 00, Commissioning of Electrical.

B. Upon completion of work and adjustment of equipment, test systems and demonstrate to Owner's Authorized Representative, Architect, and Engineer that equipment furnished and installed or connected under provisions of these Specifications functions in manner required. Provide field instruction to Owner's Maintenance Staff as specified in Division 01, General

Requirements, Section 26 00 00, Electrical Basic Requirements and individual Division 26, Electrical Sections.

C. Manufacturer's Field Services: Furnish services of a qualified person at time approved by Owner, to instruct maintenance personnel, correct defects or deficiencies, and demonstrate to satisfaction of Owner that entire system is operating in satisfactory manner and complies with requirements of other trades that may be required to complete work. Complete instruction and demonstration prior to final job site observations.

D. Training and Demonstration per Section 01 91 13, General Commissioning Requirements and 26 08 00, Commissioning of Electrical.

3.9 CLEANING

A. Confirm Cleaning requirements in Division 01, General Requirements, Section 26 00 00, Electrical Basic Requirements and individual Division 26, Electrical Sections.

B. Upon completion of installation, thoroughly clean electrical equipment, removing dirt, debris, dust, temporary labels and traces of foreign substances. Throughout work, remove construction debris and surplus materials accumulated during work.

3.10 INSTALLATION

A. Confirm Installation requirements in Division 00, Procurement and Contracting Requirements and Division 01, General Requirements, Section 26 00 00, Electrical Basic Requirements and individual Division 26, Electrical Sections.

B. Install equipment and fixtures in accordance with manufacturer's installation instructions, plumb and level and firmly anchored to vibration isolators. Maintain manufacturer's recommended clearances.

C. Start up equipment, in accordance with manufacturer's start-up instructions, and in presence of manufacturer's representative. Test controls and demonstrate compliance with requirements. Replace damaged or malfunctioning controls and equipment.

D. Provide miscellaneous supports/metals required for installation of equipment.

3.11 PAINTING

A. Confirm requirements in Division 01, General Requirements and Division 09, Finishes. In the absence of specific requirements, comply with individual Division 26, Electrical Sections and the following:

1. Ferrous Metal: After completion of work, thoroughly clean and paint exposed supports constructed of ferrous metal surfaces (i.e., hangers, hanger rods, equipment stands, etc.) with one coat of black asphalt varnish for exterior or black enamel for interior, suitable for hot surfaces.

2. In Electrical Room, on roof or other exposed areas, equipment not painted with enamel to receive two coats of primer and one coat of rustproof enamel, colors as selected by Architect.

3. See individual equipment Specifications for other painting.

4. Structural Steel: Repair damage to structural steel finishes or finishes of other materials damaged by cutting, welding or patching to match original.

5. Conduit: Clean, primer coat and paint interior/exterior conduit exposed in public areas with two coats paint suitable for metallic surfaces. Color selected by Architect.

6. Covers: Covers such as manholes, vaults and the like will be furnished with finishes which resist corrosion and rust.

3.12 ACCEPTANCE

A. Confirm requirements in Division 00, Procurement and Contracting Requirements and Division 01, General Requirements. In the absence of specific requirements, comply with individual Division 26, Electrical Sections and the following:

1. System cannot be considered for acceptance until work is completed and demonstrated to Architect that installation is in strict compliance with Specifications, Drawings and manufacturer's installation instructions, particularly in reference to following:

a. Cleaning

b. Operation and Maintenance Manuals

c. Training of Operating Personnel

d. Record Drawings

e. Warranty and Guaranty Certificates

f. Start-up/Test Document and Commissioning Reports

3.13 FIELD QUALITY CONTROL

A. Confirm Field Quality Control requirements in Division 01, General Requirements, Section 26 00 00, Electrical Basic Requirements and individual Division 26, Electrical Sections.

B. Tests:

1. Conduct tests of equipment and systems to demonstrate compliance with requirements specified. Reference individual Specification Sections for required tests. Document tests and include in operation and maintenance manuals.

2. During site evaluations by Architect or Engineer, provide appropriate personnel with tools to remove and replace trims, covers, and devices so that proper evaluation of installation can be performed.

3.14 LETTER OF CONFORMANCE

A. Provide Letter of Conformance, copies of manufacturers' warranties and extended warranties with a statement that Electrical items were installed in accordance with manufacturer's recommendations, UL listings and FM Global approvals. Include Letter of Conformance, copies of manufacturers' warranties and extended warranties in Operation and Maintenance Manuals.

3.15 SALVAGED EQUIPMENT AND RECYCLED MATERIAL

A. Salvage the following equipment not being reused and return to Owner:

1. Luminaires

2. Panelboards

3. Breakers

4. Transformers

B. Electrical equipment that cannot be salvaged for reuse, sell/give to recycling company. Recycle following excess, removed, or demolished electrical material:

1. Copper or aluminum conductors, buses, and motor/transformer windings.

2. Steel and aluminum from raceways, boxes, enclosures, and housings.

3. Acrylic and glass from luminaire lenses/refractors.

C. Provide separate on-site storage space for recycled and salvaged material. Clearly label space.

D. Confirm additional salvaged equipment and recycled materials in the Contract Documents.

END OF SECTION 26 0000

SECTION 26 0509

EQUIPMENT WIRING

PART 1 - GENERAL

1.1 SUMMARY

A. Work Included:

1. Equipment connections, whether furnished by Owner or other Divisions of the Contract.

1.2 RELATED SECTIONS

A. Contents of Division 26, Electrical and Division 01, General Requirements apply to this Section.

1.3 REFERENCES AND STANDARDS

A. References and Standards as required by Section 26 00 00, Electrical Basic Requirements and Division 01, General Requirements.

1.4 SUBMITTALS

A. Submittals as required by Section 26 00 00, Electrical Basic Requirements and Division 01, General Requirements.

B. In addition:

1. Verify mechanical and utilization equipment electrical characteristics with Drawings and equipment submittals prior to ordering equipment. Submit confirmation of this verification as a part of, or addendum to, the electrical product submittals.

1.5 QUALITY ASSURANCE

A. Quality assurance as required by Section 26 00 00, Electrical Basic Requirements and Division 01, General Requirements apply to this Section.

1.6 WARRANTY

A. Warranty of materials and workmanship as required by Section 26 00 00, Electrical Basic Requirements and Division 01, General Requirements.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Materials and Equipment for Equipment Wiring: As specified in individual Sections.

2.2 GENERAL

A. Safety Switches: Provide as required by CEC and as specified in Section 26 28 16, Enclosed Switches and Circuit Breakers.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Prior to submittal of product data for electrical distribution equipment, obtain and examine product data and shop drawings for equipment furnished by the Owner and by other trades on the project. Update the schedule of equipment electrical connections accordingly, noting proper ratings for overcurrent devices, fuses, safety disconnect switches, conduit and wiring, and the like. As a minimum, this requirement applies to equipment furnished by Owner and equipment furnished under the following divisions of work under this contract:

1. Division 8, Openings

2. Division 11, Equipment

3. Division 22, Plumbing

4. Division 23, HVAC, Heating, Ventilating and Air Conditioning

5. Division 27, Communications

6. Division 28, Electronic Safety and Security

3.2 INSTALLATION

A. Do not install unrelated electrical equipment or wiring on mechanical equipment without prior approval of Architect.

B. Provide moisture tight equipment wiring and switches in ducts or plenums used for environmental air.

C. Connect motor and appliance/utilization equipment complete from panel to motor/equipment as required by code.

D. Install motor starters and controllers for equipment furnished by others.

E. Appliance/Utilization Equipment:

1. Provide appropriate cable and cord cap for final connection unless equipment is provided with same. Provide receptacle configured to receive cord cap.

2. Verify special purpose outlet NEMA configuration and ampere rating with equipment supplier prior to ordering wiring devices and coverplates.

3.3 FIELD QUALITY CONTROL

A. Perform field inspection and testing in accordancewith Division 01, General Requirements.

3.4 SYSTEMS STARTUP

A. Provide field representative to prepare and start equipment.

1. Test and correct for proper rotation of polyphase motors.

B. Adjust for proper operation within manufacturer's published tolerances.

C. Demonstrate proper operation of equipment to Owner's Authorized Representative.

END OF SECTION 26 0509

SECTION 26 0519

LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES

PART 1 - GENERAL

1.1 SUMMARY

A. Work Included:

1. Lugs and Pads

2. Wires and Cables

3. Connectors

1.2 RELATED SECTIONS

A. Contents of Division 26, Electrical and Division 01, General Requirements apply to this Section.

1.3 REFERENCES AND STANDARDS

A. References and Standards as required by Section 26 00 00, Electrical Basic Requirements and Division 01, General Requirements.

1.4 SUBMITTALS

A. Submittals as required by Section 26 00 00, Electrical Basic Requirements and Division 01, General Requirements.

B. In addition, provide:

1. Cable insulation test reports in project closeout documentation.

1.5 QUALITY ASSURANCE

A. Quality assurance as required by Section 26 00 00, Electrical Basic Requirements and Division 01, General Requirements.

1.6 WARRANTY

A. Warranty of materials and workmanship as required by Section 26 00 00, Electrical Basic Requirements and Division 01, General Requirements.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Lugs and Pads:

1. Anderson
2. Ilsco
3. Panduit
4. Thomas & Betts
5. 3M
6. Or approved equivalent.

B. Wires and Cables:

1. General:
    a. General Cable
    b. Okonite
    c. Southwire
    d. Encore Wire
    e. Or approved equivalent.
2. Metal Clad Cable - Type MC:
    a. Alflex
    b. AFC
    c. General Cable
    d. Southwire
    e. Encore Wire
    f. Or approved equivalent.

C. Connectors:

1. Anderson Power Products
2. Burndy
3. Ilsco
4. 3M
5. Thomas & Betts

6. Or approved equivalent.

2.2 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.

B. Copper Pads: Drilled and tapped for multiple conductor terminals.

C. Lugs: Compression type for use with stranded branch circuit or control conductors; mechanical lugs for use with solid branch and feeder circuit conductors.

2.3 WIRES AND CABLES

A. Building Wires:

1. Copper: Soft-drawn with conductivity of not less than 98 percent IACS at 20 degrees C (68 degrees F). 600 volt rated throughout. Conductors 12 AWG and 10 AWG, solid. Conductors 8 AWG and larger, stranded. 12 AWG minimum conductor size. Minimum insulation rating of 90 degrees C. Insulation Type: THHN/THWN-2.

2. Aluminum conductors are not permitted unless written approval is received from the Engineer.

B. Phase color to be consistent at feeder terminations; A-B-C, top to bottom, left to right, front to back.

C. Color Code Conductors as Follows:

PHASE	**208 VOLT WYE**	**240 VOLT DELTA**	**480 VOLT**
A	Black	Black	Brown
B	Red	Orange (High Leg)	Orange
C	Blue	Blue	Yellow
Neutral	White	White	Gray or White w/colored strip
Ground	Green	Green	Green
Isolated Ground	Green w/yellow trace	N/A	N/A

D. MC Cable:

1. Standard: High strength galvanized steel flexible armor. Full length minimum size No. 12 copper ground wire, copper dual rated THHN/THWN-2, full length tape marker phase/circuit identification on cable armor. Short circuit throat insulators, mechanical compression termination.

E. AC Cable (Armored Cable): Not allowed.

F. NMB Cable: Not allowed.

2.4 CONNECTORS

A. Split bolt connectors not allowed.

B. Conductor Branch Circuits: Wire nuts with integral spring connectors for conductors 12 AWG through 8 AWG. Push-in type connectors where conductors are not required to be twisted together are not acceptable.

PART 3 - EXECUTION

3.1 GENERAL INSTALLATION REQUIREMENTS

A. Install per manufacturer instructions and CEC.

B. Field Quality Control:

1. Test conductor insulation on feeders of 100 amp and greater for conformity with 1000 volt megohmmeter. Use Insulated Cable Engineers Association testing procedures. Minimum insulation resistance acceptable is 1 megohm for systems 600 volts and below. Notify Architect if insulation resistance is less than 1 megohm.

2. Test Report: Prepare a typed tabular report indicating the testing instrument, the feeder tested, amperage rating of the feeder, insulation type, voltage, the approximate length of the feeder, conduit type, and the measured resistance of the megohmmeter test. Submit test reports with project closeout documents.

3. Inspect and test in accordance with NETA Standard ATS, except Section 4.

4. Perform inspections and tests listed in NETA Standard ATS, Section 7.3.2.

3.2 LUGS AND PADS

A. Thoroughly clean surfaces to remove all dirt, oil, great or paint.

B. Use torque wrench to tighten per manufacturer's directions.

3.3 WIRES AND CABLES

A. General:

1. Do not install or handle thermoplastic insulated wire and cable in temperatures below -10 degrees C (14 degrees F). Do not handle thermoset insulated wire and cable in temperatures below -40 degrees C (-40 degrees F). All wire and cable must be acclimated to temperatures above freezing for no less than 24 hours prior to installation.

2. Install conductors in raceways having adequate, code size cross-sectional area for wires indicated.

3. Install conductors with care to avoid damage to insulation.

4. Do not apply greater tension on conductors than recommended by manufacturer during installation.

5. Use of pulling compounds is permitted. Clean residue from exposed conductors and raceway entrances after conductor installation. Do not use pulling compounds for installation of conductors connected to GFCI circuit breakers or GFCI receptacles.

6. Conductor Size and Quantity:

   a. Install no conductors smaller than 12 AWG unless otherwise shown.

   b. Provide required conductors for a fully operable system.

   c. Power Circuits: No. 12 AWG minimum, except as follows:

      1) No. 10 AWG for 15A, 120V circuits longer than 100 ft.

      2) No. 8 AWG for 15A, 120V circuits longer than 150 ft.

      3) No. 10 AWG for 20A, 120V circuits longer than 70 ft.

      4) No. 8 AWG for 20A, 120V circuits longer than 100 ft.

   d. When exact run lengths are determined for all branch circuits, and prior to installation of the conductors, ensure that the maximum voltage drop, based on 80 percent of the circuit protective device, does not exceed 3 percent. Increase wire size from #12AWG, if necessary, to ensure that the 3 percent voltage drop is not exceeded.

7. Provide dedicated neutrals (one neutral conductor for each phase conductor) in all 120V circuits.

B. Conductors in Cabinets:

1. Cable and tree wires in panels and cabinets for power and control. Use plastic ties in panels and cabinets.

2. Tie and bundle feeder conductors in wireways of panelboards.

3. Hold conductors away from sharp metal edges.

C. Homeruns:

1. Do not change intent of branch circuit homeruns without approval. Homeruns for 20A branch circuits may be combined to a maximum of six current carrying conductors including neutral conductors in homeruns. Apply derating factors as required per NEC. Increase conductor size as needed.

2. MC cable homeruns are not allowed unless indicated on drawings.

D. Identify wire and cable under the provisions of Section 26 05 53, Identification for Electrical Systems. Identify each conductor with its panel and circuit number as indicated.

E. Exposed cable is not allowed.

F. All cable must be run parallel or perpendicular to building lines and hidden from view when possible. Where installed in tray each power cable is to be identified with Lamacoid nametag engraved with identification of equipment being fed. Tag to be fastened to cable using tie-wraps. Provide nametag at each floor level.

G. Do not install PVC jacketed cables in return air plenums, unless they are specially rated plenum cables.

H. Use of MC Cable is limited to the following conditions. Installations that do not comply with the following conditions are to be removed and replaced with no additional expense to the Owner.

1. 15 and 20 amp branch wiring where following conditions apply:

a. MC cable is allowed for branch circuits, including both lighting and power outlets, as allowed by code and restricted below.

b. Use MC cable for final flexible connections from junction or outlet boxes to recessed fixtures. Do not use MC cables to loop between fixtures, except where it is not practical to provide conduit connections between boxes or where existing inaccessible ceilings prevent installation of conduit runs. Each individual luminaire is to be serviced by an individual cable drop from the associated junction box in the ceiling space. Maximum length 6-feet of MC cable. Luminaire drops secured to, and supported by, the building structure with nylon tie wraps. The use of the ceiling suspension system for support of any type of cabling is not permitted.

c. MC Cable may be used in areas with hard lid ceiling as well as accessible space above, and in walls below windows, provided CEC requirements are otherwise met, and a minimum one 0.75-inch conduit is routed from nearest accessible ceiling space to inaccessible location, terminating in a j-box with blank faceplate, for future circuits.

3.4 CONNECTORS

A. Install to assure a solid and safe connection.

B. Select hand twist connectors for wire size and install tightly on conductors.

C. Install compression connectors using methods and tools recommended by the manufacturer.

D. Do not install stranded conductors under screw terminals unless compression lugs are installed.

E. Do not connect wiring without UL listed connectors that are listed for the purposes.

END OF SECTION 26 0519

SECTION 26 0521

MANUFACTURED WIRING ASSEMBLIES

PART 1 - GENERAL

1.1 SUMMARY

A. Work Included:

1. General Materials

2. Equipment for Fluorescent Systems

3. Equipment for HID Systems

4. Equipment for Power Systems

5. Distribution Units

6. Cable Accessories

B. Manufactured wiring assemblies are also referred to as 'Modular Wiring Systems'.

C. Modular wiring system is to provide a flexible wiring system for lighting or power distribution. System is applicable in those areas with accessible ceiling, used as static or environmental air plenums, or accessible wall areas. System incorporates factory preassembled, prewired cable assemblies which interface with luminaires installed in these spaces.

D. Modular wiring system is optional. If the modular wiring system is not used, then use standard raceways and wiring as specified. Modify wiring shown on Drawings to accommodate either modular wiring or standard wiring.

E. Provide a complete wiring system, UL listed, for use in ceiling plenums used for environmental air or nonenvironmental.

F. Drawings are designed to indicate circuit numbers and are not necessarily intended to show armored cable sets, distribution boxes, in-line connectors, and splitters.

1.2 RELATED SECTIONS

A. Contents of Division 26, Electrical and Division 01, General Requirements apply to this Section.

1.3 REFERENCES AND STANDARDS

A. References and Standards as required by Section 26 00 00, Electrical Basic Requirements and Division 01, General Requirements.

1.4 SUBMITTALS

A. Submittals as required by Section 26 00 00, Electrical Basic Requirements and Division 01, General Requirements.

1.5 QUALITY ASSURANCE

A. Quality assurance as required by Section 26 00 00, Electrical Basic Requirements and Division 01, General Requirements.

1.6 WARRANTY

A. Warranty of materials and workmanship as required by Section 26 00 00, Electrical Basic Requirements and Division 01, General Requirements.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. General Materials:

1. Lithonia
2. MWS Module Wiring Systems
3. Or approved equivalent.

B. Equipment for Fluorescent Systems:

1. Lithonia Reloc
2. MWS Modular Wiring Systems
3. Or approved equivalent.

C. Equipment for HID Systems:

1. Holophane
2. Lithonia Reloc
3. MWS Modular Wiring Systems
4. Or approved equivalent.

D. Equipment for Power Systems:

1. Holophane
2. Lithonia Reloc

3. MWS Modular Wiring Systems

4. Or approved equivalent.

E. Distribution Units:

1. Lithonia Reloc

2. MWS Modular Wiring Systems

3. Or approved equivalent.

F. Cable Accessories:

1. Lithonia Reloc

2. MWS Modular Wiring Systems

3. Or approved equivalent.

2.2 GENERAL MATERIALS

A. Manufactured Wiring Assemblies - General:

1. Factory assembled cable assemblies with appropriate connector on each end.

B. Switching Unit Assemblies:

1. Cables configured for 3-way and 4-way switches where required.

C. Convenience Receptacle Unit Assemblies:

1. Cables configured to match device type.

D. Luminaire Connector Assemblies:

1. Factory assembled cable assemblies with appropriate connector on each end.

E. Distribution Units: Suitable for terminating building wiring system and raceways.

F. Accessories: Manufacturer's standard accessories, including cable extenders, distribution tees, and switching assemblies.

2.3 EQUIPMENT FOR FLUORESCENT SYSTEMS

A. Connectors constructed with glass-reinforced, high impact, low smoke, nylon material suitable for plenum spaces. Connectors to contain copper alloy pin and socket type terminals. Housing polarized and color coded for safety.

B. Modular wiring system is an assembly of multi-face connectors, load-side connectors, line-side connectors, luminaire connectors and distribution box connectors.

C. Distribution Boxes, each box to accommodate multiple pin and socket power ports, rated for 20 amp circuits. Sockets are to be keyed to voltage to prevent mismatching components.

D. Cable sets and accessories are to provide flexible means to connect luminaires.

1. Cable sets consist of thermoplastic insulated solid No. 10 or 12 gauge wire (or as noted on drawings), rated for 600V, 90 degrees C insulation, each wire color coded, with outer jacket of armor-clad cable. Cable set ends equipped with connector on each end. Factory wire connector to accomplish switching or control as noted on drawings.

2. Extender cable sets for distances farther than standard cable sets.

3. Switch drop cable sets with switched and non-switched power connectors.

4. Starter cable set for connecting to power source.

5. Splitter for separating branch circuit into two directions.

E. Luminaires: Furnished with factory installed connectors. Furnish connectors to luminaire manufacturer from manufacturer of modular wiring system for factory assembly.

2.4 EQUIPMENT FOR HID SYSTEMS

A. Connectors: Metal clad, riveted, tamper proof, permanently embossed and color coded for safety.

B. Modular wiring system is an assembly of multi-face connectors, load-side connectors, line-side connectors, luminaire connectors, and distribution box connectors.

C. Cable sets and accessories are to provide flexible means to connect luminaires.

1. Cable sets to consist of thermoplastic insulated solid No. 10 or 12 gauge wire (or as noted on drawings) rated for 600V, 90 degrees C insulation, each wire color coded, with outer jacket of armor-clad cable.

2. Extender cable sets for distances farther than standard cable sets.

3. Switch drop cable sets with switched and non-switched power connectors.

4. Starter cable set for connecting to power source.

5. Splitter for separating branch circuit into two directions.

D. Contacts, male pin and female receptacle type with minimum conductivity of 0.60. Submit certification of conductivity prior to approval for use.

E. Construct system so an individual luminaire can be disconnected from circuit without interrupting operation of other luminaires on same or local circuits.

F. Luminaires: Furnished with factory installed connectors. Furnish connectors to luminaire manufacturer from manufacturer of modular wiring.

2.5 EQUIPMENT FOR POWER SYSTEMS

A. Connectors constructed with glass-reinforced, high impact, low smoke, nylon material suitable for plenum spaces. Connectors to contain copper alloy pin and socket type terminals. Housing polarized and color coded for safety.

B. Wiring system is an assembly of multi-face connectors, load-side connectors, line-side connectors, and distribution box connectors.

2.6 DISTRIBUTION UNITS

A. Distribution Boxes: Each box to accommodate multiple pin and socket power ports, rated for 20 amp circuits. Sockets are to be keyed to voltage to prevent mismatching components.

2.7 CABLE ACCESSORIES

A. Cable sets and accessories are to provide flexible means to connect receptacles.

1. Cable sets to consist of thermoplastic insulated solid No. 10 or 12 gauge wire (or as noted on drawings) rated for 600V, 90 degrees C insulation, each wire color coded, with outer jacket of armor-clad cable.

2. Circuit Distributor, pin and socket contacts, rated for 20 amps, color coded to identify system voltage, labeled to denote position of each conductor.

3. Cable Extender sets for distances farther than standard cable sets.

4. Circuit Selector Unit, five conductor and available with two circuit/two neutral.

5. Drop Cable set for connecting to receptacle or other devices requiring power connection.

6. Floor Module with separate compartments for data, communications and power in an access floor. Interchangeable faceplates, hinged floor plate, up to five sets of wiring devices, carpet/tile floor flange.

PART 3 - EXECUTION

3.1 GENERAL INSTALLATION REQUIREMENTS

A. Verify that field measurements are as indicated on shop drawings.

B. Install Manufactured Wiring Assemblies as directed by manufacturer's installation instructions.

C. Support cable by means of straps and clamps.

D. Install support cables independently to structure.

E. Support cable above suspended ceiling to avoid contact with and interference with removal of ceiling panels. Do not support from ceiling suspension system.

F. Arrange cable to avoid interference with access to other work.

G. Provide 10 percent slack length in each cable.

H. Life Safety Circuits: Install life safety lighting circuits for emergency egress luminaires and exit signs in EMT conduit unless flexible wiring is acceptable by local AHJ. Where Manufactured Wiring Systems are used for life safety, cable set will be of readily visible differentiation from non-life safety cable sets.

I. General Materials:

1. Install per manufacturer's written requirements and instructions.

2. See General Installation Requirements above.

3.2 EQUIPMENT FOR FLUORESCENT SYSTEMS

A. Install per manufacturer's written requirements and instructions.

B. See General Installation Requirements above.

3.3 EQUIPMENT FOR HID SYSTEMS

A. Install per manufacturer's written requirements and instructions.

B. See General Installation Requirements above.

3.4 EQUIPMENT FOR POWER SYSTEMS

A. Install per manufacturer's written requirements and instructions.

B. See General Installation Requirements above.

3.5 DISTRIBUTION UNITS

A. Install per manufacturer's written requirements and instructions.

B. See General Installation Requirements above.

3.6 CABLE ACCESSORIES

A. Install per manufacturer's written requirements and instructions.

B. See General Installation Requirements above.

END OF SECTION 26 0521

SECTION 26 0526

GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 SUMMARY

A. Work Included:

1. Grounding Electrodes
2. Connectors and Accessories
3. Grounding Busbar
4. Grounding Conductor
5. Grounding Test Well

1.2 RELATED SECTIONS

A. Contents of Division 26, Electrical and Division 01, General Requirements apply to this Section.

1.3 REFERENCES AND STANDARDS

A. References and Standards as required by Section 26 00 00, Electrical Basic Requirements and Division 01, General Requirements.

1.4 SUBMITTALS

A. Submittals as required by Section 26 00 00, Electrical Basic Requirements and Division 01, General Requirements.

B. In addition, provide:

1. Test reports of ground resistance for service and separately derived system grounds.

1.5 QUALITY ASSURANCE

A. Quality assurance as required by Section 26 00 00, Electrical Basic Requirements and Division 01, General Requirements.

B. In addition, meet the following:

1. Comply with the requirements of ANSI/NFPA 70.

1.6 WARRANTY

A. Warranty of materials and workmanship as required by Section 26 00 00, Electrical Basic Requirements and Division 01, General Requirements.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Grounding Electrodes:

1. Erico
2. Thomas & Betts
3. Talley
4. Or approved equivalent.

B. Connectors and Accessories:

1. Burndy Hyground Compression System
2. Erico/Cadweld
3. Amp Ampact Grounding System
4. Pipe Grounding Clamp:
    a. Burndy GAR Series
    b. O Z Gedney
    c. Thomas & Betts
    d. Or approved equivalent.

C. Grounding Busbar:

1. Chatsworth
2. Erico
3. Schneider Electric/Square D
4. Panduit
5. Or approved equivalent.

D. Grounding Conductor

1. General Cable

2. Okonite

3. Southwire

4. Or approved equivalent

E. Grounding Test Well

1. Erico

2. Harger

3. Thompson

4. Or approved equivalent

2.2 GROUNDING ELECTRODES

A. Ground Rods: Copper-clad steel, minimum 3/4-inch diameter, 10-feet long, tapered point, chamfered top.

2.3 CONNECTORS AND ACCESSORIES

A. Grounding Connectors: Hydraulic compression tool applied connectors or exothermic welding process connectors or powder actuated compression tool applied connectors.

B. Pipe Grounding Clamp: Mechanical ground connector with cable parallel or perpendicular to pipe.

2.4 GROUNDING BUSBAR

A. Grounding Busbar: 1/4-inch thick by 4-inch high by 10-inch long copper grounding busbar with insulators that meet ANSI J-STD-607-A specifications. UL 467 listed. Hole patterns in busbar to accommodate two-hole lugs, four-hole configuration.

2.5 GROUNDING CONDUCTOR

A. Grounding Electrode Conductor: Soft-draw bare stranded copper for wire sizes larger than #10 AWG Bare. Solid copper for wire sizes #10 AWG and smaller.

B. Equipment Grounding Conductor: Green insulated, insulation type to match that of associated feeder or branch circuit wiring, size as indicated on drawings.

2.6 GROUNDING TEST WELL

A. Grounding Well:

1. Well Pipe: 8-inch diameter by 12-inch long clay tile pipe with belled end.

2. Well Cover: Cast iron with legend "GROUND" embossed on cover. Provide lip on bottom of cover, sized to match interior pipe diameter to hold cover in place.

PART 3 - EXECUTION

3.1 GENERAL INSTALLATION REQUIREMENTS

A. Verify site conditions prior to beginning work.

B. Bond Sections of service equipment enclosure to service ground bus.

C. Separately Derived Systems: Ground each separately derived system per NEC Article 250.

D. Corrosion inhibitors: Apply a corrosion inhibitor to contact surfaces when making grounding and bonding connections. Use corrosion inhibitor appropriate for protecting a connection between metals used.

E. Grounding system resistance to ground not to exceed 5 ohms. Make necessary modifications or additions to grounding electrode system for compliance. Submit final tests to assure that this requirement is met.

F. Resistance of grounding electrode system: measure using a four-terminal fall-of-potential method as defined in IEEE 81. Take ground resistance measurements before electrical distribution system is energized and in normally dry conditions, not less than 48 hours after last rainfall. Take resistance measurements of separate grounding electrode systems before systems are bonded together below grade. Combined resistance of separate systems may be used to meet required resistance, but specified number of electrodes must still be provided.

G. Inspect and test in accordance with NETA Standard ATS, Except Section 4.

H. Perform inspections and tests listed in NETA Standard AB, Section 7.13.

3.2 GROUNDING ELECTRODES INSTALLATION

A. Concrete-Encased Electrode (“Ufer Ground”):

1. From service equipment ground bus provide grounding electrode conductor to footing/foundation rebar.

2. Bond #4 grounding electrode conductor to one minimum 20-foot long, 3/4-inch diameter independent steel rebar(s).

3. Protect grounding electrode conductor from footing/foundation to service equipment grounding bus with rigid PVC conduit where grounding electrode conductor passes through concrete floor or other concrete structure. Do not use rigid metal conduit for grounding electrode conductor protection.

4. Coordinate bonding of rebar in base of building concrete footing with installer prior to placement of concrete.

B. Ground Rod Electrode:

1. Verify that final backfill and compaction have been completed before driving rod electrodes.

2. Bond #6 grounding electrode conductor to driven ground rods as indicated on Drawings.

3. Tap at center ground rod and extend grounding electrode conductor to service grounding bus. Install grounding electrode conductor to service grounding bus in rigid PVC conduit for physical protection where grounding electrode conductor passes through concrete floor or other concrete structure.

C. Metal Underground Water Service: Bond water service pipe to service equipment ground bus or to the grounding electrode system. Connect to water pipe on utility side of isolating fittings or meters, bond across water meters.

D. Other Metal Piping Systems: Bond gas piping system, fire sprinkler piping system and other metal piping systems to service equipment ground bus or to the grounding electrode system.

E. Bond together metal siding not attached to grounded structure; bond to grounding electrode system.

3.3 CONNECTORS AND ACCESSORIES INSTALLATION

A. Install per manufacturer's instructions.

3.4 GROUNDING BUSBAR INSTALLATION

A. Install per manufacturer's instructions.

3.5 GROUNDING CONDUCTOR INSTALLATION

A. Raceways:

1. Ground metallic raceway systems. Bond to ground terminal with code size jumper except where code size or larger equipment grounding conductor is included with circuit, use grounding bushing with lay-in lug.

2. Connect metal raceways, which terminate within an enclosure but without mechanical connection to enclosure, by grounding bushings and ground conductor to grounding bus.

3. Where equipment supply conductors are in flexible metallic conduit, install stranded copper equipment grounding conductor from outlet box to equipment frame.

4. Install equipment grounding conductor, code size minimum unless noted on drawings, in metallic and nonmetallic raceway systems.

B. Feeders and Branch Circuits:

1. Provide continuous green insulated copper equipment grounding conductors for feeders and branch circuits.

2. Where installed in a continuous solid metallic raceway system and larger sizes are not detailed, provide insulated equipment grounding conductors for feeders and branch circuits sized in accordance with the latest adopted edition of NEC Article 250, Table 250-122.

C. Bond boxes, cabinets, enclosures and panelboard equipment grounding conductors to enclosure with specified conductors and lugs. Install lugs only on thoroughly cleaned contact surfaces.

D. Motors, Equipment and Appliances: Install code size equipment grounding conductor to (motor) equipment frame or manufacturer's designated ground terminal.

E. Receptacles: Connect ground terminal of receptacle and associated outlet box to equipment grounding conductor. Self grounding nature of receptacle devices does not eliminate equipment grounding conductor bolted to outlet box.

3.6 GROUNDING TEST WELL INSTALLATION

A. Provide grounding test well with cover at each rod location. Install test well pipe top flush with finished grade.

B. Install per manufacturer's instructions

END OF SECTION 26 0526

SECTION 26 0529

HANGERS AND SUPPORTS FOR ELECTRICAL SYSTEMS AND EQUIPMENT

PART 1 - GENERAL

1.1 SUMMARY

A. Work Included:

1. Anchors, Threaded Rod and Fasteners

2. Support Channel, Hangers and Supports

3. Rooftop Conduit Supports

1.2 RELATED SECTIONS

A. Contents of Division 26, Electrical and Division 01, General Requirements apply to this Section.

1.3 REFERENCES AND STANDARDS

A. References and Standards as required by Section 26 00 00, Electrical Basic Requirements and Division 01, General Requirements.

1.4 SUBMITTALS

A. Submittals not required for this Section.

1.5 QUALITY ASSURANCE

A. Quality assurance as required by Section 26 00 00, Electrical Basic Requirements and Division 01, General Requirements.

B. In addition, meet the following:

1. Manufacturers regularly engaged in the manufacture of bolted metal framing support systems, whose products have been in satisfactory use in similar service for not less than 10 years.

2. Support systems to be supplied by a single manufacturer.

3. Engineering Responsibility: Design and preparation of Shop Drawings and calculations for each multiple pipe support, trapeze, equipment hangers/supports, and seismic restraint by a qualified Structural Professional Engineer.

a. Professional Engineer Qualifications: A professional engineer who is legally qualified to practice in jurisdiction where Project is located and who is experienced in providing engineering services of the kind indicated. Engineering services are

defined as those performed for installations of hangers and supports that are similar to those indicated for this Project in material, design, and extent.

1.6 WARRANTY

A. Warranty of materials and workmanship as required by Section 26 00 00, Electrical Basic Requirements and Division 01, General Requirements.

1.7 PERFORMANCE REQUIREMENTS

A. General: Provide conduit and equipment hangers and supports in accordance with the following:

1. When supports, anchorages, and seismic restraints for equipment and supports, anchorages and seismic restraints for conduit, cable tray and equipment are not shown on the Drawings, the Contractor is responsible for their design.

2. Connections to structural framing shall not introduce twisting, torsion, or lateral bending in the framing members. Provide supplementary steel as required.

B. Engineered Support Systems: The following support systems to be designed, detailed, and bear the seal of a professional engineer registered in the State of California.

1. Support frames such as conduit racks or stanchions for conduit and equipment which provide support from below.

2. Equipment and piping support frame anchorage to supporting slab or structure.

C. Provide channel support systems, for conduits to support multiple conduits capable of supporting combined weight of support systems and system contents.

D. Provide heavy-duty steel trapezes for piping to support multiple conduit capable of supporting combined weight of supported systems and system contents.

E. Provide seismic restraint hangers and supports for conduit and equipment.

F. Obtain approval from AHJ for seismic restraint hanger and support system to be installed for piping and equipment.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Anchors, Threaded Rod and Fasteners:

1. Anchor It

2. Epcon System

3. Hilti-Hit System

4. Power Fast System

5. Or approved equivalent.

B. Support Channel, Hangers and Supports:

1. B-Line

2. Kindorf

3. Superstrut

4. Unistrut

5. Or approved equivalent.

C. Rooftop Conduit Supports:

1. Cooper B-Line Dura-Block Rooftop Support Base

2. Or approved equivalent.

2.2 ANCHORS, THREADED ROD AND FASTENERS

A. Anchors, Threaded Rod and Fasteners - General: Corrosion-resistant materials of size and type adequate to carry the loads of equipment and conduit, including weight of wire in conduit.

B. Concrete Inserts: Cast in concrete for support fasteners for loads up to 800 lbs.

C. Anchors and Fasteners:

1. Do not use powder-actuated anchors.

2. Concrete Structural Elements: Use precast inserts.

3. Steel Structural Elements: Use beam clamps.

4. Concrete Surfaces: Use self-drilling anchors.

5. Hollow Masonry, Plaster, and Gypsum Board Partitions: Use toggle bolts.

6. Solid Masonry Walls: Use expansion anchors.

7. Sheet Metal: Use sheet metal screws.

8. Wood Elements: Use wood screws.

D. Fasteners: Provide fasteners of types as required for assembly and installation of fabricated items; surface-applied fasteners are specified elsewhere.

E. Bolts: Low carbon steel externally and internally threaded fasteners conforming with requirements of ASTM A307; include necessary nuts and plain hardened washers. For structural steel elements supporting mechanical material or equipment from building structural members or connection thereto, use fasteners conforming to ASTM A325.

F. Miscellaneous Materials: Provide incidental accessory materials, tools, methods, and equipment required for fabrication.

2.3 SUPPORT CHANNEL, HANGERS AND SUPPORTS

A. Hangers and Supports - General: Corrosion-resistant materials of size and type adequate to carry the loads of equipment and conduit, including weight of wire in conduit.

1. Channel Material: Carbon steel.

2. Coating: Hot dip galvanized.

B. Pipe Straps: Two-hole galvanized or malleable iron.

C. Luminaire Chain: 90 lb. test with steel hooks.

D. Miscellaneous Metal: Provide miscellaneous metal items specified hereunder, including materials, fabrication, fastenings and accessories required for finished installation, where indicated on Drawings or otherwise not shown on drawings that are necessary for completion of the project. The Contractor is responsible for their design.

1. Fabricate miscellaneous units to size shapes and profiles indicated or, if not indicated, of required dimensions to receive adjacent other work to be retained by framing. Except as otherwise shown, fabricate from structural steel shapes and plates and steel bars, of welded construction using mitered joints for field connection. Cut, drill and tap units to receive hardware and similar items.

E. Structural Shapes: Where miscellaneous metal items are needed to be fabricated from structural steel shapes and plates, provide members constructed of steel conforming with requirements of ASTM A36 or approved equivalent.

F. Steel Pipe: Provide seamless steel pipe conforming to requirements of ASTM A53, Type S, Grade A, or Grade B. Weight and size required as specified.

G. Miscellaneous Materials: Provide incidental accessory materials, tools, methods, and equipment required for fabrication.

2.4 ROOFTOP CONDUIT SUPPORTS

A. Curb base made of 100 percent recycled rubber and polyurethane prepolymer with a uniform load

B. Capacity of 500 pounds per linear foot of support.

C. UV resistant.

D. Steel Frame: Steel, 14 gauge strut galvanized per ASTM A653 or 12 gauge strut galvanized per ASTM A653 for bridge series.

E. Continuous block channel supports with 1-inch gaps to allow water flow, bridge channel supports, extendable height channel supports and elevated single conduitsupports.

F. Attaching Hardware: Zinc-plated threaded rod, nuts and attaching hardware per ASTM B633 fastened directly into rubber material with weather resistant Type 12 lag screws.

G. Provide load distribution plates when required for heavy loads.

H. Finish: Black with safety yellow striping.

I. Provide hot dipped galvanized components for items exposed to weather.

PART 3 - EXECUTION

3.1 GENERAL INSTALLATION REQUIREMENTS

A. Fabrication - Miscellaneous Metals

1. General: Verify dimensions prior to fabrication. Form metal items to accurate sizes and configurations as indicated on Drawings and otherwise required for proper installation; make with lines straight and angles sharp, clean and true; drill, countersink, tap, and otherwise prepare items for connections with work of other trades, as required. Fabricate to detail of structural shapes, plates and bars; weld joints where practicable; provide bolts and other connection devices required. Include anchorages; clip angles, sleeves, anchor plates, and similar devices. Hot dipped galvanize after fabrication items installed in exterior locations. Set accurately in position as required and anchor securely to building construction. Construct items with joints formed for strength and rigidity, accurately machining for proper fit; where exposed to weather, form to exclude water.

2. Finishes:

a. Ferrous Metal: After fabrication, but before erection, clean surfaces by mechanical or chemical methods to remove rust, scale, oil, corrosion, or other substances detrimental to bonding of subsequently applied protective coatings. For metal items exposed to weather or moisture, galvanize in manner to obtain G90 zinc coating in accordance with ASTM A123. Provide other non-galvanized ferrous metal with one coat of approved rust-resisting paint primer, in manner to obtain not less than 1.0 mil dry film thickness. Touch-up damaged areas in primer with same material, before installation. Apply zinc coatings and paint primers uniformly and smoothly; leave ready for finish painting as specified elsewhere.

b. Metal in contact with Concrete, Masonry and Other Dissimilar Materials: Where metal items are to be erected in contact with dissimilar materials, provide contact surfaces with coating of an approved zinc-chromate primer in manner to obtain not

less than 1.0 mil dry film thickness, in addition to other coatings specified in these specifications.

c. For Galvanized Surfaces: Clean field welds, bolted connections, and abraded areas and apply galvanizing repair paint to comply with ASTM A780.

3.2 ANCHORS, THREADED ROD AND FASTENERS INSTALLATION

A. Safety factor of 4 required for every fastening device or support for equipment installed. Supports to withstand four times the weight of equipment it supports.

B. Do not use other trade's fastening devices as supporting means for luminaires, equipment or materials.

C. Do not fasten supports to pipes, ducts, mechanical equipment, or conduit.

D. Do not use supports or fastening devices to support other than one particular item.

E. Securely suspend junction boxes, pull boxes or other conduit terminating housings located above suspended ceiling from floor above or roof structure to prevent sagging and swaying.

F. Provide seismic bracing per CBC requirements.

G. Install surface-mounted cabinets and panelboards with minimum of four anchors.

H. Use spring lock washers under fastener nuts for strut.

I. Cutting and Drilling

1. Do not drill or cut structural members without prior permission from Architect.

3.3 SUPPORT CHANNEL, HANGERS AND SUPPORTS INSTALLATION

A. Install hangers and supports as required to adequately and securely support electrical system components, in a neat and workmanlike manner, as specified in NECA 1.

B. Safety factor of 4 required for every fastening device or support for equipment installed. Supports to withstand four times the weight of equipment it supports.

C. Verify mounting height of luminaires prior to installation when heights are not detailed.

D. Install vertical support members for equipment and luminaires, straight and parallel to building walls.

E. Install horizontal support members straight and parallel to ceilings or finished floor unless otherwise noted.

F. Provide independent supports to structural member for luminaires, materials, or equipment installed in or on ceiling, walls or in void spaces or over suspended ceilings.

G. Do not use other trade's fastening devices as supporting means for luminaires, equipment or materials.

H. Do not fasten supports to pipes, ducts, mechanical equipment, or conduit.

I. Do not use supports or fastening devices to support other than one particular item.

J. Support conduits within 18-inches of outlets, boxes, panels, cabinets and deflections unless more stringently required by CEC.

K. Maximum distance between supports not to exceed 8 foot spacing unless otherwise required by CEC.

L. Support flexible conduits and metal clad cable within 12-inches of outlets, boxes, panels, cabinets and deflections unless otherwise required by CEC.

M. Maximum distance between supports for flexible conduits and metal clad cable not to exceed 48-inches spacing unless otherwise required by CEC.

N. Maximum distance between supports for rigid PVC conduits unless otherwise required by CEC is as follows:

1. 1/2-inch or 3/4-inch and 1-inch conduit, 3-feet apart.

2. 1-1/4-inch or 1-1/2-inch and 2-inch conduit, 4-feet apart.

3. 2-1/2-inch and 3-inch conduit, 5-feet apart.

4. 4-inch and 5-inch conduit, 6-feet apart.

5. 6-inch conduit, 7-feet apart.

O. Maximum distance between supports for auxiliary gutters and wireways unless otherwise required by CEC is as follows:

1. Sheet metal auxiliary gutters and wireways - 4-feet apart horizontally and 10-feet vertically.

2. Non-metallic auxiliary gutters and wireways - 30-inches apart horizontally and 3-feet vertically.

P. Install strut hangers as instructed by strut manufacturer. Suspend strut hangers as instructed by strut manufacturer for the load, with a maximum spacing of 8-feet on center and within 2-feet of outlet box, cabinet, junction box or other channel raceway termination unless otherwise required by CEC.

Q. Coordinate routing of conduit racks with materials and equipment installed by other trades. Where conduit racks are exposed to view, coordinate location and installation with Architect for optimal appearance.

R. Securely suspend junction boxes, pull boxes or other conduit terminating housings located above suspended ceiling from floor above or roof structure to prevent sagging and swaying.

S. Provide seismic bracing per CBC requirements.

T. Where service disconnects are mounted on building exterior, physically attach service disconnect to the building or structure served.

U. Install surface-mounted cabinets and panelboards with minimum of four anchors.

V. Use sheet metal channel to bridge studs above and below cabinets and panelboards recessed in hollow partitions.

W. Wet and Damp Locations:

1. In wet and damp locations use steel channel supports to stand cabinets and panelboards 1-inch off wall.

3.4 ROOFTOP CONDUIT SUPPORTS INSTALLATION

A. Consult roofing manufacturer for roof membrane compression capacities. If necessary, provide a compatible sheet of roofing material (rubber pad) under rooftop support to disperse concentrated loads and add further membrane protection.

B. Do not use supports that will void roof warranty.

C. Install supports per manufacturer's instructions and recommendations.

D. Use properly sized clamps to suit conduit sizes.

E. Install supports for rooftop raceways to raise raceways a minimum of 7/8-inches above the roof structure unless otherwise noted.

END OF SECTION 26 0529

SECTION 26 0533

RACEWAYS

PART 1 - GENERAL

1.1 SUMMARY

A. Work Included:

1. Rigid Metal Conduit (RMC)
2. Polyvinyl Chloride (PVC) Externally Coated Galvanized Rigid Metal Conduit
3. Electrical Metallic Tubing (EMT)
4. Flexible Metal Conduit (FMC)
5. Liquidtight Flexible Metal Conduit (LFMC)
6. Electrical Polyvinyl Chloride (PVC) Conduit
7. Conduit Fittings

B. Provide a complete system of conduit and fittings, with associated couplings, connectors, and fittings, as shown on drawings and described in these specifications.

1.2 RELATED SECTIONS

A. Contents of Division 26, Electrical and Division 01, General Requirements apply to this Section.

B. In addition, reference the following:

1. Section 26 05 29, Hangers and Supports for Electrical Systems and Equipment
2. Section 26 05 34, Boxes
3. Section 26 05 43, Electrical Vaults and Underground Raceways

1.3 REFERENCES AND STANDARDS

A. References and Standards as required by Section 26 00 00, Electrical Basic Requirements and Division 01, General Requirements.

1.4 SUBMITTALS

A. Submittals as required by Section 26 00 00, Electrical Basic Requirements and Division 01, General Requirements.

1.5 QUALITY ASSURANCE

A. Quality assurance as required by Section 26 00 00, Electrical Basic Requirements and Division 01, General Requirements.

1.6 WARRANTY

A. Warranty of materials and workmanship as required by Section 26 00 00, Electrical Basic Requirements and Division 01, General Requirements.

1.7 DEFINITIONS

A. Raceway system is defined as consisting of conduit, tubing, duct, and fittings including but not limited to connectors, couplings, offsets, elbows, bushings, expansion/deflection fittings, and other components and accessories. Complete electrical raceway installation before starting the installation of conductors and cables.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Rigid Metal Conduit (RMC):

1. Allied Tube & Conduit
2. Beck Manufacturing Inc.
3. Picoma
4. Wheatland Tube Company
5. Or approved equivalent.

B. Polyvinyl Chloride (PVC) Externally Coated Galvanized Rigid Steel Conduit:

1. Allied Tube & Conduit
2. Thomas & Betts Corporation
3. Robroy Industries
4. O'kote Inc.
5. Or approved equivalent.

C. Electrical Metallic Tubing (EMT):

1. Allied Tube & Conduit
2. Beck Manufacturing WL

3. Picoma

4. Wheatland Tube Company

5. Or approved equivalent.

D. Flexible Metal Conduit (FMC):

1. AFC Cable Systems Inc.

2. Electri-Flex Company

3. International Metal Hose

4. Or approved equivalent.

E. Liquidtight Flexible Metal Conduit (LFMC):

1. AFC Cable Systems Inc.

2. Electri-Flex Company

3. International Metal Hose

4. Or approved equivalent.

F. Electrical Polyvinyl Chloride (PVC) Conduit:

1. AFC Cable Systems Inc.

2. Electri-Flex Company

3. International Metal Hose

4. JM Eagle

5. Or approved equivalent.

G. Conduit Fittings:

1. Bushings:

a. Insulated Type for Threaded Raceway Without Factory Installed Plastic Throat Conductor Protection:

1) Thomas & Betts 1222 Series

2) O-Z Gedney B Series

3) Or approved Equivalent.

2. Raceway Connectors and Couplings:

a. Thomas & Betts Series

b. O-Z Gedney Series

c. Or approved Equivalent.

3. Expansion/Deflection Fittings:

a. EMT: O-Z Gedney Type TX

b. RMC: O-Z Gedney Type AX, DX and AXDX, Crouse & Hinds XD

c. PVC: O-Z Gedney Type DX with PVC adapters, Carlon E945 Series, Kraloy OPEJ Series

d. Or approved equivalent.

2.2 RIGID METAL CONDUIT (RMC)

A. UL 6, ANSI C80.1. Hot dipped galvanized steel conduit after thread cutting.

1. Fittings: NEMA FB2.10.

2.3 POLYVINYL CHLORIDE (PVC) EXTERNALLY COATED GALVANIZED RIGID METAL CONDUIT

A. Description: UL 6, ANSI C80.1, and NEMA RN 1; rigid steel conduit with external PVC coating.

1. PVC Coating: Minimum 40 mils in thickness.

B. Fittings and Conduit Bodies: NEMA FB 1; steel fittings with external PVC coating to match conduit.

2.4 ELECTRICAL METALLIC TUBING (EMT)

A. Description: UL 797, ANSI C80.3; steel galvanized tubing.

B. Fittings: NEMA FB 1; steel, compression type.

2.5 FLEXIBLE METAL CONDUIT (FMC)

A. Description: UL 1, Interlocked steel construction.

B. Fittings: NEMA FB 2.20.

2.6 LIQUIDTIGHT FLEXIBLE METAL CONDUIT (LFMC)

A. Description: UL 360, inner core made from spiral wound strip of heavy gauge, hot dipped galvanized low carbon steel. 3/4-inch through 1-1/4-inch trade sizes to have a square lock core

and contain an integral bonding strip of copper. 1-1/2-inch and larger to have fully interlocked core. Jacket material to be moisture, oil and sunlight resistant flexible PVC.

B. Fittings: NEMA FB 2.20.

2.7 ELECTRICAL POLYVINYL CHLORIDE (PVC) CONDUIT

A. Description: UL 651, NEMA TC 2; Schedule 40 PVC.

B. Fittings: NEMA TC 3.

2.8 CONDUIT FITTINGS

A. Bushings:

1. Insulated type for threaded raceway connectors without factory-installed plastic throat conductor protection.

2. Insulated grounding type for threaded raceway connectors.

B. Raceway Connectors and Couplings:

1. Steel connectors, couplings, and conduit bodies, hot-dip galvanized.

2. Connector locknuts to be steel, with threads meeting ASTM tolerances. Locknuts to be hot-dip galvanized.

3. Connector throats (EMT, flexible conduit, metal clad cable and cordset connectors) to have factory installed plastic inserts permanently installed. For normal cable or conductor exiting angles from raceway, the cable jacket or conductor insulation to bear only on plastic throat insert.

4. Steel gland, Tomic or Breagle connectors and couplings are recognized for this Contract as having acceptable raceway to fitting electrical conductance.

5. Set screw connectors and couplings, without integral compression glands, are recognized for this Contract as not having acceptable raceway to fitting electrical conductance. A ground conductor sized per this Specification must be included and bonded within raceway assembly utilizing this type connector or coupling.

C. Provide expansion/deflection fittings for EMT.

PART 3 - EXECUTION

3.1 GENERAL INSTALLATION REQUIREMENTS

A. Finished Surfaces: Schedule raceway installation to avoid conflict with installed wall and ceiling surfaces. If unavoidable, coordinate work and repairs with Architect.

B. Conduit Size:

1. Minimum Size: 3/4-inch for power and control, unless otherwise noted. 3/4-inch for communication/data, unless otherwise noted. 3/4-inch for signal systems, unless otherwise noted.

C. Underground Installations:

1. More than 5-feet from Foundation Wall: Use PVC.

2. Within 5-feet from Foundation Wall: Use PVC coated RMC.

3. In or Under Slab on Grade: Use PVC.

4. Minimum Size: 1-inch.

D. In Slab Above Grade:

1. Use PVC.

2. Maximum Size Conduit in Slab: Contact Structural Engineer for maximum outside diameter of conduit.

E. Provide two pull strings/tapes in empty conduits. Types:

1. Feeders: Polyester measure/pulling tape, Greenlee 4436 or approved.

2. Branch Circuits and Low Voltage: Greenlee Poly Line 431 or approved.

3. If fish tape is used for pulling line or low voltage wiring, fiberglass type to be used. Metal fish tapes will not be allowed.

4. Secure pull string/tape at each end.

5. Provide caps on ends of empty conduit to be used in future.

6. Label both ends of empty conduits with location of opposite end.

F. Elbows: Use fiberglass or PVC coated RMC for underground installations.

G. Elbow for Low Energy Signal Systems: Use long radius factory ells where linking sections of raceway for installation of signal cable.

H. Verify that field measurements are as shown on drawings.

I. Plan locations of conduit runs in advance of the installation and coordinate with ductwork, plumbing, ceiling and wall construction in the same areas.

J. Locate penetrations and holes in advance where they are proposed in the structural sections such as footings, beams, and walls. Penetrations are acceptable only when the following occurs:

1. Where shown on the structural drawings.

2. As approved by the Structural Engineer prior to construction, and after submittal of drawing showing location, size, and position of each penetration.

K. Verify routing and termination locations of conduit prior to rough-in.

L. Conduit routing is shown on drawings in approximate locations unless dimensioned. Route as required to complete wiring system.

M. Install raceways securely, in neat and workmanlike manner, as specified in NECA 1, Standard Practices for Good Workmanship in Electrical Construction.

N. Install steel conduit as specified in NECA 101, Standard for Installing Steel Conduits.

O. Install nonmetallic conduit in accordance with manufacturer's instructions.

P. Inserts, anchors and sleeves.

1. Coordinate location of inserts and anchor bolts for electrical systems prior to concrete pour.

2. Coordinate location of sleeves with consideration for other building systems prior to concrete pour.

Q. Conduit Supports:

1. Arrange supports to prevent misalignment during wiring installation.

2. Support conduit using coated steel or malleable iron straps, lay-in adjustable hangers, clevis hangers, and split hangers.

3. Group related conduits; support using conduit rack. Construct rack using steel channel. Provide space on each for 25 percent additional conduits.

4. Do not support conduit with wire or perforated pipe straps. Remove wire used for temporary supports.

5. Do not attach conduit to ceiling support wires.

R. Flexible steel conduit length not-to-exceed 6-feet, 3-feet in concealed walls. Provide sufficient slack to reduce the effect of vibration.

S. Install conduit seals at boundaries where ambient temperatures differ by 10 degrees F or more as shown on the drawings. Install seals on warm side of partition.

T. Seal raceways stubbing up into electrical equipment. Plug raceways with conductors with duct-seal. Cap spare raceways and plug PVC raceway products with plastic plugs as made by Underground Products, or equal, shaped to fit snugly into the stubup.

U. Seal raceways penetrating an exterior building wall to prevent moisture and vermin from entering into the electrical equipment.

V. Use suitable caps on spare and empty conduits to protect installed conduit against entrance of dirt and moisture.

W. Keep 277/480 volt wiring independent of 120/208 volt wiring. Keep power wiring independent of communication system wiring.

X. Keep emergency system wiring independent of other wiring systems per NEC 700.

Y. Arrange conduit to maintain headroom and present neat appearance.

Z. Do not install conduits on surface of building exterior, along vapor barrier, across roof, on top of parapet walls, or across floors, unless otherwise noted on drawings.

AA. Exposed conduits are permitted only in following areas:

1. Mechanical rooms, electrical rooms or spaces where walls, ceilings and floors will not be covered with finished material.

2. Existing walls that are concrete or block construction.

3. Where specifically noted on Drawings.

4. Route exposed conduit parallel and perpendicular to walls, tight to finished surfaces and neatly offset into boxes.

AB. Do not install conduits or other electrical equipment in obvious passages, doorways, scuttles or crawl spaces which would impede or block area passage's intended usage.

AC. Install continuous conduit and raceways for electrical power wiring and signal systems wiring.

AD. Below Grade Conduit:

1. See Section 26 05 43, Electrical Vaults and Underground Raceways.

2. Use PVC, PVC coated RMC, or fiberglass conduit.

3. Provide watertight conduit sleeves and rubber seals for conduit entering building below grade, Link-Seal system by Thunderline Corporation or approved equivalent.

AE. Route conduit installed above accessible ceilings parallel and perpendicular to walls.

AF. Maintain adequate clearance between conduit and piping.

AG. Keep conduits a minimum of 12-inches away from steam or hot water radiant heating lines (at or above 104 degrees F) or 3-inches away from waste or water lines.

AH. Cut conduit square using saw or pipecutter; deburr cut ends.

AI. Bring conduit to shoulder of fittings; fasten securely.

AJ. Use conduit hubs to fasten conduit to cast boxes in damp and wet locations.

AK. Install no more than the equivalent of three 90 degree bends between boxes. Use conduit bodies to make sharp changes in direction, as around beams.

AL. Use hydraulic one shot bender to fabricate elbows for bends in metal conduit larger than 2-inch size.

AM. Avoid moisture traps; provide junction box with drain fitting at low points in conduit system.

AN. Provide suitable fittings to accommodate expansion and deflection where conduit crosses seismic, control, and expansion joints.

AO. Above grade raceway to freestanding electrical equipment: Where electrical equipment is mounted outside a building and connected to the building's electrical system with above grade raceway (example: switchgear connected to pull box), use liquid-tight flexible metallic conduit to avoid conduit damage due a seismic event.

AP. Conduit Terminations for Signal Systems: Provide a plastic bushing on the end of conduit used for signal system wiring.

AQ. Feeders: Do not combine or change feeder runs.

AR. Install conduit to preserve fire resistance rating of partitions and other elements, using materials and methods specified in Division 07, Thermal and Moisture Protection.

AS. Route conduit through roof openings for piping and ductwork wherever possible. Where separate roofing penetration is required, coordinate location and installation method with roofing installation and installer.

3.2 RIGID METAL CONDUIT (RMC) INSTALLATION

A. Outdoor Locations Above Grade: RMC.

B. Damp Locations: RMC.

C. In areas exposed to mechanical damage: RMC.

D. For security conduits installed exposed and subject to tampering: RMC.

3.3 POLYVINYL CHLORIDE (PVC) EXTERNALLY COATED GALVANIZED RIGID METAL CONDUIT INSTALLATION

A. Use PVC coated RMC 36-inch radius ells for power service conduits and 48-inch radius ells for telephone service conduits.

3.4 ELECTRICAL METALLIC TUBING (EMT) INSTALLATION

A. Damp Locations: EMT up to 2-inches in diameter with compression couplings.

B. Dry Locations:

1. Concealed: EMT.

2. Exposed: EMT.

C. Dry, Protected: EMT.

3.5 FLEXIBLE METAL CONDUIT (FMC) INSTALLATION

A. Dry Locations: Motors, recessed luminaires and equipment connections subject to movement or vibration, use flexible metallic conduit.

B. Install 12-inch minimum slack loop on flexible metallic conduit.

3.6 LIQUIDTIGHT FLEXIBLE METAL CONDUIT (LFMC) INSTALLATION

A. Use PVC coated liquidtight flexible metallic conduit for motors and equipment connections subject to movement or vibration and subjected to any of following conditions: Exterior location, moist or humid atmosphere, corrosive environments, water spray, oil, or grease.

B. Install 12-inch minimum slack loop on liquidtight flexible metallic conduit.

3.7 ELECTRICAL POLYVINYL CHLORIDE (PVC) CONDUIT INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Provide equipment grounding conductor in PVC conduit runs containing power conductors.

C. Underground Installation:

1. Areas subject to vehicular traffic: Schedule 80 PVC.

2. Other underground applications: Schedule 40 PVC, except where prohibited by the NEC or local codes.

D. Convert PVC conduit to Rigid Metal Conduit (RMC) prior to emerging from underground, concrete encasement, or concrete slab.

E. Locations Subject to Corrosive Influences: Schedule 80 PVC where allowed in NEC 300.6 and approved for use by the Authority Having Jurisdiction and also the Architect.

F. Provide expansion fittings to compensate for expansion and contraction per NEC 352.44.

G. PVC elbows are not acceptable. Use fiberglass or PVC coated RMC.

H. Trim cut ends inside and outside to remove rough edges.

I. Provide bushings when entering a box, fitting or other enclosure.

3.8 CONDUIT FITTINGS INSTALLATION

A. Conduit Joints: Assemble conduits continuous and secure to boxes, panels, luminaires and equipment with fittings to maintain continuity. Provide watertight joints where embedded in concrete, below grade or in damp locations. Seal metal conduit with metal thread primer. Rigid conduit connections to be threaded, clean and tight (metal to metal). Threadless connections are not permitted for RMC.

B. Join nonmetallic conduit using cement as recommended by manufacturer. Wipe nonmetallic conduit dry and clean before joining. Apply full even coat of cement to entire area inserted in fitting. Allow joint to cure for 20 minutes, minimum.

C. Use set screw type fittings only in dry locations. When set screw fittings are utilized provide insulated continuous equipment ground conductor in conduit, from overcurrent protection device to outlet.

D. Use compression fittings in dry locations, damp and rain-exposed locations. Maximum size permitted in damp locations and locations exposed to rain is 2-inches in diameter.

E. Use threaded type fittings in wet locations, hazardous locations, and damp or rain-exposed locations where conduit size is greater than 2-inches.

F. Use PVC coated, threaded type fittings in corrosive environments.

G. Use insulated type bushings with ground provision at switchboards, panelboards, safety disconnect switches, junction boxes that have feeders 60 amperes and greater.

H. Condulets and Conduit Bodies:

1. Do not use condulets and conduit bodies in conduits for signal wiring, in feeders 100 amp and larger, or for conductor splicing.

I. Sleeves and Chases - Floor, Ceiling and Wall Penetrations: Provide necessary rigid conduit sleeves, openings and chases where conduits or cables are required to pass through floors, ceilings or walls.

J. Expansion Joints:

1. Provide conduits crossing expansion joints where cast in concrete with expansion-deflection fittings, installed per manufacturer's recommendations.

2. Secure conduits 3-inches and larger to building structure on opposite sides of a building expansion joint with an expansion-deflection fitting across joint installed per manufacturer's recommendations.

3. Provide conduits less than 3-inches where not cast in concrete with junction boxes securely fastened on both sides of expansion joint, connected together with 15-inches of slack (minimum of 15-inches longer than straight line length) flexible conduit and copper

green ground bonding jumper. In lieu of this flexible conduit, an expansion-deflection fitting, as indicated for conduits 3-inch and larger may be installed.

4. Verify expansion/deflection requirements with Structural Engineer prior to installation.

K. Seismic Joints:

1. No conduits cast in concrete allowed to cross seismic joint.

2. Provide conduits with junction boxes securely fastened on both sides of seismic joint, connected together with 15-inches of slack (minimum of 15-inches longer than straight line length) flexible conduit and copper green ground bonding jumper. Prior to installation, verify with Architect that 15-inches is adequate for designed movement, and if not, increase this length as required.

3. Provide conduits less than 3-inches where not cast in concrete with junction boxes securely fastened on both sides of expansion joint, connected together with 15-inches of slack (minimum of 15-inches longer than straight line length) flexible conduit and copper green ground bonding jumper. In lieu of this flexible conduit, an expansion-deflection fitting, as indicated for conduits 3-inch and larger may be installed.

L. Provide rigid conduit coupling flush with surface of slab or wall for conduit stubbed in concrete slab or wall to serve electrical equipment or an outlet under table or to supply shop tool, etc. Provide plug where conduit is to be used in future.

END OF SECTION 26 0533

SECTION 26 0534
BOXES

PART 1 - GENERAL

1.1 SUMMARY

A. Work Included:

1. Pull and Junction Boxes

2. Box Extension Adapter

3. Weatherproof Outlet Boxes

B. Provide electrical boxes and fittings for a complete installation. Include but not limited to outlet boxes, junction boxes, pull boxes, bushings, locknuts and other necessary components.

1.2 RELATED SECTIONS

A. Contents of Division 26, Electrical and Division 01, General Requirements apply to this Section.

B. In addition, reference the following:

1. Section 26 05 33, Raceways

2. Section 26 05 53, Identification for Electrical Systems

1.3 REFERENCES AND STANDARDS

A. References and Standards as required by Section 26 00 00, Electrical Basic Requirements and Division 01, General Requirements.

1.4 SUBMITTALS

A. Submittals as required by Section 26 00 00, Electrical Basic Requirements and Division 01, General Requirements.

1.5 QUALITY ASSURANCE

A. Quality assurance as required by Section 26 00 00, Electrical Basic Requirements and Division 01, General Requirements.

1.6 WARRANTY

A. Warranty of materials and workmanship as required by Section 26 00 00, Electrical Basic Requirements and Division 01, General Requirements.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Pull and Junction Boxes:

1. Eaton/Crouse-Hinds
2. Hoffman
3. Or approved equivalent.

B. Box Extension Adapter:

1. Hubbell
2. Thomas & Betts
3. Eaton/Crouse-Hinds
4. Or approved equivalent.

C. Weatherproof Outlet Boxes:

1. Legrand (Pass & Seymour)
2. Hubbell
3. Thomas & Betts
4. Eaton/Crouse-Hinds
5. Intermatic
6. Or approved equivalent.

2.2 PULL AND JUNCTION BOXES

A. Construction: Provide ANSI 49 gray enamel painted sheet steel junction and pull boxes, with screw-on covers; of type shape and size, to suit each respective location and installation; with welded seams and equipped with stainless steel nuts, bolts, screws and washers.

B. Location:

1. Provide junction boxes above accessible ceilings for drops into walls for receptacle outlets from overhead.
2. Provide junction boxes and pull boxes to facilitate installation of conductors and limiting accumulated angular sum of bends between boxes, cabinets and appliances to 270 degrees.

C. In-Ground Cast Metal Box: NEMA 250, Type 6, outside flanged, recessed cover box for flush mounting:

1. Construction: Galvanized cast iron.

2. Cover: Smooth cover with neoprene gasket and stainless steel cover screws.

3. Cover Legend: ELECTRIC.

D. Fiberglass Handholes: Die molded glass fiber hand holes:

1. Cable Entrance: Pre-cut 6- x 6-inch cable entrance at center bottom of each side.

2. Cover: Fiberglass weatherproof cover with nonskid finish.

3. Cover Legend: ELECTRIC.

2.3 BOX EXTENSION ADAPTER

A. Construction: Diecast aluminum.

B. Location: Install over flush wall outlet boxes to permit flexible raceway extension from flush outlet to fixed or movable equipment.

2.4 WEATHERPROOF OUTLET BOXES

A. Construction: Provide corrosion-resistant cast metal weatherproof outlet wiring boxes, of the type, shape and size, including depth of box, with threaded conduit ends, cast metal faceplate with spring-hinged waterproof cap suitably configured for each application, including faceplate, gasket, blank plugs and corrosion proof fasteners. Weatherproof boxes to be constructed to have smooth sides, gray finish.

PART 3 - EXECUTION

3.1 GENERAL INSTALLATION REQUIREMENTS

A. Coordinate locations of floor boxes and wall mounted wiring device boxes with architectural and structural floor plans prior to rough-in.

B. Install boxes securely, in a neat and workmanlike manner, as specified in NECA 1, Standard Practice of Good Workmanship in Electrical Construction.

C. Secure boxes rigidly to substrate upon which they are being mounted, or solidly embed boxes in concrete or masonry.

D. Install in locations as shown on Drawings, and as required for splices, taps, wire pulling, equipment connections, and as required by NEC. Locate boxes and conduit bodies so as to ensure accessibility of electrical wiring.

E. Set wall mounted boxes at elevations to accommodate mounting heights shown on Architectural Elevations.

F. Electrical boxes are shown on drawings in approximate locations unless dimensioned.

1. Adjust box locations up to 10-feet if required to accommodate intended purpose.

G. Install boxes to preserve fire resistance rating of partitions and other elements, using materials and methods specified in Division 07, Thermal and Moisture Protection.

H. Locate flush mounting box in masonry wall to require cutting of masonry unit corner only. Coordinate masonry cutting to achieve neat opening.

I. Install flush mounting box without damaging wall insulation or reducing its effectiveness.

J. Support boxes independently of conduit, except cast box that is connected to two rigid metal conduits both supported within 12-inches of box.

K. Box Color Coding and Marking: Reference Section 26 05 53, Identification for Electrical Systems.

L. Adjust boxes to be parallel with building lines. Boxes not plumb to building lines are not acceptable.

M. Install knockout closures in unused box openings.

N. Clean interior of boxes to remove dust, debris, and other material.

O. Clean exposed surfaces and restore finish.

3.2 PULL AND JUNCTION BOXES INSTALLATION

A. Install pull boxes and junction boxes above accessible ceilings and in unfinished areas only.

B. Inaccessible Ceiling Areas: Install outlet and junction boxes no more than 6-inches from ceiling access panel or from removable recessed luminaire.

C. Do not fasten boxes to ceiling support wires.

D. Large Pull Boxes: Use hinged enclosure in interior dry locations, surface-mounted cast metal box in other locations.

3.3 BOX EXTENSION ADAPTER INSTALLATION

A. Match material to box.

B. Install gaskets at exterior and wet locations.

3.4 WEATHERPROOF OUTLET BOXES INSTALLATION

A. Use cast outlet box in exterior locations exposed to weather and wet locations.

B. Install gaskets.

END OF SECTION 26 0534

SECTION 26 0543

ELECTRICAL VAULTS AND UNDERGROUND RACEWAYS

PART 1 - GENERAL

1.1 SUMMARY

A. Work Included:

1. Handholes

2. Raceways

1.2 RELATED SECTIONS

A. Contents of Division 26, Electrical and Division 01, General Requirements apply to this Section.

B. Section 26 05 33, Raceways

1.3 REFERENCES AND STANDARDS

A. References and Standards as required by Section 26 00 00, Electrical Basic Requirements and Division 01, General Requirements.

B. In addition, meet the following:

1. NEMA TC 2 - Electrical Polyvinyl Chloride (PVC) Tubing and Conduit (EPC-40 and EPC-80).

2. NEMA TC 3 - Polyvinyl Chloride (PVC) Fittings for Use with Rigid PVC Conduit and Tubing.

3. NEMA TC 6/8 - Extra-Strength PVC Plastic Utilities Duct for Underground Installation.

4. NEMA TC 9 - Fittings for Extra-Strength Plastic Utilities Duct for Underground Installation.

5. NEMA TC 14 - Reinforced Thermosetting Resin Conduit (RTRC) and Fittings.

6. UL 1684 - Standard for Reinforced Thermosetting Resin Conduit (RTRC) and Fittings.

1.4 SUBMITTALS

A. Submittals as required by Section 26 00 00, Electrical Basic Requirements and Division 01, General Requirements.

B. In addition, provide:

1. Shop drawings detailing items provided under this Section:

a. Vault cover assigned designators.

b. Duct entry schedule.

c. Pulling iron working load.

d. ASTM load designation and percentage increase in live load for impact.

e. Vault section weights.

f. Rebar and piling support details.

g. Indicate dimensions, reinforcement, size and locations of openings, and accessory locations for precast manholes and handholes.

1.5 QUALITY ASSURANCE

A. Quality assurance as required by Section 26 00 00, Electrical Basic Requirements and Division 01, General Requirements.

B. In addition, meet the following:

1. Installer will have documented experience in the placement of vaults for a minimum of 3 years.

2. Manufacturer will have documented experience in the manufacturer of vaults for minimum of three years.

1.6 WARRANTY

A. Warranty of materials and workmanship as required by Section 26 00 00, Electrical Basic Requirements and Division 01, General Requirements.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Handholes:

1. Oldcastle Precast

2. Jensen Precast

3. Hubbell/Quazite

4. Or approved equivalent.

B. Raceways:

1. See Section 26 05 33, Raceways.

2. Fiberglass (RTRC):

a. FRE Composites Corp.

b. Champion Fiberglass

c. United Fiberglass of America

2.2 HANDHOLES

A. Housing: Polyester pre-mix with calcium carbonate and polyester resins interlaced with fiber fiberglass and ultraviolet inhibitors.

B. Extension Rings: Capable of accepting up to 18-inches of extension rings to adapt to re-leveling of grade during construction.

C. Lid: Polyester pre-mix with calcium carbonate and polyester resins interlaced with fiber fiberglass and ultraviolet inhibitors, with nonskid finish, neoprene gaskets and stainless steel screws. Same size as opening of housing for as much hand space as possible for wire access.

D. Lid Legend: ELECTRICAL.

E. Cable Entrance: Pre-cut 6 x 6-inch cable entrance at center bottom of each side.

2.3 RACEWAYS

A. See Section 26 05 33, Raceways.

B. PVC Conduit: NEMA TC 2; Schedule 40. Fittings and Conduit Bodies: NEMA TC 3.

C. Plastic Utilities Duct: NEMA TC 6/8; PVC Type DB.

D. Plastic Utility Duct Fittings: NEMA TC 9.

E. Fiberglass Conduit (RTRC), Elbows and Fittings: NEMA TC 14 and UL 1684.

1. Conduit and Fittings: 0.095 inches wall thickness.

2. Large Sweep Elbows: 1.110 inches wall thickness.

3. Joining Method: Supply each length of conduit with a tapered spigot and an integral bell with an integral urethane Tri-Seal gasket held in place with a retaining ring. Minimum 400 pound for the Tri-Seal joint.

4. Adapters: Provide appropriate UL Listed adapters for transitions to and from PVC and steel conduit.

5. Provide conduit in 20 foot lengths, free of burrs and ridges.

6. Fabricate sweeps in one piece, without couplings, joints or tangent lengths, other than at ends.

PART 3 - EXECUTION

3.1 GENERAL INSTALLATION REQUIREMENTS

A. Install per manufacturer's instructions and recommendations.

B. Plan locations of duct runs in advance of the installation. Coordinate with site utility systems and building foundation depths.

C. Duct bank routing is shown on drawings in approximate locations unless dimensions are indicated. Verify routing and termination locations of duct bank prior to excavation for rough-in. Route as required to complete duct system.

D. Manhole and vault locations are shown on drawings in approximate locations unless dimensions are indicated. Verify locations of manholes and vaults prior to excavating for installation. Locate as required to complete duct bank system.

E. Requirements for Precast Concrete Vaults: Coordinate delivery of precast concrete manhole components to jobsite with manufacturer. Handle materials in accordance with ASTM C891 and manufacturer's recommendations. Handle and store components on job site using methods that prevent damage.

F. Cleaning Vaults: Clean and leave free of debris, silt and rocks from installation work.

3.2 HANDHOLES

A. Excavate to required depth and remove materials that are unstable or unsuitable for good foundation. Prepare level, compacted foundation extending 6-inches beyond base. Some vaults may be piling supported. Check structural drawings and details.

B. Set base plumb and level. Set handhole such that cover surface matches finished grade.

C. Provide minimum 12-inches of pea gravel below handhole for stability and drainage.

D. Turn conduits up into handhold with required bend radius per guidance in 26 05 33, Raceways.

E. Engrave cover of handhole to identify its purpose (examples: “Power," “Emergency Power,” “Signal,” “Fire Alarm”).

3.3 RACEWAYS

A. Power and System Duct Bank Raceways: PVC, Fiberglass (RTRC) or PVC coated Rigid Metal Conduit.

B. Elbows for Power and System Raceways: Fiberglass (RTRC) elbows or PVC coated Rigid Metal Conduit elbows.

C. Provide all excavation and backfill required to support Division 01 and this Division of work. Coordinate trench specs for concrete, soil or sand backfill.

D. Excavate trenches six inches deeper and wider than ductbank burial and cross-sectional requirements. Remove from the site all excavated materials not suitable or specified for backfill.

E. Backfill trenches with sand, tamped firm and even to trench depth level.

F. Backfill with non-expansive soil with limited porosity. Deposit all backfill soil in 6-inch layers. Thoroughly and carefully tamp all backfill soils to 90-95 percent compaction until the ductbank is covered by no less than 12 inches of material. Backfill and tamp the remainder of the excavation at 12-inch intervals. Uniformly grade the finished surface.

G. Provide sheeting, shoring, dewatering and cleaning required to keep the trenches and their grades in proper condition for the work to be carried on.

H. Restore all landscape and paving to like new to match existing.

I. Slope raceways away from buildings and drain towards manholes or vaults with a minimum slope of 3 percent. Drain raceways into manholes or vaults, not into building structures or panels. Where sloping cannot be fully provided and there is a section of raceway where water would flow to a panel, switchboard, transformer, or building, provide a means to discharge the excess water from the raceway, or raceway system, consisting of a box or fitting at a low point prior to equipment entry, or at building entry, with a fitting or plug that can be removed to allow drainage.

J. Cut raceway square using saw or pipe cutter; de-burr cut ends.

K. Insert raceway to shoulder of fittings; fasten securely.

L. Join PVC raceway using adhesive as recommended by manufacturer.

M. Wipe PVC raceway dry and clean before joining. Apply full even coat of adhesive to entire area inserted in fitting. Allow joint to cure for 20 minutes, minimum.

N. Number of equivalent 90-degree bends permitted between pull points: Maximum of three bends for power system conduit banks.

O. Provide suitable fittings to accommodate expansion and deflection where required.

P. Terminate raceway at manhole entries using end bells.

Q. Use suitable separators and chairs installed not greater than 5 feet on centers.

R. Provide 1/4-inch polypropylene pull rope in each empty raceway except sleeves and nipples.

S. Swab raceway. Use suitable caps to protect installed conduit against entrance of dirt and moisture.

T. Interface installation of underground warning tape with backfilling. Install tape 6 inches below finished surface.

U. Concrete Encased Raceways:

1. Encasement Concrete: Minimum 2,500 psi mix. Red color additive: Provide concrete mixture ration containing five pounds of red oxide for one yard of concrete.

2. Securely anchor raceway to prevent movement during concrete placement.

3. Provide two No. 4 steel reinforcing bars in top of bank under paved areas.

4. Stagger raceway joints vertically six inches minimum.

5. Connect to existing concrete encasement using dowels.

END OF SECTION 26 0543

SECTION 26 0553

IDENTIFICATION FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 SUMMARY

A. Work Included:

1. Equipment Nameplates
2. Device Labels
3. Wire Markers
4. Conduit Markers
5. Underground Warning Tape

1.2 RELATED SECTIONS

A. Contents of Division 26, Electrical and Division 01, General Requirements apply to this Section.

1.3 REFERENCES AND STANDARDS

A. References and Standards as required by Section 26 00 00, Electrical Basic Requirements and Division 01, General Requirements.

1.4 SUBMITTALS

A. Submittals not required for this Section.

1.5 QUALITY ASSURANCE

A. Quality assurance as required by Section 26 00 00, Electrical Basic Requirements and Division 01, General Requirements.

B. In addition, meet the following:

1. Manufacturer's Qualifications: Firms regularly engaged in manufacture of identification devices of types and sizes required.
2. Manufacturer's standard products of categories and types required for each application as referenced in other Division 26, Electrical Sections. Where more than a single type is specified for application, provide single selection for each product category.
3. Codes and Standards: Comply with ANSI A13.1 for lettering size, length of color field, colors, and viewing angles of identification devices unless otherwise indicated.

1.6 WARRANTY

A. Warranty of materials and workmanship as required by Section 26 00 00, Electrical Basic Requirements and Division 01, General Requirements.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Equipment Nameplates:

1. B & I Nameplates
2. Intellicum
3. JBR Associates
4. Or approved equivalent.

B. Device Labels:

1. Kroy
2. Brady
3. Or approved equivalent.

C. Wire Markers:

1. Brady
2. Panduit
3. Sumitomo
4. Or approved equivalent.

D. Conduit Markers:

1. Allen Systems
2. Brady
3. Or approved equivalent.

E. Underground Warning Tape:

1. Allen Systems
2. Brady

3. Or approved equivalent.

2.2 EQUIPMENT NAMEPLATES

A. Engraved phenolic plastic, laminate, minimum 1/8-inch thick in the size indicated, with beveled edge border matching letter color. Federal specification L-P-387. All upper case letters in engraver standard letter style of the size and wording indicated. Punched for mechanical fastening, except where adhesive mounting is necessary due to substrate. Embossed tape style labels are not acceptable.

B. Color:

1. Normal (Utility): White letters on black background.

2. Life Safety/Critical (Emergency Systems): Black letters on orange background.

3. Equipment Branch (Legally Required Standby Systems): Black letters on yellow background.

C. Letter Size:

1. Use 1/2-inch letters minimum for identifying major equipment and loads, including switchgear, switchboards, etc.

2. Use 1/4-inch or 1/2-inch letters minimum for identifying panels, breakers, etc.

3. Use 3/16-inch minimum for identifying source, voltage, current, phase, and wire configurations.

D. Fasteners: Self-tapping stainless steel screws, except contact-type permanent adhesive where screws cannot or should not penetrate the substrate.

E. The Architect, Engineer, Commissioning Agent and Owner reserve the right to make modifications to the nameplates as necessary.

F. Locations:

1. Switchgear, switchboards, sub-distribution switchboards, distribution panels, and branch panels.

2. Main breakers and distribution breakers in switchgear, switchboards, and distribution panels.

3. Equipment including, but not limited to, motor controllers, disconnects, and VFDs.

4. Low-voltage equipment enclosures including, but not limited to, fire alarm panels, access control panels, and lighting control panels.

5. Distribution transformers.

2.3 DEVICE LABELS

A. Extra strength, laminated adhesive tape, with 3/16-inch black letters on clear background. Use only for identification of individual wall switches. Indicate device name, source panel, and source circuits. Panel and circuit designation written in permanent marker on the back of the plate and inside the back-box. Do not provide punch tape style labels.

B. Label all junction boxes to show system identification, source circuit, or raceway origin. In finished areas, utilize device label. In unfinished areas or above ceilings, use of permanent ink marker is acceptable.

2.4 WIRE MARKERS

A. Description: Vinyl-cloth self-adhesive type wire markers.

B. Locations: Each conductor at panelboard gutters, pull boxes, junction boxes, and each load connection.

C. Power and Lighting Circuits: Branch circuit or feeder number as indicated on drawings and source panel.

D. Control Circuits: control wire number indicated on schematic and interconnection diagrams on drawings or shop drawings.

2.5 CONDUIT MARKERS

A. Description: Self-sticking vinyl.

B. Location: Furnish markers for each conduit longer than 6-feet.

C. Spacing: 20-feet on center.

D. Color:

1. 480 Volt System: Black letters on Orange background

2. 208 Volt System: Black letters on Orange background

3. Fire Alarm System: Red

4. Data System System: Black letters on Orange background

2.6 UNDERGROUND WARNING TAPE

A. Description: 6-inch wide inert polyethylene plastic tape, 4-mil thick, detectable type, colored per APWA recommendations unless otherwise noted with suitable warning legend describing buried electrical lines.

PART 3 - EXECUTION

3.1 GENERAL INSTALLATION REQUIREMENTS

A. Coordinate designations used on Drawings with equipment nameplates and device labels.

B. Install nameplates and labels parallel to equipment lines.

C. Identify empty conduit and boxes with intended use.

D. Provide typewritten branch panel schedules with protective clear transparent covers accounting for every breaker installed. Use actual room designations assigned by name or number near completion of the work, and not the designations shown on drawings.

E. Provide color coded boxes as follows:

1. Fire Alarm: Red.

3.2 EQUIPMENT NAMEPLATES

A. Degrease and clean surfaces to receive nameplates.

B. Secure equipment nameplates to equipment front using self-tapping stainless steel screws.

C. Secure equipment nameplates to inside surface of door on panelboard that is recessed in finished locations.

D. Verify emergency system distribution equipment nameplate colors with Architect/Owner.

E. Switchgear, switchboards, and panels to include name source, voltage, current phase, wire configuration and fault current rating. Transformers to include source KVA, and secondary voltage, phase, and wire configuration.

F. Provide nameplates for flush mounted branch panelboards identifying name on front door. On inside of door provide nameplate as noted above. Verify with Architect/Owner if nameplate on outside of door is required.

G. Provide a second label at branch panelboards listing the means of identification of branch circuit conductors. This identification legend to consist of the color code used for each voltage system (208Y/120V and 480Y/277V). Include identification of both voltage systems on each label, regardless of the voltage of the panelboard to which the label is affixed. Comply with requirements of NEC 210.5.

1. See Specification Section 26 05 19, Low-Voltage Electrical Power Conductors and Cables, for required conductor color code for this project.

H. Provide engraved nameplate similar to distribution panelboards for transformers, lighting control panels, contactors, relays, time switches, etc. identifying name, service point and circuit number.

3.3 DEVICE LABELS

A. Reference 3.01, General Installation Requirements.

B. Install per manufacturer's instructions and recommendations.

C. Degrease and clean surfaces to receive labels.

3.4 WIRE MARKERS

A. Reference 3.01, General Installation Requirements.

B. Install per manufacturer's instructions and recommendations.

C. Provide wire markers on each conductor for power, control, signalling and communications circuits.

D. Where switches control remote lighting or power outlets, or where switches or outlets in same location serve different purposes, such as light, power, intercom, etc. or different areas, such as corridor and outside, provide plates with 1/8-inch black letters indicating function of each switch or outlet. Also label the function of light switches where two or more are mounted in same locations.

3.5 CONDUIT MARKERS

A. Reference 3.01, General Installation Requirements.

B. Install per manufacturer's instructions and recommendations.

3.6 UNDERGROUND WARNING TAPE

A. Reference 3.01, General Installation Requirements.

B. Install per manufacturer's instructions and recommendations.

C. Identify underground raceways using underground warning tape. Install one continuous tape per underground raceway at 6- to 8-inches below finish grade. Where multiple underground raceways are buried in a common trench and exceeds 16-inch width, install multiple warning tapes not over 10-inches apart (edge to edge) over the entire group of underground raceways.

END OF SECTION 26 0553

SECTION 26 0573

ELECTRICAL DISTRIBUTION SYSTEM STUDIES

PART 1 - GENERAL

1.1 SUMMARY

A. Work Included:

1. Protective Devices
2. Short Circuit Study
3. Selective Coordination Study
4. Arc Flash Labels
5. Arc Flash Risk Assessment
6. Load-Flow and Voltage Drop Study

B. Scope of Work: Provide short circuit analysis, selective coordination study, and load flow / voltage-drop analysis to provide the following:

1. Settings for adjustable trip breakers;
2. Arc flash labeling on panelboards and switchboards per NFPA 70E;
3. Demonstrate with choice of overcurrent protection and trip settings that code-required selective coordination is provided for the emergency power branch and elevators.
4. Transformer tap settings and feeder sizes for less than 2-percent voltage drop.

1.2 RELATED SECTIONS

A. Contents of Division 26, Electrical and Division 01, General Requirements apply to this Section.

1.3 REFERENCES AND STANDARDS

A. References and Standards as required by Section 26 00 00, Electrical Basic Requirements and Division 01, General Requirements.

B. In addition, meet the following:

1. IEEE 242, Recommended Practice for Protection and Coordination of Industrial and Commercial Power Systems.
2. IEEE 399, Recommended Practice for Industrial and Commercial Power Systems Analysis.
3. IEEE 1584, Guide for Performing Arc Flash Calculation.

1.4 SUBMITTALS

A. Submittals as required by Section 26 00 00, Electrical Basic Requirements and Division 01, General Requirements.

B. In addition provide:

1. Power system studies required under this Section with submittals for electrical equipment, including overcurrent protective devices.

2. Electrical equipment ordered prior to submittal of power system studies are not compliant with these specifications, and are subject to removal and replacement at no cost to Owner where not in compliance with Code and Contract Documents for selective coordination.

a. Provide written verification with Stamp or Seal and signature of preparing Engineer.

3. Provide samples of NFPA 70E compliant arc flash hazard labeling for electrical equipment.

1.5 QUALITY ASSURANCE

A. Quality assurance as required by Section 26 00 00, Electrical Basic Requirements and Division 01, General Requirements.

B. In addition, meet the following:

1. Study Preparer Qualifications: Qualified engineer of switchgear manufacturer or approved professional engineer.

a. Experienced in preparation of studies of similar type and magnitude.

b. Familiar with software analysis products specified.

2. Computer Software for Study Preparation: Use latest edition of commercially available software utilizing specified methodologies.

a. Acceptable Software Products:

1) EasyPower

2) Operation Technology, Inc; ETAP.

3) SKM Systems Analysis, Inc; Power Tools for Windows.

3. Contractor Responsibility: Provide project-related data needed by study preparer, including equipment, wire sizes, insulation types, conduit types, actual circuit lengths and available fault currents from utility. Provide information in a timely matter to allow studies to be completed prior to release of equipment.

1.6 WARRANTY

A. Warranty of materials and workmanship as required by 26 00 00, Electrical Basic Requirements and Division 01, General Requirements.

PART 2 - PRODUCTS

2.1 GENERAL

A. Analyze specific electrical and utilization equipment (according to NEC definition), actual protective devices to be used, and actual feeder lengths to be installed.

1. Scope of Studies: New and existing distribution wiring and equipment, from primary source to buses and branch circuit panelboards.

2. Primary Source, for Purposes of Studies: Utility company primary protective devices.

3. Study Methodology: Comply with requirements and recommendations of NFPA 70, IEEE 399, and IEEE 242.

4. Report: State methodology and rationale employed in making each type of calculation; identify computer software package(s) used.

B. One-Line Diagrams: Prepare schematic drawing of electrical distribution system, with electrical equipment and wiring to be protected by protective devices; identify nodes on diagrams for reference on report that includes:

1. Calculated fault impedance, X/R ratios, utility contribution, and short circuit values (asymmetric and symmetric) at main switchboard bus and downstream devices containing protective devices.

2. Breaker and fuse ratings.

3. Generator kW and voltage ratings, percent impedance, X/R ratios, and wiring connections.

4. Transformer kVA and voltage ratings, percent impedance, X/R ratios, and wiring connections.

5. Identification of each bus, with voltage.

6. Conduit materials, feeder sizes, actual lengths, and X/R ratios.

2.2 PROTECTIVE DEVICES

A. Provide protective devices of ratings and settings as required so that protective device closest to fault will open first.

B. Replace existing protective devices to achieve specified performance.

C. Analyze and determine ratings and settings of protective devices to minimize damage caused by fault and so that protective device closest to fault will open first.

1. Required Ratings and Settings: Derive required ratings and settings of protective devices in consideration of upstream protective device settings and optimize system to ensure selective coordination.

2. Motors with Solid-State Protective Modules: Select settings for best possible motor protection, taking into consideration actual installed motor torque and current and thermal characteristics.

3. Identify any equipment that is underrated as specified.

4. Identify specified protective devices that will not achieve required protection or coordination but with minor changes can be made to do so; provide such modified devices at no additional cost to Owner and identify them on submittals as "revised in accordance with Protective Device Coordination Study"; minor changes include different trip sizes in same frame, time curve characteristics of induction relays, CT ranges, etc.

5. Identify specified protective devices that will not achieve required protection or coordination and cannot be field adjusted to do so, and for which adequate devices would involve change to contract sum.

6. In all cases where adequate protection or coordination cannot be achieved at no extra cost to Owner, provide a discussion of alternatives and logical compromises for best achievable coordination.

7. Do not order, furnish, or install protective devices that do not meet performance requirements unless specifically approved by Engineer.

D. Protective Device Rating and Setting Chart: Summarize in tabular format required characteristics for each protective device based on analysis; include:

1. Device identification.

2. Relay CT ratios, tap, time dial, and instantaneous pickup.

3. Circuit breaker sensor rating, long-time, short-time, and instantaneous settings, and time bands.

4. Fuse rating and type.

5. Ground fault pickup and time delay.

6. Input level and expected response time at two test points that are compatible with commonly available test equipment and ratings of protective device.

7. Highlight devices that as furnished by Contractor will not achieve required protection.

E. Specified equipment has been designed and selected to achieve specified performance; ensure that equipment actually installed provides that performance.

F. In addition to requirements specified elsewhere, provide overcurrent protective devices having ratings and settings in accordance with results of system studies.

2.3 SHORT CIRCUIT STUDY

A. Calculate fault impedance to determine available 3-phase short circuit and ground fault currents at each bus and piece of equipment during normal conditions, alternate operations, emergency power conditions, and other operations that could result in maximum fault conditions.

1. Show fault currents available at key points in system down to fault current of 1,000 A at 480 V and 208 V.

2. Include motor contributions in determining momentary and interrupting ratings of protective devices.

3. Primary Fault Level Assumptions: Obtain data from utility company.

2.4 SELECTIVE COORDINATION STUDY

A. For all emergency, legally required standby and critical operations systems over current devices, perform an organized time-current analysis of each protective device in series from individual device back to source, under normal and emergency power conditions.

1. Graphically illustrate that adequate time separation exists between series devices, including upstream primary device.

2. Plot specific time-current characteristics of each protective device on log-log paper.

3. Organize plots so that upstream devices are clearly depicted on one sheet.

4. Also show following on curve plot sheets:

a. Device identification.

b. Voltage and current transformer ratios for curves.

c. 3-phase and 1-phase ANSI damage curves for each transformer.

d. No-damage, melting, and clearing curves for fuses.

e. Cable damage curves.

f. Transformer inrush points.

g. Maximum short circuit cutoff point.

h. Simple one-line diagram for portion of system that each curve plot illustrates.

i. Software report for each curve plot, labeled for identification.

B. Devices to coordinate down to 0.01 seconds. Coordination required for emergency systems, legally required systems.

2.5 ARC FLASH LABELS

A. Provide label compliant with NFPA 70E guidelines indicating personal protective equipment (PPE) recommended for servicing of electrical equipment while energized, as well as calculated incident energy levels and arc flash protective boundary distance.

2.6 ARC FLASH RISK ASSESSMENT

A. Calculate arc flash incident energy (AFIE) levels and flash protection boundary distances to determine required level of personal protective equipment (PPE) at each bus and piece of equipment during normal conditions, emergency power conditions, and other operations that could result in maximum arc flash incident energy levels.

1. Show flash protection boundary distance.

2. Include incident energy levels.

PART 3 - EXECUTION

3.1 FIELD QUALITY CONTROL

A. Provide services of qualified field engineer and necessary tools and equipment to test, calibrate, and adjust installed protective devices to conform to requirements determined by coordination analysis.

B. Adjust installed protective devices having adjustable settings to conform to requirements determined by coordination analysis.

C. Submit report showing final adjusted settings of protective devices.

3.2 ELECTRICAL POWER SYSTEM STUDIES

A. Short Circuit Analysis Study:

1. Provide complete short circuit study, equipment interrupting and withstand evaluation. Study to include complete electrical distribution system, including contributions from normal source of power without alternative sources of power. Include complete low voltage distribution systems as specified in this Section.

2. Study Basis: thoroughly cover normal and alternative operation modes that can produce maximum fault conditions, including simultaneous motor contributions.

3. Perform study in accordance with applicable ANSI/IEEE Standards.

4. Study Input Data: Utility company short circuit single and three phase contribution, and X/R ratio; resistance and reactance components of each feeder, busway and branch impedance; motor and generator contributions; applicable circuit parameters and contribute to short circuit duty.

5. Calculate short circuit momentary duties and interrupting duties on basis of maximum available fault current at each switchgear bus, switchboard, motor control center, panelboards, transfer switches, busway plug connection point, dry-type transformer primary and secondary locations, other significant locations throughout system affected by available fault current (including large HVAC units, uninterruptible power supplies, etc.).

6. Perform equipment evaluation study to determine adequacy of overcurrent protection devices by tabulating and comparing short circuit ratings of these devices with available fault current. Notify Owner in writing where problem areas or inadequacies appear in electrical equipment.

7. Study Report: In bound final report, include sheets listing tabulated information from study, including feeder impedances, motor, utility and generator impedances and fault contributions, and resulting short circuit current including asymmetrical, symmetrical, three, five and eight cycle fault current levels, and line-to-neutral and three-phase-bolted-fault current levels at each calculated point in electrical distribution system.

B. Selective Coordination Study:

1. Perform time-current coordination analysis with aid of computer software intended for this purpose. Include determination of settings, ratings, or types for overcurrent protective devices supplied.

2. Where necessary, make an appropriate compromise between system protection and service continuity with service continuity considered more important than system protection.

3. Provide sufficient number of computer generated log-log plots to indicate degree of system protection and coordination by displaying time-current characteristics of series connected overcurrent devices and other pertinent system parameters.

4. Time-Current Coordination Curves: Determine settings of overcurrent protective devices to achieve selective coordination. Graphically illustrate that adequate time separation exists between devices installed in series, including power utility company's upstream devices. Prepare separate sets of curves for the switching schemes and for emergency periods where the power source is local generation. Show the following information:

a. Device tag and title, one-line diagram with legend identifying the portion of the system covered.

b. Terminate device characteristic curves at a point reflecting maximum symmetrical fault current to which the device is exposed.

c. Identify the device associated with each curve by manufacturer type, function, and, if applicable, tap, time delay, and instantaneous settings recommended.

d. No more than 3 devices per TCC.

e. Plot the following listed characteristic curves, as applicable:

1) Power utility's overcurrent protective device.

2) Medium-voltage equipment overcurrent relays.

3) Medium- and low-voltage fuses including manufacturer's minimum melt, total clearing, tolerance, and damage bands.

4) Low-voltage equipment circuit-breaker trip devices, including manufacturer's tolerance bands.

5) Transformer full-load current, magnetizing inrush current, and ANSI through-fault protection curves.

6) Cables and conductors damage curves.

7) Ground-fault protective devices.

8) Generator short-circuit decrement curve and generator damage point.

9) The largest feeder circuit breaker in each motor-control center and panelboard.

5. Study includes separate, tabular computer printout containing suggested device settings of adjustable overcurrent protective devices, equipment where device is located, and device number corresponding to device on system one-line diagram.

6. Provide computer generated system one-line diagram which clearly identifies individual equipment buses, bus numbers, device identification numbers and maximum available short-circuit current at each bus when known.

7. Discussion Section which evaluates degree of system protection and service continuity with overcurrent devices, along with recommendations as required for addressing system protection or device coordination deficiencies.

8. Call significant deficiencies in protection and/or coordination to attention of Engineer and recommendations made for improvements as soon as they are identified.

9. Contractor responsible for supplying pertinent electrical system conductor, circuit breaker, generator, and other component and system information in timely manner to allow time-current analysis to be completed prior to final installation.

C. Arc Flash Risk Assessment:

1. Perform arc flash risk assessment with aid of computer software intended for this purpose.

2. Perform arc flash risk assessment in conjunction with short-circuit analysis and time-current coordination analysis.

3. Submit results of assessment in tabular form, and include device or bus name, bolted fault and arcing fault current levels, flash protection boundary distances, personal-protective equipment classes and AFIE levels.

4. Perform analysis under worst-case arc flash conditions, and final report describes, when applicable, how these conditions differ from worst-case bolted fault conditions.

5. Arc flash risk assessment includes recommendations for reducing AFIE levels and enhancing worker safety.

6. Proposed vendor demonstrates experience with arc flash risk assessment by submitting names of at least ten actual arc flash risk assessments it has performed in past year.

7. Proposed vendor demonstrates capabilities in providing equipment, services, and training to reduce arc flash exposure and train workers in accordance with NFPA 70E and other applicable standards.

8. Proposed vendor demonstrates experience in providing equipment labels in compliance with CEC and ANSI Z535.4 to identify AFIE and appropriate Personal Protective Equipment classes.

D. Load-Flow And Voltage Drop Study:

1. Perform a load-flow and voltage drop study to determine the steady state loading profile of the system. Determine load-flow and voltage drop based of full load current shown in the design. The model should include all loads indicated in the panel schedules, one-line diagram, and equipment connection schedules, as applicable.

2. Prepare the load-flow and voltage-drop analysis and report to show power system components that are overloaded; indicate voltage drop for all buses in the system.

3. Provide recommendations for areas that have voltage drop values higher than 2-percent for feeders.

4. Indicate the recommended fixed transformer taps that might be used to solve the voltage drop issues.

END OF SECTION 26 0573

SECTION 26 0800

COMMISSIONING OF ELECTRICAL

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes: Definitions, warranties, test equipment requirements, and electrical commissioning requirements as required by the Owner's ProjectRequirements.

1.2 RELATED SECTIONS

A. Contents of Division 26, Electrical and Division 01, General Requirements apply to this section.

B. Reference Section 01 91 13, General Commissioning Requirements.

1.3 WARRANTY

A. Manufacturer's Warranty:

1. Commissioning, inspecting, and testing not to modify terms or time periods of electrical equipment, systems, and controls warranties including related equipment and systems, and adjacent work.

2. Electrical system warranties to start from date of Commissioning Agentacceptance.

1.4 REFERENCES AND STANDARDS

A. References and Standards as required by Section 26 00 00, Electrical Basic Requirements and Division 01, General Requirements.

B. In addition, reference:

1. ASHRAE Guideline 0, The Commissioning Process.

2. NECA 90, Commissioning Building Electrical Systems.

1.5 SUBMITTALS

A. Reference Section 01 91 13, General Commissioning Requirements, for specific submittal requirements.

B. In addition, submit the following:

1. Certificates of readiness.

2. Certificates of completion of installation, prestart, and startup activities.

3. Operations and Maintenance (O&M) manuals.

4. Test reports.

1.6 COORDINATION

A. Reference Section 01 91 13, General Commissioning Requirements, for requirements pertaining to coordination during the commissioning process.

1.7 DEFINITIONS

A. Commissioning Authority: Commissioning Agent, representing the Owner and directing commissioning activities.

PART 2 - PRODUCTS

2.1 TEST EQUIPMENT

A. Provide testing equipment required to perform startup, initial checkout and functional performance testing for the equipment being tested under Division 26, Electrical. Furnish two-way radios for each testing participant.

B. Furnish special equipment, tools and instruments (specific to tested equipment and only available from vendor) required for testing. At conclusion of commissioning, turn equipment over to the Owner except for stand-alone data logging equipment that may be used by the Commissioning Authority.

C. Manufacturer: Furnish proprietary test equipment and software required by equipment manufacturer procedures for programming and/or start-up. Demonstrate its use, and assist in the commissioning process as needed. Proprietary test equipment (and software) to become the property of the Owner upon completion of the commissioning process.

D. Data logging equipment and software required to test equipment will be furnished by the Commissioning Authority during commissioning.

E. Testing equipment to be of sufficient quality and accuracy to test and/or measure system performance with the tolerances specified in the Specifications.

PART 3 - EXECUTION

3.1 GENERAL DOCUMENTATION REQUIREMENTS

A. With assistance from the installing contractors, the Commissioning Authority will prepare Pre-Functional Checklists for commissioned components, equipment, and systems.

B. Red-lined Drawings:

1. Verify equipment, systems, instrumentation, wiring and components are shown correctly on red-lined drawings.

2. Record the red-lined drawing changes, as a result of Functional Testing and incorporate into the final as-built drawings.

C. Operation and Maintenance Data:

1. Submit a copy of O&M literature within 45 days of each submittal acceptance for use during the commissioning process for commissioned equipment and systems.

2. The Commissioning Authority will review the O&M literature once for conformance to project requirements.

3. The Commissioning Authority will receive a copy of the final approved O&M literature once corrections have been made by the Contractor.

D. Demonstration and Training:

1. Provide demonstration and training as required by the specifications.

2. Submit complete training plan and schedule to the Commissioning Authority four weeks prior to training.

3. Submit training agenda for each training session to the Commissioning Authority one week prior the training session.

4. Notify the Commissioning Authority at least 72 hours in advance of scheduled tests so that testing may be observed by the Commissioning Authority and Owner's Authorized Representative. Submit copies of the test record to the Commissioning Authority, Owner, and Architect.

5. Engage a Factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain specific equipment.

6. Train Owner's maintenance personnel on procedures and schedules for starting and stopping, trouble shooting, servicing, and maintaining equipment.

7. Review data in O&M Manuals.

3.2 CONTRACTOR'S RESPONSIBILITIES

A. Perform commissioning tests at the direction of the Commissioning Authority.

B. Attend construction phase controls coordination meetings.

C. Participate in Electrical systems, assemblies, equipment, and component maintenance orientation and inspection as directed by the Commissioning Authority.

D. Provide information requested by the Commissioning Authority for final commissioning documentation.

E. Include requirements for submittal data, operation and maintenance data, and training in each purchase order or sub-contract written.

F. Prepare preliminary schedule for Electrical system orientation and inspections, operation and maintenance manual submissions, training sessions, equipment start-up and task completion for owner. Distribute preliminary schedule to commissioning team members.

G. Update schedule as required throughout the construction period.

H. During the startup and initial checkout process, execute the related portions of the prefunctional checklists for commissioned equipment.

I. Contractor to participate and complete checklists using the Commissioning Authority's web based commissioning software Facility Grid. A desktop, laptop, tablet, or iPad will be required.

J. Assist the Commissioning Authority in verification and functional performance tests.

K. Provide measuring instruments and logging devices to record test data, and provide data acquisition equipment to record data for the complete range of testing for the required test period.

L. Gather operation and maintenance literature on equipment, and assemble in binders as required by the specifications. Submit to Commissioning Authority 45 days after submittal acceptance.

M. Coordinate with the Commissioning Authority to provide 48-hour advance notice so that the witnessing of equipment and system start-up and testing can begin.

N. Participate in, and schedule vendors and contractors to participate in the training sessions.

O. Provide written notification to the CM/GC and Commissioning Authority that the following work has been completed in accordance with the Contract Documents, and that the equipment, systems, and sub-system are operating as required.

1. Electrical equipment including switchgear, panel boards, motor control centers, lighting, receptacles, dimmers and other equipment furnished under this Division.

2. Automatic Lighting Controls.

3. Emergency generators, ATS switches and emergency power systems.

4. Fire Alarm System.

5. UPS Systems.

6. Photovoltaic Energy Systems.

P. Obtain performance documentation from equipment supplier.

Q. Provide training of the Owner's operating staff using expert qualified personnel.

R. Equipment Suppliers

1. Submit requested submittal data, including detailed start-up procedures and specific responsibilities of the Owner, to keep warranties in force.

2. Assist in equipment testing per agreements with contractors.

3. Provide information requested by Commissioning Authority regarding equipment sequence of operation and testing procedures.

3.3 TESTING PREPARATION

A. Certify in writing to the Commissioning Authority that Electrical systems, subsystems, and equipment have been installed and started and are operating according to the Contract Documents.

B. Certify in writing to the Commissioning Authority that Electrical instrumentation and control systems have been completed and that they are operating according to the Contract Documents.

C. Certify in writing that testing procedures have been completed and that testing reports have been submitted, discrepancies corrected, and corrective work approved.

D. Place systems, subsystems, and equipment into operating mode to be tested (e.g., normal shutdown, normal auto position, normal manual position, emergency power, and alarm conditions).

E. Inspect and verify the position of each device and interlock identified on checklists.

F. Testing Instrumentation: Install measuring instruments and logging devices to record test data as directed by the Commissioning Authority.

3.4 GENERAL TESTING REQUIREMENTS

A. Provide technicians, instrumentation, and tools to perform commissioning test at the direction of the Commissioning Authority.

B. Scope of Electrical testing includes the entire Electrical installation, from the incoming power equipment throughout the distribution system. Testing includes measuring, but is not limited to resistance, voltage, and amperage of system(s) and devices.

C. Test operating modes, interlocks, control responses, and responses to abnormal or emergency conditions, and verify proper response of building automation system controllers and sensors.

D. The Commissioning Authority along with the Electrical contractor and other contracted subcontractors, including the fire alarm Subcontractor to prepare detailed testing plans, procedures, and checklists for Electrical systems, subsystems, and equipment.

E. Tests will be performed using design conditions whenever possible.

F. Simulated conditions may need to be imposed using an artificial load when it is not practical to test under design conditions. Before simulating conditions, calibrate testing instruments. Provide equipment to simulate loads. Set simulated conditions as directed by the Commissioning Authority and document simulated conditions and methods of simulation. After tests, return settings to normal operating conditions.

G. The Commissioning Authority may direct that set points be altered when simulating conditions is not practical.

H. The Commissioning Authority may direct that sensor values be altered with a signal generator when design or simulating conditions and altering set points are not practical.

I. If tests cannot be completed because of a deficiency outside the scope of the Electrical system, document the deficiency and report it to the Owner. After deficiencies are resolved, reschedule tests.

J. If the testing plan indicates specific seasonal testing, complete appropriate initial performance tests and documentation and schedule seasonal tests.

3.5 ELECTRICAL SYSTEMS, SUBSYSTEMS, AND EQUIPMENT TESTING PROCEDURES

A. Equipment Testing and Acceptance Procedures: Testing requirements are specified in individual Division 26, Electrical Sections. Provide submittals, test data, inspector record and certifications to the Commissioning Authority.

B. Electrical Instrumentation and Control System Testing: Field testing plans and testing requirements are specified in Division 26, Electrical Controls Sections. Assist the Commissioning Authority with preparation of testing plans.

C. Emergency Generator Testing and Acceptance Procedures: Provide technicians, load banks, infrared cameras, instrumentation, tools and equipment to test performance of designated systems and devices at the direction of the Commissioning Authority.

D. Electrical Distribution System Testing: Provide technicians, load banks, infrared cameras, instrumentation, tools and equipment to test performance of designated systems and devices at the direction of the Commissioning Authority.

E. The work included in the commissioning process involves a complete and thorough evaluation of the operation and performance of components, systems and sub-systems. Evaluate the following equipment and systems:

1. Automatic Lighting Controls (LCP, Occupancy Sensors, Daylighting Controls)

3.6 DEFICIENCIES/NON-CONFORMANCE, COST OF RETESTING, FAILURE DUE TO MANUFACTURER DEFECT

A. Reference Section 01 91 13, General Commissioning Requirements, for requirements pertaining to deficiencies/non-conformance, cost of retesting, or failure due to manufacturer defect.

3.7 OPERATION AND MAINTENANCE (O&M) MANUALS

A. The Operation and Maintenance Manuals to conform to Contract Documents requirements as stated in Division 26, Electrical.

3.8 TRAINING OF OWNER PERSONNEL

A. Electrical Contractor's training responsibilities:

1. Provide the Commissioning Authority with a training plan two weeks before the planned training.

2. Provide designated Owner personnel with comprehensive training in the understanding of the systems and the operation and maintenance of each major piece of commissioned electrical equipment or system.

3. Training starts with classroom sessions, if necessary, followed by hands on training on each piece of equipment, which illustrates the various modes of operation, including startup, shutdown, fire/smoke alarm, power failure, etc.

4. During any demonstration, should the system fail to perform in accordance with the requirements of the O&M manual or sequence of operations, the system will be repaired or adjusted as necessary and the demonstration repeated.

5. The appropriate trade or manufacturer's representative provides the instructions on each major piece of equipment. This person may be the start-up technician for the piece of equipment, the installing contractor or manufacturer's representative. Practical building operating expertise as well as in-depth knowledge of modes of operation of the specific piece of equipment are required. More than one party may be required to execute the training.

6. The training sessions follows the outline in the Table of Contents of the operation and maintenance manual and illustrate whenever possible the use of the O&M manuals for reference.

7. Training includes:

a. Use the printed installation, operation and maintenance instruction material included in the O&M manuals.

b. Include a review of the written O&M instructions emphasizing safe and proper operating requirements, preventative maintenance, special tools needed and spare parts inventory suggestions. The training includes start-up, operation in modes possible, shut-down, seasonal changeover and any emergency procedures.

c. Discuss relevant health and safety issues and concerns.

d. Discuss warranties and guarantees.

e. Cover common troubleshooting problems and solutions.

f. Explain information included in the O&M manuals and the location of plans and manuals in the facility.

g. Discuss any peculiarities of equipment installation or operation.

8. Hands-on training includes start-up, operation in modes possible, including manual, shut-down and any emergency procedures and preventative maintenance of pieces of equipment.

9. Fully explain and demonstrate the operation, function and overrides of any local packaged controls, not controlled by the central control system.

10. Schedule training after functional testing is complete, unless approved otherwise by the Owner.

END OF SECTION 26 0800

SECTION 26 0805

ELECTRICAL ACCEPTANCE TESTING

PART 1 - GENERAL

1.1 SUMMARY

A. Work included: Testing, evaluation, and calibration of:

1. Power Distribution Equipment

B. Test procedures specified in this Section are in addition to those specified in other Sections of Division 26, Electrical.

1.2 RELATED SECTIONS

A. Contents of Division 26, Electrical and Division 01, General Requirements apply to this Section.

1.3 REFERENCES AND STANDARDS

A. References and Standards as required by Section 26 00 00, Electrical Basic Requirements and Division 01, General Requirements.

B. In addition, meet the following:

1. Acceptance Testing Criteria: Latest edition of Acceptance Testing Specifications for Electrical Power Distribution Equipment and Systems, published by NETA.

1.4 SUBMITTALS

A. Submittals as required by Section 26 00 00, Electrical Basic Requirements and Division 01, General Requirements.

B. In addition, provide:

1. Test Reports:

a. Maintain written record of tests.

b. At completion of project, assemble and certify a final test report. Document testing and performance compliance with NETA recommended forms, parameters, and level of detail. Submit report to Architect prior to final acceptance to include:

1) Summary of Project

2) Description of Equipment Tested

3) Visual Inspection Report

4) Description of Tests

5) Test Results

6) Conclusions and Recommendations

1.5 QUALITY ASSURANCE

A. Quality assurance as required by Section 26 00 00, Electrical Basic Requirements and Division 01, General Requirements.

B. In addition, meet the following:

1. Qualifications of Testing Firm:

a. Corporately independent testing organization which can function as an unbiased testing authority, professionally independent of manufacturers, suppliers and installers of equipment or systems evaluated by testing firms.

b. Independent organization as defined by a NETA Level II ETT certified testing agency in compliance with NETA Level II ETT certified testing requirements and practices.

c. Regularly engaged in testing of electrical materials, devices, appliances, electrical installations and systems for purpose of preventing injury to persons or damage to property and other equipment.

d. Engaged in testing practices for minimum of five years.

e. Use only full-time technicians, regularly employed by firm for testing services. Electrically unskilled employees are not permitted to perform testing or assistance of any kind. Electricians and line workers may assist, but may not perform testing or inspection services.

f. Submit proof of above qualifications with Bid Documents.

2. Certifications:

a. Comply with NETA Level II ETT certified testing agency criteria for accreditation of testing laboratories. Full membership in NETA constitutes proof of such criteria.

b. Lead, on site, technical person currently certified by NETA in Electrical Power Distribution System Testing.

c. Instruments used by testing firm to evaluate electrical performance meet NETA Specifications for Test Instruments.

1.6 PERFORMANCE REQUIREMENTS

A. Retain services of recognized independent testing firm for purpose of performing inspections and tests as specified.

B. Independent test firm providing report direct to Architect.

C. Material, equipment, labor and technical supervision to perform tests and inspections provided by testing firm.

D. Intent of these tests to assure that electrical equipment, Contractor or Owner supplied, is operational within industry and manufacturer's tolerances and is installed in accordance with design Specifications.

E. Tests and inspections determine suitability for energization.

F. Supply to independent testing organization complete sets of approved shop drawings, coordination study (provided by Contractor's equipment supplier under Contractor's direction), setting of adjustable devices and other information requested by testing agency.

1.7 SCOPE OF WORK

A. Provide testing, evaluation, and calibration of the following:

1. Dry Type Transformers

2. Low Voltage Circuit Breakers (greater than 100 amp)

3. Switchboards

4. Panelboards

5. Grounding Systems

B. Test cable, equipment and systems listed above to assure proper installation, setting, connections, and functioning in accordance with the Drawings, Specifications, and the manufacturer's recommendations. It is the intent that field testing be extensive, and complete as specified, to provide positive assurance of totally correct installation and operation of equipment.

C. Furnish necessary test equipment to satisfactorily perform tests specified.

PART 2 - PRODUCTS

2.1 POWER DISTRIBUTION EQUIPMENT

A. The testing agency provides test equipment.

B. Care and Precautions:

1. Contractor responsible for any damage to equipment or material due to improper test procedures or test apparatus handling. Replace or restore to original condition any damaged equipment or material.

2. Provide and use safety devices such as rubber gloves and blankets, protective screen, barriers and danger signs to adequately protect and warn personnel in the vicinity of the tests.

3. Use test equipment that is calibrated and certified traceable to the National Bureau of Standards. Certification Date: No later than 6 months.

PART 3 - EXECUTION

3.1 FIELD QUALITY CONTROL

A. Tests:

1. Contractor's Responsibilities:

a. Perform routine insulation resistance, continuity and rotation tests for distribution and utilization equipment prior to and in addition to tests performed by testing firm.

b. Notify testing firm when equipment becomes available for acceptance tests. Coordinate work to expedite project scheduling.

2. Testing Firm's Responsibilities:

a. Notify Architect prior to commencement of any testing.

b. Report directly to Architect any systems, material or installation found defective on basis of acceptance tests.

c. Provide auxiliary portable power supply necessary for conducting tests.

3.2 REPLACEMENT OF DEFECTIVE MATERIAL OR EQUIPMENT

A. Repair or replace any material or equipment found defective or cannot pass the tests specified in this Section at no additional cost to the Owner.

B. Complete correction of defective material or equipment and retesting within the Contract period.

C. If the equipment or material cannot pass the second test, remove the defective equipment and replace it with equivalent equipment that meets the requirements of the Specifications. Such replacement at no additional cost to the Owner.

3.3 ADJUSTING

A. Final Settings: Testing firm responsible for implementing final settings and adjustments on protective devices and tap changes in accordance with Architect's specified values.

END OF SECTION 26 0805

SECTION 26 0810

BUILDING LIGHTING ACCEPTANCE TESTING AND DOCUMENTATION

PART 1 - GENERAL

1.1 SUMMARY

A. Work Included:

1. Duties of the Team

2. Time Schedule

3. Acceptance Testing - Phase I - Documentation

4. Acceptance Testing - Phase II - Inspection and Testing

5. Acceptance Testing - Phase III - Certification

B. This Section describes the acceptance testing and documentation of the lighting system(s) and outlines the duties and responsibilities of the contracting team for acceptance testing.

C. Supply the acceptance requirements to products, equipment and systems provided under this Division, where indicated on Drawings, and where required by California Title 24 requirements.

D. Engage the services of a firm specializing in commissioning of lighting systems or submit contractor qualifications for review by architect where testing and documentation is to be performed by contractor.

1.2 RELATED SECTIONS

A. Contents of Division 26, Electrical and Division 01, General Requirements apply to this Section.

1.3 REFERENCES AND STANDARDS

A. References and Standards as required by Section 26 00 00, Electrical Basic Requirements and Division 01, General Requirements.

1.4 SUBMITTALS

A. Submittals as required by Section 26 00 00, Electrical Basic Requirements and Division 01, General Requirements.

1.5 QUALITY ASSURANCE

A. Quality assurance as required by Section 26 00 00, Electrical Basic Requirements and Division 01, General Requirements.

1.6 COMMISSIONING TEAM

A. Form the Commissioning Team of:

1. Electrical Contractor's Representative

2. Lighting Controls Manufacturer's Representative

3. Inspector of Record

4. Owner's Staff Representative

PART 2 - PRODUCTS - NOT USED

PART 3 - EXECUTION

3.1 DUTIES OF THE TEAM

A. The duties of the Team are as outlined in the California Title 24 requirements and summarized below:

1. Plan, organize and implement the acceptance testing process and within 1 month of the award of the contract, submit the names and addresses of the Testing team member(s).

2. The acceptance testing team to submit a complete description of the testing procedures and systems to be tested to the architect for review.

3. The acceptance testing team to coordinate tests of systems and equipment and assemble documentation related to tests. Submit documentation relative to tests and proposed procedures to design engineer for review prior to submitting documentation to Authority Having Jurisdiction (AHJ). Team responsible for performing data analysis, calculation of performance indices and cross-checking of results with the requirements of California Title 24 and the Contract documents. The installing contractor or agent responsible for testing and documentation to record their State of California Contractor's license number or their State of California Professional Registration License number on each Certificate of Acceptance for submittal.

4. Responsible for submitting Certificate of Acceptance including paper and electronic copies of measurements and monitoring results and supporting documentation to the AHJ. Where AHJ questions results or requires additional testing, complete additional testing and provide required documentation at no additional cost to the Owner.

3.2 TIME SCHEDULE

A. Determine the time period of the commissioning of the systems by the general contractor and acceptance testing team. It is important to note that AHJ will not release a final Certificate of Occupancy until a Certificate of Acceptance is submitted that demonstrates that the specified systems and equipment have been shown to be performing in accordance with the California Title 24 standards.

3.3 ACCEPTANCE TESTING - PHASE I - DOCUMENTATION

A. Team to assemble documentation showing lighting fixture locations, lighting control device locations, control sequences and notes.

B. Per California Title 24 requirements, team to provide record drawings to building Owner within 90 days of receiving a final occupancy permit (reference other specification Sections for requirements on record drawings.)

C. Per California Title 24 requirements, team to provide operating and maintenance manuals to the building Owner (reference other specification Sections for requirements on operation and maintenance manuals.)

3.4 ACCEPTANCE TESTING - PHASE II - INSPECTION AND TESTING

A. Team to review the installation, perform acceptance testing and document results for the following systems:

1. Occupancy Sensors

2. Manual Daylight Controls

3. Automatic Daylight Controls

4. Automatic Time Switch Controls

B. Review of installation to confirm lighting fixtures and lighting controls are properly located, identified, calibrated, and set points and schedules programmed per contract document requirements.

3.5 ACCEPTANCE TESTING - PHASE III - CERTIFICATION

A. Team to document operating and maintenance information, complete installation certificate, and indicate test results on the Certificate of Acceptance, and submit the Certificate to the AHJ prior to receiving final occupancy permit.

B. Team to submit NRCA-LTO form as required by California Title 24 requirements.

3.6 ACCEPTANCE TESTS AND DOCUMENTATION

A. Reference State of California requirements for specific testing procedures and documentation requirements. Contractor is responsible for reviewing and complying with standards as required by Division 01, General Requirements and Section 26 00 00, Electrical Basic Requirements as well as State and governmental standards related to this work.

B. Reference California Title 24, 2019 Nonresidential Compliance Manual and Documents for specific testing procedures and documentation requirements. Contractor is responsible for reviewing and complying with these standards. The detailed requirements can be found at: http://www.energy.ca.gov/title24/2019standards/index.html.

END OF SECTION 26 0810

SECTION 26 0900

CONTACTORS AND CONTROL DEVICES

PART 1 - GENERAL

1.1 SUMMARY

A. Work Included:

1. Contactors

2. Electronic Time Switches

3. Photoelectric Switches

4. Emergency Lighting Relays

1.2 RELATED SECTIONS

A. Contents of Division 26, Electrical and Division 01, General Requirements apply to this Section.

1.3 REFERENCES AND STANDARDS

A. References and Standards as required by Section 26 00 00, Electrical Basic Requirements and Division 01, General Requirements.

B. In addition, meet the following:

1. UL 924: Standard for Safety of Emergency Lighting and Power Equipment.

1.4 SUBMITTALS

A. Submittals as required by Section 26 00 00, Electrical Basic Requirements and Division 01, General Requirements.

B. In addition, provide:

1. Shop Drawings: Submit to NEMA ICS 1 indicating control panel layouts, wiring connections and diagrams, dimensions, support points.

2. Product Data: Provide for each component showing electrical characteristics and connection requirements.

3. Manufacturer's Installation Instructions: Indicate application conditions and limitations of use stipulated by product testing agency. Include instructions for storage, handling, protection, examination, preparation, installation, and starting of product.

1.5 QUALITY ASSURANCE

A. Quality assurance as required by Section 26 00 00, Electrical Basic Requirements and Division 01, General Requirements apply to this Section.

1.6 WARRANTY

A. Warranty of materials and workmanship as outlined in Section 26 00 00, Electrical Basic Requirements and Division 01, General Requirements.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Contactors:

1. Asco
2. Eaton Electrical
3. ABB/General Electric
4. Schneider Electric/Square D
5. Or approved equivalent.

B. Electronic Time Switches:

1. Intermatic
2. Paragon
3. Sangamo
4. Tork
5. Or approved equivalent.

C. Photoelectric Switches:

1. Precision
2. Paragon
3. Tork
4. Or approved equivalent.

D. Emergency Lighting Relay:

1. Nine 24

2. Bodine

3. Wattstopper

4. Or approved equivalent.

2.2 CONTACTORS

A. Lighting:

1. Continuously rated 20 amp per pole for types of ballast and tungsten lighting and resistance loads, do not derate for use on high-inrush loads.

2. Power Contacts:

a. Double break, silver cadmium oxide.

b. Auxiliary arcing contacts not acceptable.

c. Convertible Contacts, N.O. or N.C.

d. Contact status, N.O. or N.C., clearly visible.

3. Approved per UL 508.

4. Design in accordance with NEMA ICS2-211B, rated for application to 600 voltmaximum.

5. Electrically Operated and Mechanically Held Contactor: Encapsulated latch and unlatch coils, coil clearing contacts.

B. Power Contactors:

1. Continuously rated 30 to 800 amp per pole for types of ballast and tungsten lighting, resistance and motor loads.

2. Power Contacts:

a. Totally enclosed contacts.

b. Double break, silver cadmium oxide.

c. Auxiliary arcing contacts not acceptable.

d. Provide for contact inspection or replacement without disturbing line or load wiring.

3. Straight through wiring, terminals clearly marked.

4. Approved per UL 508.

5. Design in accordance with NEMA ICS2-211B, rated for application to 600 volt maximum.

6. Field Addition Accessories:

   a. Auxiliary contacts, 6 amp, 600 volt, N.O. or N.C. Maximum of four.

   b. Control circuit fuse holder, one or two fuses.

   c. Transient-suppression module for control circuit of 120 volt.

7. Electronically Operated and Mechanically Held Contactor: Encapsulated latch and unlatch coils, coil clearing contacts.

C. Enclosures: NEMA enclosure suitable for location and use, flush or surface mount as indicated on Drawings.

2.3 ELECTRONIC TIME SWITCHES

A. Digital time clock: Double pole, single throw. One N.O. and one N.C. contact. 7 days operation mode. Astronomical time clock. Holiday schedule. Battery power source to provide minimum three years memory backup. Eight event setpoints. Enclosure with hinged door.

2.4 PHOTOELECTRIC SWITCHES

A. Characteristics:

1. Hermetically sealed light sensitive element installed in die cast weatherproof enclosure.

2. Adjustable external light level slide.

3. Swivel adjustable enclosure.

B. Electrical Rating: 120VAC, 1800VA, connected for pilot duty unless otherwise indicated.

2.5 EMERGENCY LIGHTING RELAY

A. UL924 listed for connected load of 20 amps at 277 volt or 120 volt.

B. UL rated N.C. contacts, minimum 20 amps rating.

C. Integral surge protection.

D. Two separate status emergency lighting indicators for troubleshooting:

1. Amber LED indicates presence of normal utility power.

2. Red LED indicates presence of unswitched emergency power.

E. Manual and/or automatic diagnostic testing feature.

F. Dimming control: Where 0-10 volt dimming control is connected to emergency lighting, supply and connect auxiliary relay to open dimming 0-10 volt control circuit upon loss of normal power, or else supply emergency lighting relay with integral contact to open 0-10 volt control circuit.

PART 3 - EXECUTION

3.1 GENERAL INSTALLATION REQUIREMENTS

A. Testing:

1. Test to ensure that control devices, components, equipment and systems are calibrated, adjusted and operate in accordance with approved drawings and specifications.

a. Daylight sensing automatic lighting controls.

b. Occupant sensing automatic lighting controls.

c. Automatic time switches for lighting control.

d. Emergency lighting controls.

2. Functionally test all control devices to ensure operation in accordance with approved drawings and specifications.

3. Prepare and complete report of test procedures and results and file with the Owner.

B. Install items per manufacturers written instructions.

3.2 CONTACTORS

A. Provide vibration isolation mounting pads for electrically held contactors installed within or on walls which are common to occupied spaces. Isolate terminals and operating mechanisms from enclosure.

B. Install contactors and relays to reduce noise such that it will not create a disturbance or distraction in the areas in which such equipment is located.

3.3 ELECTRONIC TIME SWITCHES

A. Install time switches and other automatic control devices in accessible locations near the source of power or grouped at a common location in mechanical rooms or similar spaces.

3.4 PHOTOELECTRIC SWITCHES

A. Install photoelectric control devices at such locations as necessary to be most effective. Avoid locating photoelectric devices in or at locations where they can be influenced by other than natural light or under eaves. Verify location of equipment with Architect.

B. Exterior Lighting Control: Control exterior lighting and interior atrium lighting using photoelectric switches to energize contactors controlling lighting circuits. Time clocks used to deenergize lighting at any preset time if desired.

3.5 EMERGENCY LIGHTING RELAYS

A. Emergency Relay (UL924):

1. Provide unswitched emergency circuit, and unswitched and switched normal circuit to UL924 relay for control of emergency luminaires with remaining room luminaires on normal power.

2. Install each relay within dedicated 4-11/16-inch junction box with double-gang plaster ring for wall or ceiling flush-mount as indicated on Drawings. Where location in ceiling would interfere with removal of ceiling tiles, install relay flush-mounted in nearest wall at ceiling level. Do not locate behind wall switch.

3. Where 0-10 volt dimming control is connected to emergency lighting, supply and connect auxiliary relay to open dimming 0-10 volt control circuit upon loss of normal power.

END OF SECTION

26 0900

SECTION 26 0925

DIGITAL LIGHTING CONTROLS

PART 1 - GENERAL

1.1 SUMMARY

A. Work included:

1. General Performance
2. Digital Wall or Ceiling Mounted Occupancy Sensor System
3. Digital Wall Switches
4. Handheld Remote Controls
5. Digital Photosensors
6. Room Network (DLM Local Network)
7. Configuration Tools
8. Network Bridge
9. Segment Manager
10. Emergency Lighting
11. Source Quality Control

B. Basis of Design: Daylighting and occupancy sensor layout on Drawings are designed based on Wattstopper product line. Approved manufacturers listed below are allowed on condition of meeting specified conditions including complete sensor coverage of area controlled and switching of luminaires in area controlled. Provide additional sensors and room controllers as needed to provide same level of functionality as shown on Drawings. Remove and replace electrical equipment installed not meeting these conditions at no cost to Owner.

C. System Description and Operation:

1. The Lighting Control and Automation system as defined under this section covers the following equipment:

a. Digital Occupancy Sensors: Self-configuring, digitally addressable and calibrated occupancy sensors with LCD display and two-way active infrared (IR) communications.

b. Digital Switches: Self-configuring, digitally addressable pushbutton switches, dimmers, and scene switches with two-way active infrared (IR) communications.

c. Digital Photosensors: Single-zone closed loop and multi-zone open loop daylighting sensors with two-way active infrared (IR) communications can provide switching or dimming control for daylighting harvesting.

d. Configuration Tools: Handheld remote for room configuration provides two way infrared (IR) communications to digital devices and allows complete configuration and reconfiguration of the device/room from up to 30 feet away. Unit to have Organic LED display, simple pushbutton interface, and allow send and receive of room variables and store of occupancy sensor settings. Computer software also customizes room settings.

e. Handheld Remotes for Personal Control: One-button dimming, two-button on/off, or five-button scene remotes provide control using infrared communications. Remote may be configured in the field to control selected loads or scenes without special tools.

f. Room Network - Digital Lighting Management (DLM) Local Network: Free topology, plug-in wiring system (Cat 5e) for power and data to room devices.

g. Network Bridge: Provides BACnet MS/TP-compliant digital networked communication between rooms, panels, and the Segment Management or building automation system (BAS).

h. Segment Manager: Provides web browser-based user interface for system control, scheduling, power monitoring, room device parameter administration and reporting.

i. Emergency Lighting Control Unit (ELCU): Allows a standard lighting control device to control emergency lighting in conjunction with normal lighting in any area within a building.

D. Lighting Control Applications:

1. Unless relevant provisions of the applicable local Energy Codes are more stringent, provide a minimum application of lighting controls as follows:

a. Space Control Requirements: Provide occupancy/vacancy sensors with Manual-ON functionality in all spaces except toilet rooms, storerooms, library stacks, or other applications where hands-free operation is desirable and Automatic-ON occupancy sensors are more appropriate. Provide Manual-ON occupancy/vacancy sensors for any enclosed office, conference room, meeting room, open plan system and training room. For spaces with multiple occupants, or where line-of-sight may be obscured, provide ceiling-or corner-mounted sensors and Manual-ON switches.

b. Daylit areas: All luminaires within 15-feet of windows or within 7-feet of skylights (the daylit zones) will be controlled separately from luminaires outside of daylit zones. Luminaires closest to the daylight aperture will be controlled separately from luminaires farther from the daylight aperture, within the daylight zone.

c. Daytime setpoints for total ambient illumination (combined daylight and electric light) level that initiate dimming will be programmed to be not less than 125 percent of the nighttime maintained designed illumination levels.

d. Multiple-leveled switched daylight harvesting controls may be utilized for areas marked on Drawings.

e. Provide smooth and continuous daylight dimming for areas marked on Drawings. Daylighting control system may be designed to turn off electric lighting when daylight is at or above required lighting levels, only if system functions to turn lamps back on at dimmed level, rather than turning full-on prior to dimming.

1.2 RELATED SECTIONS

A. Contents of Division 26, Electrical and Division 01, General Requirements apply to this Section.

1.3 REFERENCES AND STANDARDS

A. References and Standards per Division 01, General Requirements and Section 26 00 00, Electrical Basic Requirements.

1.4 SUBMITTALS

A. Submittals as required by Section 26 00 00, Electrical Basic Requirements and Division 01, General Requirements.

B. In addition, provide:

1. Layout of sensors indicating their sensing distribution on reproducible Architectural Floor Plans.

2. Shop Drawings: Provide wiring diagrams indicating low voltage and line voltage wiring requirements for occupancy sensors, and each digital lighting control system shown on the electrical drawings.

3. Closeout Submittals:

a. Sustainable Design Closeout Documentation: Lighting Control System Manufacturer to provide Enhanced Start-up documentation that details the start-up procedure being performed including a process to follow, details on tests performed and an area that documents any test results.

1.5 QUALITY ASSURANCE

A. Quality assurance as required by Section 26 00 00, Electrical Basic Requirements and Division 01, General Requirements.

B. In addition, meet the following:

1. Manufacturer: Minimum 10 years experience in manufacture of architectural lighting controls.

2. Manufacturer's Quality System: Registered to ISO 9001:2000 Quality Standard, including in-house engineering for product design activities.

3. Lighting Control System Components: Listed by UL specifically for the required loads. Provide evidence of compliance upon request.

4. Prior to adjusting and calibrating daylighting control system and local photocell field adjustable settings, contact local manufacturer representative and arrange for representative to visit site to educate both field installer and Owner's Authorized Representative on the operation of the controls.

5. Use manufacturer's published testing and adjusting procedures to adjust sensors time delay, daylight sensitivity, and passive infrared sensitivity to satisfaction of Owner.

6. Training: Provide minimum 4-hour training session to Owner's Authorized Representatives at a time approved by Owner after Owner has received approved operation and maintenance manuals. Training to include discussion of operation, adjustment, and replacement of sensors, photocells and control.

7. Prepare and complete report of test procedures and results. Submit these test procedures and results to Owner.

1.6 WARRANTY

A. Warranty of materials and workmanship as required by Section 26 00 00, Electrical Basic Requirements and Division 01, General Requirements.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Wattstopper DLM Series

B. Lutron Quantum Series

C. Douglas Lighting Controls Dialog Series

D. Acuity Controls

E. Eaton Wavelinx

F. Or approved equivalent.

2.2 GENERAL PERFORMANCE

A. Daylight Harvesting and Occupant Detection to Control Lighting with the Following Hierarchy:

1. Emergency (Highest Priority): Ignores all other inputs.

2. Programming: During system programming, sensor inputs are ignored.

3. Occupant Sensor: Allows lights to be on/off.

4. Daylight Sensor: Imposes a high end limit for light output.

5. Personal Control: Fine tune light levels up to the daylight sensor limit.

B. Response to a single sensor can be unique on luminaire by luminaire basis.

C. Power failure recovery - All devices return to their previous light level prior to power loss.

D. All programmable devices with integral power failure memory to maintain settings for a minimum of 10 hours during power loss.

E. Wall station and sensor replacement accomplished without programming.

2.3 DIGITAL WALL OR CEILING MOUNTED OCCUPANCY SENSOR SYSTEM

A. Wall or Ceiling mounted (to suit installation) dual technology digital (passive infrared and ultrasonic) occupancy sensor. Furnish the system accommodating the square-foot coverage requirements for each area controlled, utilizing room controllers, digital occupancy sensors, and accessories which suit the lighting and electrical system parameters.

B. Digital Occupancy Sensors will provide graphic LCD display for digital calibration and electronic documentation. Features include the following:

1. Digital calibration and pushbutton programming for the following variables:

a. Sensitivity: 0-100 percent in 10 percent increments.

b. Time delay: 1-30 minutes in 1 minute increments.

c. Test mode: Five second time delay.

d. Detection technology: PIR, Ultrasonic or Dual Technology activation and/or re-activation.

e. Walk-through mode.

f. Load parameters including Auto/Manual-ON, blink warning, and daylight enable/disable when photosensors are included in the DLM local network.

2. Two RJ-45 port(s) for connection to DLM local network.

3. Two-way infrared (IR) transceiver to allow remote programming through handheld commissioning tool and control by remote personal controls.

4. Device Status LEDs including:

    a. PIR Detection.

    b. Ultrasonic detection.

    c. Configuration mode.

    d. Load binding.

5. Assignment of occupancy sensor to a specific load within the room without wiring or special tools.

6. Manual override of controlled loads.

C. Units will not have any dip switches or potentiometers for field settings.

D. Multiple occupancy sensors may be installed in a room by simply connecting them to the free topology DLM local network. No additional configuration will be required.

E. Wattstopper product number: LMDC-100 or LMDX-100.

2.4 DIGITAL WALL SWITCHES

A. Low voltage momentary pushbutton switches in 1, 2, 3, and 4 button configuration; available in white, light almond, ivory, grey, and black; compatible with wall plates with decorator opening. Wall switches will include the following:

1. Two-way infrared (IR) transceiver for use with personal and configuration remote controls.

2. Removable buttons for field replacement with engraved buttons and/or alternate color buttons. Button replacement may be completed without removing the switch from the wall.

3. Red configuration LED on each switch that blinks to indicate data transmission.

4. Blue Load/Scene Status LED on each switch button with the following characteristics:

    a. Bi-level LED.

    b. Dim locator level indicates power to switch.

    c. Bright status level indicates that load or scene is active.

5. Dimming switches will include seven bi-level LEDs to indicate load levels using 14 steps.

B. Two RJ-45 ports for connection to DLM local network.

C. Multiple digital wall switches may be installed in a room by simply connecting them to the free topology DLM local network. No additional configuration will be required to achieve multi-way switching.

D. The following switch attributes may be changed or selected using a wireless configuration tool:

1. Load and Scene button function may be reconfigured for individual buttons (from Load to Scene, and vice versa).

2. Individual button function may be configured to Toggle, On only, or Off only.

3. Individual scenes may be locked to prevent unauthorized change.

4. Fade Up and Face Down times for individual scenes may be adjusted from 0 seconds to 18 hours.

5. Ramp rate may be adjusted for each dimmer switch.

E. Wattstopper product number: LMSW-101, LMSW-102, LMSW-103, or LMSW-104.

2.5 HANDHELD REMOTE CONTROLS

A. Battery-operated handheld switches in 1, 2, and 5 button configuration for remote switching or dimming control. Remote controls will include the following features:

1. Two-way infrared (IR) transceiver for line of sight communication with DLM local network within up to 30 feet.

2. Blue LED on each button confirms button press.

3. Inactivity timeout to save battery life.

B. A wall mount holster and mounting hardware will be included with each remote control.

C. Wattstopper product number: LMRH-101, LMRH-102, or LMRH-105.

2.6 DIGITAL PHOTOSENSORS

A. Digital photosensors work with room controllers to provide automatic switching or dimming daylight harvesting capabilities for any load type connected to a room controller. Closed loop photosensors measure the ambient light in the space and control a single lighting zone. Open loop photosensors measure incoming daylight in the space, and are capable of controlling up to three lighting zones. Photosensors shall be interchangeable without the need for rewiring.

B. Digital photosensors include the following features:

1. An internal photodiode that measures only within the visible spectrum, and has a response curve that closely matches the photopic curve. The photodiode shall not measure energy in either the ultraviolet or infrared spectrums. The photocell shall have a

sensitivity of less than 5 percent for any wavelengths less than 400 nanometers or greater than 700 nanometers.

2. Sensor light level range shall be from 1-200 footcandles (fc).

3. The capability of switching one-third, one-half or all lighting ON and OFF, or raising or lowering lighting levels, for each controlled zone, depending on the selection of room controller(s) and load binding to room controller(s).

4. For switching daylight harvesting, the photosensor shall provide a deadband or a separation between the "ON Setpoint" and the "OFF Setpoint" that will prevent the lights from cycling after they turn off.

5. For dimming daylight harvesting, the photosensor shall provide the option, when the daylight contribution is sufficient, of turning lights off or dimming lights to a user-selectable minimum level.

6. Programmable wall switch override to allow occupants to reduce lighting level to increase energy savings or, if permitted by system administrator, raise and lower lighting levels for a selected period of time or cycle of occupancy.

7. Infrared (IR) transceiver for configuration and/or commissioning with a handheld configuration tool, to transmit detected light level to wireless configuration tool, and for communication with personal remote controls.

8. Red configuration LED that blinks to indicate data transmission.

9. Blue status LED indicates test mode, override mode and load binding.

10. Recessed switch to turn controlled load(s) ON and OFF.

11. One RJ-45 port for connection to DLM local network.

12. An adjustable head and a mounting bracket to accommodate multiple mounting methods and building materials. The photosensor may be mounted on a ceiling tile, skylight light well, suspended lighting fixture or backbox.

C. Open loop digital photosensors include the following additional features:

1. An internal photodiode that measures light in a 60 degree angle cutting off the unwanted light from the interior of the room.

2. Automatically establishes setpoints following calibration using a wireless configuration tool or a PC with appropriate software.

3. A proportional control algorithm for dimming daylight harvesting with a "Setpoint" to be maintained during operation.

4. Wattstopper product number: LMLS-500.

2.7 ROOM NETWORK (DLM LOCAL NETWORK)

A. The DLM local network is a free topology lighting control physical connection and communication protocol designed to control a small area of a building. Digital room devices connect to the network using CAT 5e cables with RJ-45 connectors which provide both data and power to room devices. Features of the DLM local network include:

1. Plug n' Go automatic configuration and binding of occupancy sensors, switches and lighting loads to the most energy-efficient sequence of operation based upon the device attached.

2. Simple replacement of any device in the network with a standard off the shelf unit without requiring commissioning, configuration or setup.

3. Push n' Learn configuration to change the automatic configuration, including binding and load parameters without tools, using only the buttons on the digital devices in the local network.

4. Two-way infrared communications for control by handheld remotes, and configuration by a handheld tool including adjusting load parameters, sensor configuration and binding, within a line of sight of up to 30 feet from a sensor, wall switch or IR receiver.

2.8 CONFIGURATIONS TOOLS

A. A configuration tool facilitates optional customization of DLM local networks, and is used to set up open loop daylighting sensors. A wireless configuration tool features infrared communications, while PC software connects to each local network via a USB interface.

B. Features and functionality of the wireless configuration tool shall include:

1. Two-way infrared (IR) communication with DLM IR-enabled devices within a range of approximately 30 feet.

2. High visibility organic LED (OLED) display, pushbutton user interface and menu-driven operation.

3. Read, modify and send parameters for occupancy sensors, daylighting sensors, room controllers, and buttons on digital wall switches.

4. Save up to nine occupancy sensor setting profiles, and apply profiles to selected sensors.

5. Temporarily adjust light level of any load(s) on the local network, and incorporate those levels in scene setting.

6. Adjust or fine-tune daylighting settings established during auto-commissioning, and input light level data to complete commissioning of open loop daylighting controls.

C. Wattstopper product number: LMCT-100.

2.9 NETWORK BRIDGE

A. The network bridge connects a DLM local network to a BACnet-compliant network for communication between rooms, panels and a segment manager or BAS. Each local network shall include a network bridge component to provide a connection to the local network room devices. The network bridge shall use industry standard BACnet MS/TP network communication.

1. Provide Plug n' Go operation to automatically discover all room devices connected to the local network and make all device parameters visible to the segment manager via the segment network. No commissioning shall be required for set up of the network bridge on the local network.

2. The network bridge shall automatically create standard BACnet objects for selected room device parameters to allow any BACnet-compliant BAS to include lighting control and power monitoring features as provided by the DLM room devices on each local network. Standard BACnet objects shall be provided as follows:

a. Read/write the normal or after hours schedule state for the room.

b. Read the detection state of the occupancy sensor.

c. Read/write the On/Off state of loads.

d. Read/write the dimmed light level of loads.

e. Read the button states of switches.

f. Read total current in amps, and total power in watts through the room controller.

g. Read/write occupancy sensor time delay, PIR sensitivity and ultrasonic sensitivity settings.

h. Activate a preset scene for the room.

i. Read/write daylight sensor fade time and say and night setpoints.

j. Read the current light level, in footcandles, from interior and exterior photosensors and photocells.

k. Set daylight sensor operating mode.

l. Read/write wall switch lock status.

3. Wattstopper product number: LMBC-300.

2.10 SEGMENT MANAGER

A. The Digital Lighting Management system shall include at least one segment manager to manage network communication. It shall be capable of serving up a graphical user interface via a standard web browser. Each segment manager shall have support for one segment networks

as required and allow for control of a maximum of 120 local networks (rooms) and/or lighting control panels per segment network.

B. Operational features of the segment manager shall include the following:

1. Connection to PC or LAN via standard Ethernet TCP/IP.

2. Easy to learn and use graphical user interface, compatible with Internet Explorer 11, or equal browser.

3. Log in security capable of restricting some users to view-only or other limited operations.

4. Automatic discovery of all DLM devices on the segment network(s). Commissioning beyond activation of the discovery function shall not be required.

5. After discovery, all rooms and panels shall be presented in a standard navigation tree format. Selecting a device from the tree will allow the device settings and operational parameters to be viewed and changed by the user.

6. Ability to view and modify room device operational parameters. It shall be possible to set device parameters independently for normal hours and after hours operation.

7. Ability to set up schedules for rooms and panels. Schedules shall automatically set controlled zones or areas to either a normal hours or after hours mode of operation.

8. Ability to group rooms and loads for common control by schedules, switches or network commands.

9. Provide seamless integration with the BAS via BACnet IP.

C. Wattstopper product number: LMSM-3E.

2.11 EMERGENCY LIGHTING

A. Emergency Lighting Control Unit - A UL 924 listed device that monitors a switched circuit providing normal lighting to an area. The unit provides normal ON/OFF control of emergency lighting along with the normal lighting. Upon normal power failure the emergency lighting circuit will close, forcing the emergency lighting ON until normal power is restored. Features include:

1. 120/277 volts, 50/60 Hz, 20 amp ballast rating.

2. Push to test button.

3. Auxiliary contact for remote test or fire alarm system interface.

4. UL2043 plenum rated.

B. Wattstopper product number: ELCU-100, with EMTS-100 remote test switch.

2.12 SOURCE QUALITY CONTROL

A. Perform full-function testing on all completed assemblies at end of line.

B. Diagnostics and Service - Tiered control scheme for dealing with component failure that minimizes loss of control for occupant.

1. Bus Failure: Lights go to emergency level for safety.

2. Failure of One Sensor Type: Ballast still controllable via other sensors.

3. Ballast Failure: Only impacts one fixture - remainder of system operates as programmed.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install equipment in accordance with manufacturer’s installation instructions and Contract Documents.

B. Provide equipment at locations and in quantities indicated on Drawings. Provide any additional equipment required to provide control intent.

C. Install photocells as directed by manufacturer's instructions. Complete connections to control circuits, photocells, control modules, power supply pack and low voltage wiring.

D. Verify with manufacturer's representative that sensors and photocells are laid out in compliance to manufacturer's published sensing distribution. Provide additional sensors for complete coverage of space being sensed.

E. Photocell Placement and Wiring:

1. Drawings are schematic, and show photocell quantities together with the daylighting zones that they control.

2. Reference manufacturer installation instructions for the recommended location and orientation of photocell with respect to exterior glazing and both interior and exterior lighting.

3. Ensure that daylight sensor placement minimizes sensors view of electric light sources; ceiling mounted and fixture-mounted daylight sensors shall not have direct view of luminaries.

4. Reposition sensor at no additional cost to Owner to avoid conflict between sensor and object obscuring its view, and between sensor and both interior and exterior lighting that causes daylighting controls to repeatedly increase and decrease in brightness (i.e., "cycling").

5. Field wire photocell for correct footcandle range.

F. Do not install equipment until following conditions can be maintained in spaces to receive equipment:

1. Ambient temperature: 32 degrees F to 104 degrees F.

2. Relative Humidity: Maximum 90 percent, non-condensing.

G. Lighting control system must be protected from dust during installation.

H. Prior to applying continuous dimming daylighting controls, maintain LED lighting at full output for a minimum of 100 hours. If this is not done, replace lamps and drivers of affected luminaires at no cost to Owner.

I. Use manufacturer's published testing and adjusting procedures to adjust sensor time delay, daylight sensitivity, and passive infrared sensitivity to satisfaction of Owner.

J. Systems Integration:

1. Equipment Integration Meeting Visit: Owner's Authorized Representative to coordinate meeting with Lighting Control System Manufacturer and other related equipment manufacturers to discuss equipment and integration procedures.

3.2 STARTUP AND PROGRAMMING

A. Provide factory-certified field service engineer to ensure proper system installation and operation under following parameters:

1. Qualifications for Factory-Certified Field Service Engineer:

a. Minimum experience of two years training in the electrical/electronic field.

b. Certified by the equipment manufacturer on the system installed.

2. Site Visit Activities:

a. Verify connection of power feeds and load circuits.

b. Verify connection of controls.

c. Verify system operation control by control, circuit by circuit.

d. Obtain sign-off on system functions.

e. Demonstrate and educate Owner's Authorized Representative on system capabilities, operation and maintenance.

B. Tech Support: Provide factory direct technical support hotline 24 hours per day, seven days per week.

3.3 FIELD QUALITY CONTROL

A. Manufacturer Services:

1. Aim and Focus Visit: Facility Representative to coordinate on-site meeting with Lighting Control System Manufacturer and Lighting Design Consultant to make required lighting adjustments to the system for conformance with the Lighting Design Consultant's original design intent.

3.4 CLOSEOUT ACTIVITIES

A. Training Visit: Lighting Control System Manufacturer to provide one day additional on-site system training to site personnel no less than two months after Substantial Completion, separate from start-up and programming visit.

B. On-Site Walk Through: Lighting Control System Manufacturer to provide a factory certified Field Service Engineer to demonstrate system functionality to the Commissioning Agent.

C. Test lighting controls to ensure that control devices, components, equipment and systems are calibrated, adjusted and operate in accordance with Drawings and Specifications. Provide functional testing of sequences of operation to ensure operation in accordance with Drawings and Specifications. Provide complete report of test procedures and results to engineer and insert approved copy into project closeout documents.

D. Testing Includes:

1. Daylight automatic controls.

2. Occupant sensing automatic controls.

3. Automatic time and override controls for interior lighting.

4. Automatic time and photo controls for exterior lighting.

3.5 MAINTENANCE

A. Capable of providing on-site service support within 24 hours as part of Warranty and Maintenance Plan.

B. Offer renewable service contract on yearly basis, to include parts, factory labor, and annual training visits. Make service contracts available up to ten years after date of system startup separate from Construction Contract.

C. System Optimization Visit: Lighting Control System Manufacturer to visit site six months after system start-up to evaluate system usage and discuss opportunities to make efficiency improvements that will fit with the current use of the facility.

END OF SECTION 26 0925

SECTION 26 2200

LOW-VOLTAGE TRANSFORMERS

PART 1 - GENERAL

1.1 SUMMARY

A. Work Included:

1. Two-Winding Transformers

1.2 RELATED SECTIONS

A. Contents of Division 26, Electrical and Division 01, General Requirements apply to this Section.

1.3 REFERENCES AND STANDARDS

A. References and Standards as required by Section 26 00 00, Electrical Basic Requirements and Division 01, General Requirements.

B. In addition, meet the following:

1. UL 1561: Dry-Type General Purpose and Power Transformers.

1.4 SUBMITTALS

A. Submittals as required by Section 26 00 00, Electrical Basic Requirements and Division 01, General Requirements.

1.5 QUALITY ASSURANCE

A. Quality assurance as required by Section 26 00 00, Electrical Basic Requirements and Division 01, General Requirements.

B. In addition, meet the following:

1. Production test each unit according to NEMA Standard 20.

1.6 WARRANTY

A. Warranty of materials and workmanship as required by Section 26 00 00, Electrical Basic Requirements and Division 01, General Requirements.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Basis of Design: Eaton

B. Federal Pacific

C. ABB/General Electric

D. Jefferson Electric

E. Schneider Electric/Square D

F. Or approved equivalent.

G. Basis of Design: Schneider Electric/Square D. Manufacturers listed are allowed on condition of meeting specified conditions including available space for equipment and Code required working clearances. Remove and replace equipment installed that does not meet these conditions at no cost to Owner.

2.2 TWO-WINDING TRANSFORMERS

A. Description: Factory assembled, air cooled dry type transformer. Efficiency compliant with Federal Code 10 CFR Part 431 and DOE 2016 efficiency requirements. NEMA TP-1 efficiency levels are not acceptable.

B. Primary Voltage: 480 volts, 3 phase.

C. Secondary Voltage: 208Y/120 volts, 3 phase.

D. Windings: Aluminum.

E. Insulation system and average winding temperature rise for rated kVA as follows:

1. 1-15 kVA: Class 220 with 115 degrees C rise.

2. 16-500 kVA: Class 220 with 115 degrees C rise.

F. Maximum Winding Temperature: Do not exceed 30 degrees C rise above 40 degrees C ambient at warmest point at full load.

G. Winding Taps:

1. Transformers Less than 15 kVA: Two 5 percent below rated voltage, full capacity taps on primary winding.

2. Transformers 15 kVA and Larger: NEMA ST 20.

H. Conductor Termination Lugs: Compression.

I. Sound Levels: NEMA ST 20.

J. Basic Impulse Level: 10 kV.

K. Impedance: 3 to 5 percent, unless otherwise noted on drawings. Minimum reactance 2 percent.

L. Ground core and coil assembly to enclosure by means of a visible flexible copper grounding strap.

M. Mounting:

1. 1-15 kVA: Suitable for floor mounting.

2. 16-75 kVA: Suitable for floor mounting.

3. Larger than 75 kVA: Suitable for floor mounting.

N. Coil Conductors: Continuous windings with terminations brazed or welded.

O. Transformer Enclosure: NEMA ST 20.

1. Exterior: Type 3R.

2. Ventilated.

3. Provide lifting eyes or brackets.

P. Isolate core and coil from enclosure using vibration-absorbing mounting pads.

Q. Nameplate: Reference Section 26 05 53, Identification for Electrical Systems.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Set transformers plumb and level.

B. Use flexible conduit, 2-feet minimum length with slack, for connections to transformer case. Make conduit connections to side panel of enclosure.

C. Mount wall-mounted transformers using integral flanges or accessory brackets furnished by manufacturer. Mount to allow a minimum of 6-feet, 6-inches headroom below unit.

D. Mount trapeze-mounted transformers as indicated.

E. Provide grounding and bonding in accordance with Section 26 05 26, Grounding and Bonding of Electrical Systems.

F. Clearance: Minimum 6-inches clear on sides and back. Front clearance per NEC 110.26. Maintain minimum clearance from combustible materials per NEC. Comply with manufacturers recommendations.

G. Exterior Installations: Weather resistant enclosure.

1. Provide 8-inches diameter by 24-inches (above and below grade) concrete filled steel bollards where subject to vehicular traffic.

2. Where grouped with switchgear refinish as required so that transformers and switchgear match in color.

H. Unacceptable Humming and Noise Levels: Revise installation as required to achieve a noise level less than or equal to those defined in NEMA ST-20 for associated transformer size or replace with a new unit with an acceptable sound level.

I. Provide Concrete Housekeeping Pad:

1. Exterior Pads: Provide concrete pads of 2,500 to 3,000 PSI concrete reinforced with 8 gauge wire fabric or No. 6 reinforcing bars on 12-inch centers. Provide 10-inch thick base of gravel below pad for support. Pad extends 6-inches on all sides from exterior most prominent dimension. Provide 3/4-inch by 10-foot ground rod at each corner bonded to No. 2 AWG bare copper grounding conductor, bonded to transformer and concrete reinforcement.

2. Housekeeping pads provided under provisions of Division 03, Concrete.

J. Provide equipment nameplates per Section 26 05 53, Identification for Electrical Systems.

K. Provide arc flash labels per Section 26 05 73, Electrical Distribution System Studies.

3.2 FIELD QUALITY CONTROL

A. Perform field inspection, testing, and adjusting.

B. Perform inspections and tests listed in accordance with manufacturers requirements. In addition including following:

1. Perform turns ratio tests at tap positions.

2. Verification that as-left tap connections are as specified.

3. Perform excitation-current tests on each phase.

4. Measure resistance of each winding at each tap connection.

5. Overpotential test on high- and low-voltage windings-to-ground.

C. Check for damage and tight connections prior to energizing transformers.

3.3 ADJUSTING

A. Measure primary and secondary voltages and make appropriate tap adjustments.

3.4 TESTING

A. Reference Section 26 08 05, Electrical Acceptance Testing.

3.5 COMMISSIONING

A. Reference Section 26 08 00, Commissioning of Electrical.

END OF SECTION 26 2200

SECTION 26 2413

SWITCHBOARDS

PART 1 - GENERAL

1.1 SUMMARY

A. Work Included:

1. Switchboards

1.2 RELATED SECTIONS

A. Contents of Division 26, Electrical and Division 01, General Requirements apply to this Section.

B. In addition, reference the following:

1. Section 26 05 73, Electrical Distribution System Studies.

2. Section 26 28 00, Overcurrent Protective Devices.

1.3 REFERENCES AND STANDARDS

A. References and Standards as required by Section 26 00 00, Electrical Basic Requirements and Division 01, General Requirements.

B. In addition, meet the following:

1. UL 891, Standards for Switchboards.

1.4 SUBMITTALS

A. Submittals as required by Section 26 00 00, Electrical Basic Requirements and Division 01, General Requirements.

B. In addition, provide:

1. Operation and Maintenance Manuals:

a. After completion of work and start-up of the equipment at the project site, deliver to the Owner's Authorized Representative operation instructions, maintenance manuals and drawings presenting full details for care and maintenance of each time of equipment provided under this Contract. Number of copies in accordance with Division 01.

b. Each copy to contain the operating and maintenance information and parts lists for equipment provided under this Contract. When necessary, provide supplemental drawings to show system operation and servicing maintenance points. For electrical

components, provide wiring and connection diagrams. Include instructions required to accomplish specified operation and functions. Data to be neat, clean and legible.

c. Switchboard drawings and wiring diagrams to be included and up to date at the completion of start-up and system acceptance by the Owner. Drawings and wiring diagrams to include any field modifications or changes to reflect actual as-installed conditions.

d. In general, the manual to include, but not necessarily be limited to, the following:

1) Switchboard Elevation and One line.

2) AC and DC Schematic and Physical Component Layout Drawings.

3) Remote Interface Drawing.

4) Bill of Material.

5) Description of Operation.

e. Provide manuals in accordance with Division 01 adequately labeled with the project name and location and the contents indexed.

1.5 QUALITY ASSURANCE

A. Quality assurance as required by Section 26 00 00, Electrical Basic Requirements and Division 01, General Requirements.

1.6 WARRANTY

A. Warranty of materials and workmanship as required by Section 26 00 00, Electrical Basic Requirements and Division 01, General Requirements.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Switchboards

1. Basis of Design: Eaton

2. GE Industries

3. Schneider Electric/Square D

4. Or approved equivalent.

B. Manufacturers listed above are allowed on condition of meeting specified conditions including available space for equipment, Code required working clearances, selective coordination per Section 26 0573, Electrical Distribution System Studies, and amps interrupting capacity (AIC) per short circuit study in Section 26 0573, Electrical Distribution System Studies. Prior to submitting

bid, manufacturer to provide documentation to Engineer verifying specific conditions, including those mentioned above, can be met. Remove and replace electrical equipment installed, at no cost to the Owner, that does not meet these conditions.

2.2 SWITCHBOARDS

A. Description: NEMA PB 2 freestanding switchboard with electrical ratings and configurations as indicated and specified.

B. Integrated Equipment Rating: Provide fully rated integrated equipment rating greater than the available fault current. Series rated switchboards are not acceptable. Reference drawings for available fault current. If drawings do not have available fault current shown, then coordinate with serving electrical utility. Final rating based on the protective device study completed under the provisions of Division 26, Electrical Distribution System Studies.

C. Enclosure to be suitable for having 100 percent rated circuit breakers installed and applied at 100 percent. Enclosure to meet minimum size and ventilation requirements set forth on the 100 percent circuit breaker or must be UL tested for 100 percent rating of the circuit breaker.

D. Bus Material: Copper, standard size.

E. Ground Bus: Extend length of switchboard, 50 percent of phase bus capacity.

F. Neutral Bus: 100 percent rated, full length of switchboard.

G. Lugs: Mechanical type for copper conductors.

H. Fusible Switch Assemblies: NEMA KS 1, quick make, quick break, load interrupter enclosed knife switch with externally operable handle. Provide interlock to prevent opening front cover with switch in ON position. Handle lockable in OFF position. Fuse clips: Provide fuse rejection feature for Class R fuses up to 600 amp.

1. Provide switches of 30 to 200 amp with plug-on line side connections.

I. Fusible Switch Assemblies, 800 Amperes and Larger: Bolted pressure contact switches. Fuse clips: Designed to accommodate Class L fuses. Provide with shunt trip and ground fault capabilities.

J. Molded Case Circuit Breakers: Integral thermal and instantaneous magnetic trip in each pole.

1. Provide circuit breakers UL listed as Type HACR for air conditioning equipment branch circuits.

2. Include shunt trip where indicated.

K. Circuit breakers 1200 Amp and Greater: Provide breaker with energy-reducing maintenance switching with local status indicator per NEC Article 240.87(B).

L. Metering Transformer Compartment: For utility company's use; compartment size, bus spacing and drilling, door, and locking and sealing requirements in accordance with utility company's requirements.

M. Utility Pull Section:

1. Width as shown on drawings. Depth and height to match switchboard.

2. Arrange as shown on drawings.

N. Future Provisions: Fully equip spaces for future devices with bussing and bus connections, suitably insulated and braced for short circuit currents. Provide continuous current rating as indicated.

O. Pull Box: Removable top and sides, same construction as switchboard.

1. Electrical shall size in accordance with NEC.

2. Provide insulating, fire-resistive bottom with separate openings for each circuit to pass into switchboard.

P. Enclosure: NEMA Type 1 - Indoor.

1. Align sections as shown on drawings.

2. Finish: Manufacturer's standard light gray enamel over external surfaces. Coat internal surfaces with minimum one coat corrosion-resisting paint, or plate with cadmium or zinc.

3. Removable front covers: Screw attached.

4. Provide removable hinge pins on hinged doors.

5. Provide full height barriers between sections.

PART 3 - EXECUTION

3.1 GENERAL INSTALLATION REQUIREMENTS

A. Provide concrete housekeeping pad. Extend 6-inches beyond switchboard width and depth dimensions. Minimum 3-inches above finished floor. Install plumb and level.

B. Verify that field measurements are as indicated on Shop Drawings.

C. Install in a neat and workmanlike manner and in location shown on Drawings, according to NEMA PB 2.1.

D. Adjust all operating mechanisms for free mechanical movement.

E. Tighten bolted bus connections in accordance with manufacturer's instructions.

F. Reference Section 26 08 05, Electrical Acceptance Testing for testing requirements.

G. Reference Section 26 08 00, Commissioning of Electrical for commissioning requirements.

3.2 SWITCHBOARDS INSTALLATION

A. Shop inspect and test switchboard according to NEMA PB 2.

B. Make completed switchboard available for inspection at manufacturer's factory prior to packaging for shipment. Notify Owner at least 7 days before inspection is allowed.

C. Install switchboard in accordance with manufacturer's installation instructions.

D. Tighten accessible bus connections and mechanical fasteners after placing switchboard.

E. Provide arc flash labels per Section 26 0573, Electrical Distribution System Studies.

F. Provide engraved nameplates per Section 26 05 53, Identification of Electrical Systems.

G. Provide fuses in each switch.

H. Perform field inspection and testing.

I. Perform inspections and tests listed in NETA STD ATS, Section 7.1.

J. Measure, using a Megger, insulation resistance of each bus section phase-to-phase and phase-to-ground for one minute each, at minimum test voltage of 1000 Vdc; minimum acceptable value for insulation resistance is 1 megohms.

K. Check tightness of accessible bolted bus joints using calibrated torque wrench per manufacturers recommended torque values.

L. Physically test key interlock systems to check for proper functionality.

M. Test ground fault systems by operating push-to-test button.

N. Shunt Trip Circuit Breakers: Provide wiring to remote trip switch/contacts as indicated on Drawings.

O. Adjust circuit breaker trip and time delay settings to values indicated.

P. Adjust circuit breaker trip and time delay settings to values as instructed by Engineer.

Q. Clean exterior and interior of switchboard in accordance with manufacturers installation instructions.

R. Vacuum construction dust, dirt, and debris out of switchboard interior.

S. Where enclosure finish is damaged, touch up finish with matching paint in accordance with manufacturer's specifications and installation instructions.

END OF SECTION 26 2413

SECTION 26 2416

PANELBOARDS

PART 1 - GENERAL

1.1 SUMMARY

A. Work Included:

1. Power Distribution Panelboards

1.2 RELATED SECTIONS

A. Contents of Division 26, Electrical and Division 01, General Requirements apply to this Section.

B. In addition, reference the following:

1. Section 26 05 73, Electrical Distribution System Studies.

2. Section 26 24 13, Switchboards.

3. Section 26 28 00, Overcurrent Protective Devices.

1.3 REFERENCES AND STANDARDS

A. References and Standards as required by Section 26 00 00, Electrical Basic Requirements and Division 01, General Requirements.

B. In addition, meet the following:

1. UL 67, Standards for Panelboards.

1.4 SUBMITTALS

A. Submittals as required by Section 26 00 00, Electrical Basic Requirements and Division 01, General Requirements.

1.5 QUALITY ASSURANCE

A. Quality assurance as required by Section 26 00 00, Electrical Basic Requirements and Division 01, General Requirements.

1.6 WARRANTY

A. Warranty of materials and workmanship as required by Section 26 00 00, Electrical Basic Requirements and Division 01, General Requirements.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Power Distribution Panelboards:

1. Basis of Design: Eaton

2. ABB/General Electric

3. Schneider Electric/Square D

4. Or approved equivalent.

B. Manufacturers listed above are allowed on condition of meeting specified conditions including available space for equipment, Code required working clearances, selective coordination per Section 26 0573, Electrical Distribution System Studies, and amps interrupting capacity (AIC) per short circuit study in Section 26 0573, Electrical Distribution System Studies. Prior to submitting bid, manufacturer to provide documentation to Engineer verifying specific conditions, including those mentioned above, can be met. Remove and replace electrical equipment installed, at no cost to the Owner, that does not meet these conditions.

2.2 POWER DISTRIBUTION PANELBOARDS

A. Description: NEMA PB 1 Type 3R, circuit breaker type.

B. Integrated Equipment Rating: Provide fully rated integrated equipment rating greater than the available fault current. Series rated panelboards are not acceptable. Reference drawings for available fault currents. If drawings do not have available fault current shown, then coordinate with serving electrical utility. Final rating based on the protective device study completed under the provisions of Division 26, Electrical Distribution System Studies.

C. Panelboard Bus: Non-reduced copper, ratings as indicated on drawings. Bus bar with suitable electroplating (tin) for corrosion control at connection. Provide copper ground bus in each panelboard.

D. Lugs: Mechanical type for both aluminum and copper conductors. All device terminals/lugs shall be rated for a minimum of 75 degrees C to facilitate the use of 75 degrees C conductor ampacity rating.

E. Molded Case Circuit Breakers: With integral thermal and instantaneous magnetic trip in each pole; UL listed. For air conditioning equipment branch circuits provide circuit breakers UL listed as Type HACR.

F. Molded Case Circuit Breakers with Current Limiters: With replaceable current limiting elements, in addition to integral thermal and instantaneous magnetic trip in each pole; UL listed.

G. Circuit Breaker Accessories: Trip units and auxiliary switches as indicated.

H. Circuit Breakers 1200 Amp and Greater: Provide breaker with energy-reducing maintenance switching with local status indicator per CEC Article 240.87(B).

I. Fully equip unused spaces for future devices, including manufacturer required connections and mounting hardware.

J. Cabinet Front: Surface type hinged door with flush lock, metal directory frame, finished in manufacturer's standard gray enamel.

PART 3 - EXECUTION

3.1 GENERAL INSTALLATION REQUIREMENTS

A. Install panelboards in accordance with NEMA PB 1.1, NECA 1 and manufacturers installation instructions.

B. Install panelboards level and plumb. Install recessed panelboards flush with wall finishes.

C. Height: 6-feet 6-inches to top of panelboard; install panelboards taller than 6-feet 6-inches with bottom no more than 4-inches above floor.

D. Provide filler plates for unused spaces in panelboards.

E. Provide typed circuit directory for each branch circuit panelboard. Include all "spaces" and "spares." Revise directory to reflect circuiting changes and as-installed conditions. Use final Owner designated room names and numbers, and not designations shown on drawings.

F. Provide engraved plastic nameplates per Section 26 05 53, Identification for Electrical Systems.

G. Provide arc flash labels per Section 26 0573, Electrical Distribution System Studies.

H. Provide concrete housekeeping pad for floor-mounted distribution panelboards. Extend 6-inches beyond distribution panel width and depth dimensions. Minimum 3-inches above finished floor. Install plumb and level.

I. Provide two 1-inch spare conduits out of each recessed panelboard to an accessible location above ceiling. Identify each as SPARE.

J. Provide permanent identification number in or on panelboard dead-front adjacent to each breaker pole position. Horizontal centerline of numbers to correspond with centerline of circuit breaker pole position.

K. Ground and bond panelboard enclosure per NEC.

L. Paint:

1. Standard factory finish unless noted otherwise.

2. Panelboards located in finished interior areas in view of building occupants; paint to match adjacent wall surface. Color and paint preparation as specified by Architect. Covers to be painted off wall, then installed over dried, painted wall surface.

M. Provide handle guards on each circuit supplying obviously constant loads such as fire alarm, security, lighting controls, refrigerators and freezers, fire protection, etc.

N. Provide interior wiring diagram, neutral wiring diagram, UL label, and short circuit rating on interior or in booklet format inserted in sleeve inside panel cover.

O. Verify available recessing depth and coordinate wall framing with other divisions.

P. Maintain fire rating of wall where panels are installed flush in fire rated walls.

Q. Perform inspections and tests in accordance with manufacturer's requirements.

R. Thoroughly clean exterior and interior of each panelboard in accordance with manufacturer's installation instructions.

S. Vacuum construction dust, dirt, and debris out of each panelboard.

T. Where enclosure finish is damaged, touch up finish with matching paint in accordance with manufacturer's specifications and installation instructions.

U. Reference Section 26 08 05, Electrical Acceptance Testing for testing requirements.

V. Reference Section 26 08 00, Commissioning of Electrical for commissioning requirements.

3.2 POWER DISTRIBUTION PANELBOARDS INSTALLATION

A. Breakers being added to existing panelboards: Coordinate breaker type and short circuit rating with existing panelboard. Breakers to match existing in manufacturer's type and AIC rating. Provide new typed circuit directory.

B. Provide handle tie to branch circuit breakers of multiwire branch circuits for simultaneous disconnection of circuits. Handle tie will be identified for use with circuit breakers provided. Reconfigure assigned circuits as necessary so that circuit breakers associate with multiwire branch circuits are physically adjacent, record changes in panelboard schedules and circuiting plans for record drawings.

C. Shunt Trip Circuit Breakers: Provide wiring to remote trip switch/contacts as indicated on Drawings.

D. Measure steady state load currents at each panelboard feeder; rearrange circuits in panelboard to balance phase loads to within 20 percent of each other. Maintain proper phasing for multi-wire branch circuits.

END OF SECTION 26 2416

SECTION 26 2510

FEEDER AND PLUG-IN BUSWAY

PART 1 - GENERAL

1.1 SUMMARY

A. Work Included:

1. Short Circuit Rating and Tests

2. Construction

3. Voltage Drop

4. Plug-in Units

5. Plug-in Unit Safety Devices

1.2 RELATED SECTIONS

A. Contents of Division 26, Electrical and Division 01, General Requirements apply to this Section.

1.3 REFERENCES AND STANDARDS

A. References and Standards as required by Section 26 00 00, Electrical Basic Requirements and Division 01, General Requirements.

1.4 SUBMITTALS

A. Submittals as required by Section 26 00 00, Electrical Basic Requirements and Division 01, General Requirements.

B. In addition, provide:

1. Shop Drawings: Indicate ratings, dimensions and finishes. Include dimensioned layout diagram, installation details and locations of supports and fittings including but not limited to firestops and weather seals. Include details of wall and floor penetrations.

2. Manufacturer's Installation Instructions: Indicate application conditions and limitations of use stipulated by Product testing agency. Include instructions for storage, handling, protection, examination, preparation, installation, and starting of product.

3. Project Record Documents: Record actual locations of busway routing and plug-in units.

1.5 QUALITY ASSURANCE

A. Quality assurance as required by Section 26 00 00, Electrical Basic Requirements and Division 01, General Requirements.

B. In addition, meet the following:

1. Qualifications: Manufacturing company specializing in manufacturing the products specified in this Section with minimum 3 years documented experience.

2. Regulatory Requirements: Straight lengths, fittings, and plug-in units UL listed. This listing to include mounting of the busway in any position (i.e. horizontal, flatwise, edgewise and vertical) without derating.

1.6 WARRANTY

A. Warranty of materials and workmanship as required by Section 26 00 00, Electrical Basic Requirements and Division 01, General Requirements.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Eaton Electrical

B. ABB/General Electric

C. Schneider Electric/Square D

D. Or approved equivalent.

E. Manufacturers listed above are allowed on condition of meeting specified conditions including available space for equipment, Code required working clearances, selective coordination per Section 26 0573, Electrical Distribution System Studies, and amps interrupting capacity (AIC) per short circuit study in Section 26 0573, Electrical Distribution System Studies. Prior to submitting bid, manufacturer to provide documentation to Engineer verifying specific conditions, including those mentioned above, can be met. Remove and replace electrical equipment installed, at no cost to the Owner, that does not meet these conditions.

2.2 GENERAL

A. Provide a complete low impedance prefabricated busway distribution system as shown on the drawings.

B. Busway: 208 volts 3 phase 4 wire with 50 percent capacity integral ground bus.

C. The ampere ratings, approximate footage, fittings, plug-in units and the like, are shown on the drawings. Route busway to avoid clearance and spatial conflicts with other trades. Make final field measurements prior to release of the busway for fabrication. Verify that field measurements are as detailed on shop drawings or instructed by manufacturer.

2.3 SHORT CIRCUIT RATING AND TESTS

A. Busway Rating: (consulting engineer's calculated required rating), RMS symmetrical amps which is the ultimate anticipated short-circuit current available at the source.

B. Determine the short-circuit rating of the busway according to UL Standard No. 857. This rating must be based upon actual tests at the rated short-circuit current.

2.4 CONSTRUCTION

A. Housing:

1. Construct the busway housing of code gauge steel or aluminum to reduce hysteresis and eddy current losses. Provide with a suitable protective finish of ANSI 49 gray epoxy paint.

2. Provide totally enclosed busway housing, non ventilated, for protection against mechanical damage and dust accumulation.

3. Manufacture of totally enclosed housing by busway manufacturer. Modifications of busway to make it totally enclosed by other than the busway manufacturer voids the manufacturer's warranty. Busway so modified is unacceptable.

4. Provide plug-in busway in an indoor enclosure.

5. Provide feeder busway in an indoor or outdoor rated housing.

B. Joints:

1. Busway Joints: One-bolt type which utilizes a high strength steel bolts and Belleville washer to maintain proper pressure over a large contact surface area.

2. Bolts:

a. Torque indicating, fully insulated and at ground potential.

b. Two-headed design to indicate when proper torque has been applied and require only a standard long handle wrench to be properly activated.

3. Access: Required to only one side of the busway for tightening joint bolts.

4. On Busway 800 Amp and Above: Make possible to remove any joint connection assembly to allow electrical isolation or physical removal of a busway length without disturbing adjacent busway lengths.

C. Bus Bars:

1. Plated their entire length. Bus Bars: Tin plated aluminum or Silver flashed copper.

2. Insulate each bus bar over its entire length with Class B (130C) rated insulating material.

3. The temperature rise at any point in the busway not-to-exceed 55 C rise above ambient temperature when operating at rated load current.

4. Both feeder and plug-in busway (800 amp and above) of sandwich construction, meaning no air gap to exist between bus bars except at plug-in openings and joints.

D. Plug-In Openings:

1. Plug-in Busway: Five dead front, hinged cover type plug-in openings on each side of each 10 foot lengths.

2. Openings: Usable simultaneously.

3. Install busway so that plugs are side mounted to permit practical use of 10 plug-in openings.

4. Individually insulate each phase position of a plug-in opening.

E. Support of Busway:

1. Hanger Spacing: (Noted on layout drawings) (Not exceed manufacturer's recommendations).

2. Approve plug-in/feeder type busway hanger for spacing of up to 10-feet on horizontal runs and 16-feet when vertically mounted.

3. Sway brace plug-in busway as detailed to counteract the unbalanced weight of plug-ins, ladders, and the like.

4. Approve outdoor busway for hanger spacing of up to 5-feet on horizontal and vertical runs.

2.5 VOLTAGE DROP

A. Base the voltage drop (input voltage minus voltage at most distant available plug-in provision) specified on the busway operating at full rated current and at stabilized operating temperature in 30C ambient temperature.

B. The 3 phase, line-to-line voltage drop not-to-exceed 2.4 volt per 100-feet at 40 percent power factor concentrated load which condition may exist during motor starting.

C. The line-to-line voltage drop not-to-exceed 3.3 volt per 100-feet at the load power factor which produces maximum voltage drop in the busway.

2.6 PLUG-IN UNITS

A. Plug-in Units: Circuit breaker type or Fusible switch type with visible blade quick-make and break mechanism.

B. Equip plug-in units which cannot be operating directly from the floor with suitable means for hookstick operation.

C. Interrupting rating circuit breaker plug units: Refer to spec 26 05 73 Electrical Distribution Studies for the final rating. Refer to the submittal by the contractor for the final rating.

D. Circuit breakers 1200 Amp and Greater: Provide breaker with energy-reducing maintenance switching with local status indicator per CEC Article 240.87(B).

2.7 PLUG-IN UNIT SAFETY DEVICES

A. Mechanically interlock each plug-in unit rated 100 amp or below with the busway housing to prevent installation or removal of plug-in units while the switch is in the ON position, and be equipped with an operating handle which always remains in control of the switching mechanism.

B. Plug-in enclosures to make positive ground connection with the ground bus before the jaws make contact with the phase bars.

C. The ground method is such that it cannot be defeated by future painting of the busway housing.

D. Equip the plug-in units with internal barriers to prevent accidental contact of fish tape and conductors with live parts on the line side of the protective device during time of wire pulling.

E. Covers of plug-in units must be "releasable" type interlocks to prevent the cover from being opened when the switch is in the ON position.

F. Provide plugs with means for padlocking the switch in the OFF position.

G. Equip plug-in units with means for direct positioning on the busway before the plug-in jaws make contact.

PART 3 - EXECUTION

3.1 GENERAL INSTALLATION

A. Do not install busway where installation location is not protected from moisture.

B. Install busway and accessories in accordance with manufacturer's instructions. Additional instructions are detailed in NEMA publication BU1.1 provided with the equipment by busway manufacturer.

C. Install busway length with expansion fitting at each location where busway run crosses building expansion joint.

D. Install busway with integral firestops located where busway penetrates fire-rated walls and floors. Seal around opening to maintain fire rating of wall or floor.

E. Provide concrete curb around interior floor penetrations.

F. Install busway with integral weather seal located where busway penetrates exterior wall or roof. Provide wall or roof flange and seal around opening to maintain weather tight installation.

G. Provide engraved plastic nameplates per Section 26 05 53, Identification for Electrical Systems.

H. Motor Data: Provide neatly typed label inside each motor starter door identifying motor served, nameplate horsepower, full load amps, code letter, service factor, and voltage/phase rating.

I. Field Quality Control:

1. Perform field inspection and testing.

J. Demonstration:

1. Provide systems demonstration.

END OF SECTION 26 2510

SECTION 26 2716

ELECTRICAL CABINETS AND ENCLOSURES

PART 1 - GENERAL

1.1 SUMMARY

A. Work Included:

1. Hinged Cover Enclosures
2. Cabinets
3. Terminal Blocks
4. Accessories

1.2 RELATED SECTIONS

A. Contents of Division 26, Electrical and Division 01, General Requirements apply to this Section.

B. In addition, reference the following:

1. Division 26, Electrical, Hangers and Supports for Electrical Systems.

1.3 REFERENCES AND STANDARDS

A. References and Standards as required by Section 26 00 00, Electrical Basic Requirements and Division 01, General Requirements.

B. In addition, meet the following:

1. NECA 1 - Standard Practices for Good Workmanship in Electrical Contracting; National Electrical Contractors Association.
2. NEMA 250 - Enclosures for Electrical Equipment (1000 Volts Maximum); National Electrical Manufacturers Association.
3. NEMA ICS 4 - Industrial Control and Systems: Terminal Blocks; National Electrical Manufacturers Association.
4. NFPA 70 - National Electrical Code; National Fire Protection Association.

1.4 SUBMITTALS

A. Submittals as required by Section 26 00 00, Electrical Basic Requirements and Division 01, General Requirements.

B. In addition, provide:

1. Product Data: Provide manufacturer's standard data for enclosures and cabinets.

2. Manufacturer's Instructions: Indicate application conditions and limitations of use stipulated by product testing agency specified under Quality Assurance. Include instructions for storage, handling, protection, examination, preparation, and installation of product.

3. Cabinet Keys: Deliver to Owner in accordance with Division 01, General Requirements for maintenance materials.

1.5 QUALITY ASSURANCE

A. Quality assurance as required by Section 26 00 00, Electrical Basic Requirements and Division 01, General Requirements.

B. In addition, meet the following:

1. Conform to requirements of NFPA 70.

2. Products: Listed and classified by Underwriters Laboratories Inc. or testing firm acceptable to the authority having jurisdiction as suitable for the purpose specified and indicated.

1.6 WARRANTY

A. Warranty of materials and workmanship as required by Section 26 00 00, Electrical Basic Requirements and Division 01, General Requirements.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Hinged Cover Enclosures:

1. Cooper B-Line

2. Qube Corporation

3. Robroy Industries

4. Circle AW

5. Hoffman

6. Wiegmann

7. Or approved equivalent.

B. Cabinets:

1. Hoffman

2. Circle AW

3. Cooper B-Line

4. Or approved equivalent.

C. Terminal Blocks:

1. Allen-Bradley/Rockwell Automation

2. Cooper Bussmann

3. WECO Electrical Connectors Inc.

4. Or approved equivalent.

D. Accessories:

1. Cooper B-Line

2. Rob Roy

3. Qube Corporation

4. Or approved equivalent.

2.2 HINGED COVER ENCLOSURES

A. Construction: NEMA 250, Type 1 steel enclosure.

B. Covers: Continuous hinge, held closed by flush latch operable by screwdriver, key, or thumb latch.

C. Provide interior plywood panel for mounting terminal blocks and electrical components; finish with white enamel.

D. Enclosure Finish: Manufacturer's standard enamel.

E. Keys: Provide two of each different key.

2.3 CABINETS

A. Boxes: Galvanized Steel, Plastic, Fiberglass, or Stainless Steel.

B. Box Size: As noted on drawings.

C. Backboard: Provide 3/4-inch thick plywood backboard for mounting terminal blocks. Paint matte white.

D. Fronts: Steel, flush type with concealed trim clamps, door with concealed hinge, and flush lock keyed to match branch circuit panelboard. Finish with gray baked enamel.

E. Provide metal barriers to form separate compartments for wiring of different systems and voltages.

F. Provide accessory feet for free-standing equipment.

G. Keys: Provide two of each different key.

2.4 TERMINAL BLOCKS

A. Terminal Blocks: NEMA ICS 4.

B. Power Terminals: Unit construction type with closed back and tubular pressure screw connectors, rated 600 volts.

C. Signal and Control Terminals: Modular construction type, suitable for channel mounting, with tubular pressure screw connectors, rated 300 volts.

D. Provide ground bus terminal block, with each connector bonded to enclosure.

2.5 ACCESSORIES

A. Plastic Raceway: Plastic channel with hinged or snap-on cover.

PART 3 - EXECUTION

3.1 GENERAL INSTALLATION REQUIREMENTS

A. Install securely, in a neat and workmanlike manner as specified in NECA 1.

B. Install items per manufacturer's written instructions and the requirements of the project.

C. Cleaning:

1. Clean electrical parts to remove conductive and harmful materials.

2. Remove dirt and debris from enclosure.

3. Clean finishes and touch up damage.

3.2 HINGED COVER ENCLOSURES

A. Install enclosures and boxes plumb. Anchor securely to wall and structural supports at each corner under the provisions of Section 26 05 29, Hangers and Supports for Electrical Systems.

3.3 CABINETS

A. Install cabinet fronts plumb.

3.4 TERMINAL BLOCKS

A. Install terminal blocks securely in a neat and workmanlike manner as specified in NECA 1.

3.5 ACCESSORIES

A. Install plastic raceways channel parallel to the structure per manufacturer's written instructions.

END OF SECTION 26 2716

SECTION 26 2726

WIRING DEVICES

PART 1 - GENERAL

1.1 SUMMARY

A. Work Included: Provision of materials, installation and testing of:

1. Wall Switches
2. Receptacles
3. Finish Plates
4. Surface Covers

1.2 RELATED SECTIONS

A. Contents of Division 26, Electrical and Division 01, General Requirements apply to this Section.

1.3 REFERENCES AND STANDARDS

A. References and Standards as required by Section 26 00 00, Electrical Basic Requirements and Division 01, General Requirements.

1.4 SUBMITTALS

A. Submittals as required by Section 26 00 00, Electrical Basic Requirements and Division 01, General Requirements.

B. In addition, provide:

1. Wall switches
2. Receptacles
3. Wall Plates
4. In-Use Cover

1.5 QUALITY ASSURANCE

A. Quality assurance as required by Section 26 00 00, Electrical Basic Requirements and Division 01, General Requirements.

1.6 WARRANTY

A. Warranty of materials and workmanship as required by Section 26 00 00, Electrical Basic Requirements and Division 01, General Requirements.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Wall Switches:

1. Toggle Type Characteristics:

a. Cooper AH1201

b. Hubbell HBL1221

c. Leviton 1221

d. Legrand P&S PS20AC1

e. Or approved equivalent.

2. Decorative AC Rocker Switch Characteristics:

a. Cooper

b. Hubbell

c. Leviton

d. Legrand P&S

e. Or approved equivalent.

3. Key Switches:

a. Cooper AH1201L

b. Hubbell HBL 1221L

c. Leviton 12212L

d. Legrand P&S PS20AC1L

e. Or approved equivalent.

B. Receptacles:

1. Industrial Grade:

a. Cooper 5362

b. Hubbell HBL5362

c. Bryant BRY5362

d. Leviton 5362

e. Legrand P&S 5362A

f. Or approved equivalent.

2. Commercial Grade:

a. 20 Amp:

1) Cooper 5362

2) Hubbell 5362

3) Bryant CBRS20

4) Leviton 5362S

5) Legrand P&S 5362

6) Or approved equivalent.

3. Ground Fault Circuit Interrupter (GFCI) Receptacle - 20 Amp:

a. Cooper WRSGF20W

b. Hubbell GFR5362SGW

c. Legrand P&S 2097TRWR

d. Or approved equivalent.

C. Finish Plates:

1. Bryant

2. Cooper

3. Hubbell

4. Leviton

5. Legrand P&S

6. Or approved equivalent.

D. Surface Covers:

1. Aluminum with Gasket, Blanks, Single Gang:

a. Bell 240-ALF

b. Carlon

c. Or approved equivalent.

2. 2-Gang:

a. Bell 236-ALF

b. Carlon

c. Or approved equivalent.

3. While-in-Use Weatherproof Cover:

a. Die Cast Cover:

1) Intermatic

2) Hubbell

3) Cooper

4) Or approved equivalent.

E. Provide lighting switches and receptacles of common manufacturer and appearance.

2.2 WALL SWITCHES

A. Characteristics: Toggle type, quiet acting, 20 amp, 120/277 volt, UL listed for motor loads up to 80 percent of rated amperage, extra heavy duty.

B. Key Switches: 20 amp/120-277 volt, black key guide.

C. Finish: White.

2.3 RECEPTACLES

A. Duplex Receptacles Characteristics: Straight parallel blade, 125 volt, 2 pole, 3 wire grounding.

1. Commercial Grade: Riveted. Back and side wired. Brass ground contact on steel strap. Nylon face and nylon base. 20 amp.

B. Ground Fault Circuit Interrupter (GFCI) Receptacle: Feed through type, back-and-side wired, tamper-resistant, weather resistant self-testing, 20 amp, 125VAC.

C. Special Purpose Receptacles: Reference Drawings for NEMA Standard Specification.

D. Finish:

1. Same exposed finish as switches.

2. Receptacles installed in surface raceway to match raceway finish. See Section 26 05 33, Raceways.

3. All automatically controlled, nonlocking type, 125 volt, 15 amp and 20 amp rated receptacles to be permanently marked by the manufacturer with the "universal power" symbol and the word "controlled."

2.4 FINISH PLATES

A. Finish Plates: Type 302 stainless steel with smooth satin finish.

B. Provide telephone/signal device plates; activated outlets to have coverplates to match modular jack.

2.5 SURFACE COVERS

A. Material: Galvanized steel, drawn, 1/2-inch raised industrial type with openings appropriate for devices installed on surface receptacles.

B. Cast Box and Extension Adaptors: Aluminum with gasket, blanks single gang or 2-gang.

C. While-in-Use Weatherproof Cover: NEMA 3R when closed over energized plug. Vertical mount for duplex receptacle. Provide continuous use cover with cover capable of closing over energized cord cap with bottom aperture for cord exit.

1. Die cast cover with closed cell neoprene foam gasket: Capable of being locked closed to prevent tampering or unauthorized use.

PART 3 - EXECUTION

3.1 GENERAL INSTALLATION REQUIREMENTS

A. See Architectural elevations for location and mounting height of wiring devices. Review Architectural elevations prior to rough-in and contact Architect immediately if conflicts are found between Architectural and Electrical Drawings. Do not rough-in devices until conflicts are resolved.

B. Install wiring devices and finish plates plumb with building lines, equipment cabinets and adjacent devices. Devices not plumb will be fixed at no additional cost to Owner.

C. Orientation:

1. Install wiring devices with long dimension oriented vertically at centerline height shown on drawings or as specified.

2. Vertical Alignment: When more than one device is shown on drawings in close proximity to each other, but at different elevations, align devices on a common vertical center line for best appearance. Verify with Architect.

3. Horizontal Alignment: When more than one device is shown on drawings in close proximity to each other with same elevation, align devices on a common horizontal center line for best appearance. Verify with Architect.

D. Provide labeling per Section 26 05 53, Identification for Electrical Systems.

E. Test wiring devices to ensure electrical continuity of grounding connections, and after energizing circuitry, to demonstrate compliance with requirements. Test receptacles for line to neutral, line to ground and neutral to ground faults. Correct any defective wiring.

3.2 WALL SWITCHES INSTALLATION

A. At time of substantial completion, replace those items which have been damaged.

3.3 RECEPTACLES INSTALLATION

A. Upon installation, adhere to proper and cautious use of convenience receptacles. At time of substantial completion, replace those items which have been damaged, including those burned and scored by faulty receptacles or cord caps.

B. GFCI Receptacles: One GFCI receptacle may not be used to provide GFCI protection to downstream duplex receptacles on the same branch circuit.

3.4 FINISH PLATES INSTALLATION

A. Do not install items until finish painting is complete. Replace scratched and paint splattered finish plates and wiring devices.

3.5 SURFACE COVERS INSTALLATION

A. Do not install items until finish painting is complete. Replace scratched and paint splattered finish plates and wiring devices.

END OF SECTION 26 2726

SECTION 26 2800

OVERCURRENT PROTECTIVE DEVICES

PART 1 - GENERAL

1.1 SUMMARY

A. Work Included:

1. Fuses

2. Molded Case Circuit Breakers

3. Fuse Cabinets

1.2 RELATED SECTIONS

A. Contents of Division 26, Electrical and Division 01, General Requirements apply to this Section.

1.3 REFERENCES AND STANDARDS

A. References and Standards as required by Section 26 00 00, Electrical Basic Requirements and Division 01, General Requirements.

1.4 SUBMITTALS

A. Submittals as required by Section 26 00 00, Electrical Basic Requirements and Division 01, General Requirements.

B. In addition, provide:

1. Product data and instantaneous let-through current curves and average melting time current curves for fuses supplied to project.

2. Product data and time/current trip curves for circuit breakers supplied to project.

1.5 QUALITY ASSURANCE

A. Quality assurance as required by Section 26 00 00, Electrical Basic Requirements and Division 01, General Requirements apply to this Section.

1.6 WARRANTY

A. Warranty of materials and workmanship as required by Section 26 00 00, Electrical Basic Requirements and Division 01, General Requirements.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Fuses:

1. Bussmann
2. Ferraz-Shawmut
3. Littelfuse
4. McGraw-Edison
5. Or approved equivalent.

B. Molded Case Circuit Breakers:

1. Eaton Electrical
2. ABB/General Electric
3. Schneider Electric/Square D
4. Or approved equivalent.

C. Fuse Cabinet:

1. Bussmann
2. Circle AW
3. Ferraz-Shawmut
4. Littelfuse
5. Schneider Electric/Square D
6. Or approved equivalent.

2.2 FUSES

A. Characteristics:

1. Dual element, time delay, current limiting, nonrenewable type, rejection feature.
2. Combination Loads: UL Class RK1, RK5, or J, 1/10 to 600 amp. UL Class L, above 600 amps.
3. Motor Loads: UL Class RK5, 1/10 to 600 amp.
4. Fuse pullers for complete range of fuses.

2.3 MOLDED CASE CIRCUIT BREAKERS

A. 1-, 2- or 3-pole bolt-on, single handle common trip, 600VAC or 250VAC as indicated on Drawings.

B. Overcenter toggle-type mechanism, quick-make, quick-break action. Trip indication is by handle position.

C. Calibrate for operation in 40 degrees C ambient temperature.

D. 15 to 150 Amp Breakers: Permanent trip unit containing individual thermal and magnetic trip elements in each pole.

E. 151 to 400 Amp Breakers: Adjustable magnetic trip elements. Provide push-to-trip button on cover of breaker for mechanical tripping.

F. Greater than 401 Amp: Electronic trip type with adjustments for long-time, instantaneous, and short-time functions.

G. Circuit breakers 1200 Amp and Greater: Provide breaker with energy-reducing maintenance switching with local status indicator per CEC Article 240.87(B).

H. Provide ground fault function for breakers greater than 800 amps where applied at 480 volts line-to-line; and where indicated on drawings.

2.4 FUSE CABINET

A. Enclosure:

1. Metallic cabinet surface mounted, with internal shelves, trim cover with hinged and latched door.

2. Size cabinet such that spare fuses required by these Documents do not exceed 50 percent of cabinet volume.

B. Label: Provide engraved label to identify as spare fuse cabinet.

PART 3 - EXECUTION

3.1 GENERAL INSTALLATION REQUIREMENTS

A. Coordination:

1. Obtain and review the submitted product data for equipment furnished by the Owner, and furnished under other Divisions of this contract, particularly under Divisions 22 and 23.

2. Confirm the equipment nameplate maximum overcurrent protection (MOCP) and make accommodations and adjustments to overcurrent protective devices as necessary to coordinate with the nameplate rating.

B. Install all items in accordance with manufacturers written instructions.

3.2 FUSES

A. Fuses: For each class and ampere rating of fuse installed, provide the following quantities of spares for quantity of fuses installed:

1. 0 to 24: Provide 6 spare.

2. 25 to 48: Provide 9 spare.

3. 49 and Above: Provide 12 spare.

3.3 MOLDED CASE CIRCUIT BREAKERS

A. Provide testing of ground fault interrupting breakers.

B. Provide circuit breakers, as specified and on Drawings, for installation in panelboards, individual enclosures or combination motor starters.

C. Provide ground fault interrupter circuit breakers for equipment in damp or wet locations.

D. Provide device on handle to lock breaker in "ON" position for breakers feeding time switches, night lights and similar circuits required to be continuously energized.

E. Shunt Trip Circuit Breakers: Provide wiring to remote trip switch/contacts as indicated on Drawings.

F. Provide multi-pole branch circuit breakers for multiwire branch circuits for simultaneous disconnection of circuits.

3.4 FUSE CABINETS

A. Install fuse cabinet on wall in the Electrical Room in coordination with electrical equipment.

END OF SECTION 26 2800

SECTION 26 2816

ENCLOSED SWITCHES AND CIRCUIT BREAKERS

PART 1 - GENERAL

1.1 SUMMARY

A. Work Included:

1. Toggle Type Disconnect Switches
2. Manual Motor Starters
3. Safety Switches
4. Enclosed Circuit Breakers
5. Molded Case Switches

1.2 RELATED SECTIONS

A. Contents of Division 26, Electrical and Division 01, General Requirements apply to this Section.

B. In addition, reference the following:

1. Section 26 05 73, Electrical Distribution System Studies.
2. Section 26 24 16, Panelboards.
3. Section 26 28 00, Overcurrent Protective Devices.

1.3 REFERENCES AND STANDARDS

A. References and Standards as required by Section 26 00 00, Electrical Basic Requirements and Division 01, General Requirements.

1.4 SUBMITTALS

A. Submittals as required by Section 26 00 00, Electrical Basic Requirements and Division 01, General Requirements.

1.5 QUALITY ASSURANCE

A. Quality assurance as required by Section 26 00 00, Electrical Basic Requirements and Division 01, General Requirements.

1.6 WARRANTY

A. Warranty of materials and workmanship as required by Section 26 00 00, Electrical Basic Requirements and Division 01, General Requirements.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Toggle Type Disconnect Switches:

1. Cooper
2. Hubbell
3. Leviton
4. Legrand (Pass & Seymour)
5. Slater
6. Or approved equivalent.

B. Manual Motor Starters:

1. Eaton Electrical
2. ABB/General Electric
3. Schneider Electric/Square D
4. Or approved equivalent.

C. Safety Switches:

1. Eaton Electrical
2. ABB/General Electric
3. Schneider Electric/Square D
4. Or approved equivalent.

D. Enclosed Circuit Breakers:

1. Eaton Electrical
2. ABB/General Electric
3. Schneider Electric/Square D

4. Or approved equivalent.

E. Molded Case Switches:

1. Eaton Electrical

2. ABB/General Electric

3. Schneider Electric/Square D

4. Or approved equivalent.

2.2 TOGGLE TYPE DISCONNECT SWITCHES

A. Rating: 120 or 277 volt, 1 or 2 pole, 20 amp, 1 hp maximum.

B. Enclosure:

1. NEMA 1: Dry locations/Indoors.

2. NEMA 3R: Damp or wet locations/Outdoors.

C. Handle lockable in 'off' position.

2.3 MANUAL MOTOR STARTERS

A. Quick-Make, Quick-Break. Thermal overload protection. Device labeled with maximum voltage, current, and horsepower.

B. Enclosure:

1. NEMA 1: Dry locations/Indoors.

2. NEMA 3R: Damp or wet locations/Outdoors.

2.4 SAFETY SWITCHES

A. Heavy duty fusible type and non-fusible type (as indicated on drawings), dual rated, quick-make, quick-break with fuse rejection feature for use with Class R fuses only, unless other fuse type is specifically noted.

B. Clearly marked for maximum voltage, current, and horsepower.

C. Operable handle interlocked to prevent opening front cover with switch in 'on' position.

D. Switches rated for maximum available fault current.

E. Handle lockable in 'off' position.

F. Enclosure:

1. NEMA 1: Dry locations/Indoors.

2. NEMA 3R: Damp or wet locations/Outdoors.

G. Fusible Switch Assemblies: NEMA KS 1, quick-make, quick-break, load interrupter enclosed knife switch with externally operable handle. Provide interlock to prevent opening front cover with switch in ON position. Handle lockable in OFF position. Fuse clips: Provide fuse rejection feature for Class R or J fuses up to 600 amp. Remove if circuit breaker type is used. Provide switches of 30 to 200 amp with plug-on line side connections.

H. Fusible Switch Assemblies, 800 Amperes and Larger: Bolted pressure contact switches. Fuse Clips: Designed to accommodate Class L fuses. Provide with shunt-trip and ground fault capabilities. Remove if circuit breaker type is used.

2.5 ENCLOSED CIRCUIT BREAKERS

A. Molded case circuit breakers:

1. 1-, 2-, or 3-pole bolt on, single-handle common trip, 600VAC or 250VAC as indicated on drawings.

2. Overcenter toggle-type mechanism, quick-make, quick-break action. Trip indication is by handle position.

3. Calibrate for operation in 40C ambient temperature.

4. 15 to 150 Amp Breakers: Permanent trip unit containing individual thermal and magnetic trip elements in each pole.

5. 151 to 400 Amp Breakers: Variable magnetic trip elements. Provide push-to-trip button on cover of breaker for mechanical tripping.

6. Greater than 401 Amp: Electronic trip type with adjustments for long-time, instantaneous, and short-time functions. Provide ground fault function for breakers greater than 400 amps.

7. Provide handle mechanisms that are lockable in the open (off) position.

8. Circuit breakers to have minimum symmetrical interrupting capacity as indicated on Drawings.

B. Enclosure:

1. NEMA 1: Dry locations/Indoors.

2. NEMA 3R: Damp or wet locations/outdoors.

2.6 MOLDED CASE SWITCHES

A. Removable cover, galvanized steel enclosure, powder coat painted.

B. Provide cover padlock provision.

C. Provide trip unit with no overcurrent, overload, or low level fault protection. Trip unit to be high instantaneous magnetic fixed trip type with magnetic trip reset at factory to interrupt high fault currents at or above preset level.

D. Enclosure:

1. NEMA 1: Dry locations/Indoors.

2. NEMA 3R: Damp or wet locations/Outdoors.

PART 3 - EXECUTION

3.1 GENERAL INSTALLATION REQUIREMENTS

A. Obtain and review the submitted product data for equipment furnished by the Owner, and furnished under other Divisions of this contract, particularly under Divisions 22 and 23.

B. Confirm the equipment nameplate maximum overcurrent protection (MOCP) and make accommodations and adjustments to switches, fuses and circuit breakers as necessary to coordinate with the nameplate rating

C. Install in accordance with manufacturer's instructions.

D. Provide engraved nameplates per Section 26 05 53, Identification for Electrical Systems.

E. Provide arc flash labels per Section 26 05 73, Electrical Distribution System Studies.

F. Apply neatly typed adhesive tag on inside door of each fusible switch indicating NEMA fuse class and size installed.

3.2 TOGGLE TYPE DISCONNECT SWITCHES

A. Install fuses in fusible disconnect switches. Coordinate fuse ampere rating with installed equipment. Do not provide fuses of lower ampere rating than motor starter thermal units.

B. Install products, systems and equipment in accordance with manufacturer's written instructions and requirements.

C. See General Installation Requirements above.

3.3 MANUAL MOTOR STARTERS

A. Provide disconnecting means within sight of each motor controller and of each motor. Motor controller disconnecting means equipped with lock-out/tag-out padlock provisions do not require a disconnect switch at the controlled motor location. Locate disconnect means in view of and not inside of equipment, such that tools are not needed to remove covers to access the disconnecting means.

B. Install products, systems and equipment in accordance with manufacturer's written instructions and requirements.

C. See General Installation Requirements above.

3.4 SAFETY SWITCHES

A. Install products, systems and equipment in accordance with manufacturer's written instructions and requirements.

B. See General Installation Requirements above.

3.5 ENCLOSED CIRCUIT BREAKERS

A. Install products, systems and equipment in accordance with manufacturer's written instructions and requirements.

B. See General Installation Requirements above.

3.6 MOLDED CASE SWITCHES

A. Install products, systems and equipment in accordance with manufacturer's written instructions and requirements.

B. See General Installation Requirements above.

END OF SECTION 26 2816

SECTION 26 5100

LIGHTING

PART 1 - GENERAL

1.1 SUMMARY

A. Work Included:

1. Luminaires

2. LED Drivers

3. Emergency LED Luminaire Power Supply

B. Provide wiring for complete and operating lighting system.

1.2 RELATED SECTIONS

A. Contents of Division 26, Electrical and Division 01, General Requirements apply to this Section.

1.3 REFERENCES AND STANDARDS

A. References and Standards as required by Section 26 00 00, Electrical Basic Requirements and Division 01, General Requirements.

B. In addition, meet the following:

1. NECA 500 - Commercial Lighting.

2. UL 8750 – Light Emitting Diode (LED) equipment for use in lighting products.

1.4 SUBMITTALS

A. Submittals as required by Section 26 00 00, Electrical Basic Requirements and Division 01, General Requirements.

B. In addition, provide:

1. Submit product data for:

a. LED Luminaires: Electrical ratings, dimensions, mounting, material, clearances, terminations, wiring, connection diagram, LM-79 photometric data, LM-80 lumen depreciation data.

b. LED Drivers

c. Emergency LED Luminaire Power Supply

2. Submittal Cutsheets: Highlight, circle or otherwise graphically indicate which option(s) are being selected for the products submitted. Cutsheets that are not edited to indicate which products and options are submitted for this project or that list only catalog numbers to identify submitted options are not acceptable.

3. Specified manufacturers are approved to submit bid. However, inclusion does not relieve manufacturer from supplying product as described.

4. Provide the following operating and maintenance instructions as required by Section 26 00 00, Electrical Basic Requirements:

   a. Luminaires

   b. LED Drivers

   c. Emergency LED Luminaire Power Supply

1.5 QUALITY ASSURANCE

A. Quality assurance as required by Section 26 00 00, Electrical Basic Requirements and Division 01, General Requirements.

B. In addition, meet the following:

1. Provide luminaires acceptable to code authority for application and location installed.

2. Comply with applicable ANSI standards.

3. Comply with applicable NEMA standards.

4. Provide luminaires and lampholders that comply with UL standards and have been listed and labeled for location and use indicated by a testing agency acceptable by the AHJ (e.g., UL, ETL, and the like).

5. Comply with CEC as applicable to installation and construction of luminaires.

6. Comply with fallout and retention requirements of CBC for diffusers, baffles, and louvers.

7. Provide LED luminaires from the same manufacturer and manufacturing LED source batch for similar applications (e.g., all LED downlights from a single manufacturer and batch, all linear LED products from single manufacturer and batch).

1.6 WARRANTY

A. Warranty as required by Section 26 00 00, Electrical Basic Requirements and Division 01, General Requirements.

B. In addition, provide:

1. LED Luminaire Manufacturer's Warranty: Not less than 5 years for luminaire based on date of substantial completion. Includes normal cost of labor to replace luminaire. Replacement luminaire will match physical dimensions, physical appearance, chromaticity, lumen output and photometric characteristics of original installed equipment.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Luminaires:

1. Reference description and manufacturers in Luminaire Schedule on Drawings.

2. Or approved equivalent.

B. LED Drivers:

1. Outdoor Drivers:

a. Advance/Philips

b. Osram Sylvania

c. LG

d. Or approved equivalent.

C. Emergency LED Luminaire Power Supply:

1. Bodine

2. Hatch

3. Fulham

4. Or approved equivalent.

2.2 LUMINAIRES

A. Luminaires: Reference description and manufacturers in Luminaire Schedule on drawings.

B. Where recessed luminaires are installed in cavities intended to be insulated, provide IC rated luminaires or other code approved installation.

C. UL label luminaires installed under canopies, roof or open porches, and similar damp or wet locations, as suitable for damp or wet location.

D. Suspended luminaires: Provide minimum 24-inch adjustability in aircraft cable length where used.

E. Recessed Luminaires: Frame compatible with ceiling material installed at particular luminaire location. Provide proper factory trim and frame for luminaire to fit location and ceiling material. Verify with Architectural Reflected Ceiling Plan prior to submittals.

F. Finishes:

1. Manufacturer's standard finish (unless otherwise indicated) over corrosion resistant primer.

2. Interior Light Reflecting Finishes: White or specular finish with not less than 85 percent reflectance.

3. Exterior Finishes: As detailed in Luminaire Schedule or on drawings. Refer cases of uncertain applicability to Architect for resolution prior to release for fabrication.

G. Light Transmitting Components:

1. Plastic diffusers, molded or extruded of 100 percent virgin acrylic.

2. Prismatic acrylic, extruded, flat diffusers, 0.125-inch overall thickness, unless otherwise noted.

H. LED Luminaires:

1. UL listing of luminaire includes drivers, transformers, enclosures, rated wire, communications devices and accessories needed for a complete and functional system.

2. LM-79: Testing and measurement of absolute photometry, chromaticity (CCT) and luminaire power. Report provided by DOE certified independent testing laboratory. CCT as specified in Luminaire Schedule.

3. Standards: ANSI C78.377, LM-79 and LM-82 compliant for performance characteristics, photometry, colorimetry, efficacy and thermal characteristics.

4. LM-80 + TM-21: Testing and measurement, and statistical prediction of LED lamp life. Report provided by DOE certified independent testing laboratory.

5. LEDs in one module/luminaire: Supplied from same batch/bin and fall within 3-step MacAdam Ellipse, or as described in Luminaire Schedule, whichever is the more stringent requirement.

6. Provide luminaires with integral LED thermal management system (heat sinking).

7. Luminaires to be equipped with an LED driver that accepts 120V through 277V, 50Hz to 60Hz (universal). Component-to-component wiring within the luminaire will carry no more than 80 percent of rated current and be listed by UL for use at 600VAC at 302 degrees F/150 degrees C or higher. Plug disconnects to be listed by UL for use at 600VAC, 15A or higher.

8. Provide luminaires with individual LED arrays/modules and drivers that are accessible and replaceable from exposed side of the luminaire.

2.3 LED DRIVERS

A. General:

1. Performance: Meet dimming range called out in Luminaire Schedule, free from perceived flicker or visible stroboscopic flicker, smooth and continuous change in level (no visible steps in transitions), natural square law response to control input, and stable when input voltage conditions fluctuate over what is typically experienced in a commercial environment. Demonstration of this compliance to dimming performance will be necessary for substitutions or prior approval.

2. Ten-year expected life while operating at maximum case temperature and 90 percent non-condensing relative humidity.

3. Minimum efficiency of 85 percent, power factor greater than or equal to 0.90, compliance with reduction of hazardous substances (RoHS). Rated for operating temperature range of area in which driver is installed.

4. Limit inrush current to minimize breaker tripping.

   a. Base specification: NEMA 410 standard for inrush current for electronic drivers.

   b. Preferred Specification: Meet or exceed 30 milliamp-squared-seconds at 277VAC for up to 50 watts of load and 75 amps at 240 microseconds at 277VAC for 100 watts of load.

5. Withstand up to a 1,000 volt surge without impairment of performance as defined by ANSI C62.41 Category A.

6. No visible change in light output with a variation of plus/minus 10 percent line voltage input.

7. Total Harmonic Distortion less than 10 percent and meet ANSI C82.11 maximum allowable THD requirements at full output. THD at no point in the dimming curve allows imbalance current to exceed full output THD.

8. Support automatic adaptation, allowing for future luminaire upgrades and enhancements and deliver improved performance:

   a. Adjustment of forward LED voltage, supporting 3V through 55V.

   b. Adjustment of LED current from 150mA to 1.4A at the 100 percent control input point in increments of 1mA.

c. Adjustment for operating hours to maintain constant lumens (within 5 percent) over the 50,000 hour design life of the system, and deliver up to 20 percent energy savings early in the life cycle.

9. Operate for a (+/- 10 percent) supply voltage of 120V through 277VAC at 60Hz.

10. UL Recognized under the component program and modular for simple field replacement. Drivers that are not UL Recognized or not suited for field replacement will not be considered.

11. Ability to provide no light output when the analog control signal drops below 0.3 V, or the DALI/DMX digital signal calls for light to be extinguished and consume 0.5 watts or less in this standby. Control dead band between 0.3V and 0.65V included to allow for voltage variation of incoming signal without causing noticeable variation in luminaire to luminaire output.

B. Light Quality:

1. Over the entire range of available drive currents, driver to provide step-free, continuous dimming to black from 100 percent to 0.1 percent and 0 percent relative light output, or 100 percent to 1 percent light output and step to 0 percent where indicated. Driver to respond similarly when raising from 0 percent to 100 percent.

a. Driver must be capable of 20 bit dimming resolution for white light LED drivers or 15 bit resolution for RGBW LED drivers.

2. Driver must be capable of configuring a linear or logarithmic dimming curve, allowing fine grained resolution at low light levels.

3. Drivers to track evenly across multiple luminaires at all light levels, and must have an input signal to output light level that allows smooth adjustment over the entire dimming range.

4. Driver and luminaire electronics to deliver illumination that is free from objectionable flicker as measured by flicker index (ANSI/IES RP-16-10). At all points within the dimming range from 100 percent to 0.1 percent luminaire will have:

a. LED dimming driver to provide continuous step-free, flicker free dimming similar to incandescent source.

b. Base specification: Based on IEEE PAR1789, minimum output frequency should be greater than 1250 Hz.

c. Preferred specification: Flicker index to be equal to incandescent, less than 1 percent at all frequencies below 1000 Hz.

C. Control Input:

1. Provide control protocol to match lighting control system specified for use with luminaire.

2. 4-Wire (0-10V DC Voltage Controlled) Dimming Drivers:

a. Meet IEC 60929 Annex E for General White Lighting LED drivers.

b. Connect to devices compatible with 0 to 10V Analog Control Protocol, Class 2, capable of sinking 0.6 ma per driver at a low end of 0.3V. Limit the number of drivers on each 0-10V control output based on voltage drop and control capacity.

c. Meet ESTA E1.3 for RGBW LED drivers.

2.4 EMERGENCY LED LUMINAIRE POWER SUPPLY

A. Internal Type: Self-contained, modular, battery unit, factory mounted within luminaire body and compatible with driver. Comply with UL 924.

1. Emergency Connection: Operate one LED module continuously at a minimum output of 1400 lumens each. Connect unswitched circuit to battery unit and switched circuit to luminaire driver.

2. Test Push Button and Indicator Light: Visible and accessible without opening luminaire or entering ceiling space.

a. Push Button: Push-to-test type, in unit housing, simulates loss of normal power and demonstrates unit operability.

b. LED Indicator Light: Indicates normal power on. Normal glow indicates trickle charge; bright glow indicates charging at end of discharge cycle.

3. Battery: Sealed, maintenance-free, nickel-cadmium type. Sized for a minimum output of 90 minutes.

4. Charger: Fully automatic, solid-state, constant-current type with sealed power transfer relay.

B. External Type: Self-contained, modular, battery unit, suitable for powering one or more LED modules, remote mounted from luminaire. Comply with UL 924.

1. Emergency Connection: Operate one LED module continuously. Connect unswitched circuit to battery unit and switched circuit to luminaire driver.

2. Charger: Fully automatic, solid-state, constant-current type.

3. Housing: NEMA 250, Type 1 enclosure.

4. Test Push Button: Visible and accessible without entering ceiling space.

a. Push-to-test type, in remote unit housing, simulates loss of normal power and demonstrates unit operability.

b. LED Indicator Light: Indicates normal power on. Normal glow indicates trickle charge; bright glow indicates charging at end of discharge cycle.

c. Faceplate Finish: Verify finish with Architect for each room prior to ordering materials.

5. Battery: Sealed, maintenance-free, nickel-cadmium type. Sized for a minimum output of 90 minutes.

PART 3 - EXECUTION

3.1 GENERAL INSTALLATION REQUIREMENTS

A. Install per manufacturer's written installation instructions and requirements.

B. Install luminaires securely, in neat and workmanlike manner.

C. Install luminaires of types indicated where shown and at indicated heights in accordance with manufacturer's written instructions and with recognized industry practices to ensure that luminaires comply with requirements and serve intended purposes.

D. Wiring:

1. Recessed luminaires to be installed using flexible metallic conduit or MC Cable as allowed by Section 26 0519 with luminaire conductors spliced to branch circuit conductors in nearby accessible junction box over ceiling. Junction box fastened to building structural member within 6-feet of luminaire.

2. Luminaires for lift out and removal from ceiling pattern without disconnecting conductors or defacing ceiling materials.

3. Flexible connections where permitted to exposed luminaires; neat and straight, without excess slack, attached to support device.

4. Install junction box, flexible conduit and high temperature insulated conductors for through wiring of recessed luminaires.

E. Relamp luminaires which have failed lamps at substantial completion.

F. Replace LED drivers deemed as excessively noisy by Architect, Engineer, or Owner.

G. Install suspended luminaires and exit signs using pendants supported from swivel hangers. Provide pendant length required to suspend luminaire at indicated height.

H. Support luminaires larger than 2- by 4-foot size independent of ceiling framing.

I. Locate recessed ceiling luminaires as indicated on architectural reflected ceiling plan.

J. Install surface mounted luminaires and exit signs plumb and adjust to align with building lines and with each other. Secure to prevent movement.

K. Exposed Grid Ceilings:

1. Support surface mounted luminaires in grid ceiling directly from building structure.

2. Provide auxiliary members spanning ceiling grid members to support surface mounted luminaires.

3. Fasten surface mounted luminaires to ceiling grid members using bolts, screws, rivets, or suitable clips.

L. Install recessed luminaires to permit removal from below.

M. Install recessed luminaires using accessories and firestopping materials to meet regulatory requirements for fire rating.

N. Install clips to secure recessed grid-supported luminaires in place.

O. Install wall mounted luminaires, emergency lighting units, and exit signs at height as indicated on Architectural Drawings.

P. Install accessories furnished with each luminaire.

Q. Make wiring connections to branch circuit using building wire with insulation suitable for temperature conditions within luminaire.

R. Bond products and metal accessories to branch circuit equipment grounding conductor.

S. Install specified lamps in each emergency lighting unit, exit sign, and luminaire.

T. Where manufactured wiring assemblies are used, ensure that wiring assembly manufacturer sends components to appropriate luminaire manufacturer for respective installation of proper components.

U. Coordination:

1. Coordination of Conditions: Coordinate ceiling construction, recessing depth and other construction details prior to ordering luminaires for shipment. Refer cases of uncertain applicability to Architect for resolution prior to release of luminaires for shipment. Where luminaires supplied do not match ceiling construction, replace luminaires at no cost to Owner.

2. Electrical drawings are schematic, identifying quantity and type of luminaires used and their approximate location, but are not to be used for dimensional purposes. Reference architectural drawings for exact locations, including mounting heights.

3. Provide lighting indicated on drawings with luminaire of the type designated and appropriate for location.

4. Provide LED luminaires with driver compatible to lighting control system as shown in drawings and as specified.

5. Where remote drivers are required, ensure adequate accessibility to driver. Upsize conductors between luminaire and driver to accommodate voltage drop.

V. Field Quality Control:

1. Perform field inspection in accordance with Division 01, General Requirements.

2. Operate each luminaire after installation and connection. Inspect for proper connection and operation.

W. Cleaning:

1. Clean electrical parts to remove conductive and deleterious materials.

2. Remove dirt and debris from enclosures.

3. Clean paint splatters, dirt, dust, fingerprints, and debris from luminaires.

4. Clean photometric control surfaces as recommended by manufacturer.

5. Clean finishes and touch up damaged finishes per by manufacturer's instructions.

X. Demonstrate luminaire operation for minimum of two hours.

3.2 LUMINAIRES

A. Install per manufacturer's written installation instructions and requirements.

B. Align, mount and level luminaires uniformly. Use ball hangers for suspended stem mounted luminaires.

C. Avoid interference with and provide clearance from equipment. Where indicated locations for luminaires conflict with locations for equipment, change locations for luminaire by minimum distance necessary as directed by Architect.

D. Suspended Luminaires: Mounting heights indicate clearances between bottom of luminaire and finished floors.

E. Emergency Egress Luminaires: Provide unswitched circuit for battery charging and autotransfer circuiting for exit signs and luminaires with integral batteries. Where test switch cannot be integral to luminaire, mount remote test switch flush-to-ceiling and adjacent to egress luminaire.

F. Interior Luminaire Supports:

1. Support Luminaires: Anchor supports to structural slab or to structural members within a partition, or above a suspended ceiling.

2. Maintain luminaire positions after cleaning and relamping.

3. Support luminaires without causing ceiling or partition to deflect.

4. Provide mounting supports for recessed and pendant mounted luminaires as required by CBC.

G. Adjusting:

1. Aim and adjust luminaires as indicated.

2. Focus and adjust floodlights, spotlights and other adjustable luminaires, with Architect, at such time of day or night as required.

3. Align luminaires that are not straight and parallel/perpendicular to structure.

4. Position exit sign directional arrows as indicated.

3.3 LED DRIVERS

A. Install lamps per manufacturer's installation instructions and requirements.

B. Where driver is remote mounted, size wiring based on type of driver, driver distance from luminaire, and voltage/power level, and manufacturer's installation instructions.

C. Protect 0-10V input from line voltage mis-connection, and so it will be immune and the output unresponsive to induced AC voltage on the control leads.

END OF SECTION 26 5100

SECTION 27 0000

COMMUNICATIONS BASIC REQUIREMENTS

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Work included in 27 00 00, Communications Basic Requirements applies to Division 27, Communications work to provide materials, labor, tools, permits, incidentals, and other services to provide and make ready for Owner's use of communications systems for proposed project.

B. Contract Documents include, but are not limited to, Specifications including Division 00, Procurement and Contracting Requirements and Division 01, General Requirements, Drawings, Addenda, Owner/Architect Agreement, and Owner/Contractor Agreement. Confirm requirements before commencement of work.

C. Definitions:

1. Provide: To furnish and install, complete and ready for intended use.

2. Furnish: Supply and deliver to project site, ready for unpacking, assembly and installation.

3. Install: Includes unloading, unpacking, assembling, erecting, installation, applying, finishing, protecting, cleaning and similar operations at project site as required to complete items of work furnished.

4. Approved or Approved Equivalent: To possess the same performance qualities and characteristics and fulfill the utilitarian function without any decrease in quality, durability or longevity. For equipment/products defined by the Contractor as "equivalent," substitution requests must be submitted to Engineer for consideration, in accordance with Division 01, General Requirements, and approved by the Engineer prior to submitting bids for substituted items.

5. Authority Having Jurisdiction (AHJ): Indicates reviewing authorities, including local fire marshal, Owner's insurance underwriter, Owner's Authorized Representative, and other reviewing entity whose approval is required to obtain systems acceptance.

6. Entrance Facility (EF): Area or location that contains entrance point (demarcation) cable and associated equipment for telecommunication services entering the building.

7. Equipment Room (ER): Area or location that contains backbone cabling associated with interbuilding cable or cable that connects buildings together in a campus environment. ERs may contain Main Cross-Connects, Intermediate Cross-Connects, Horizontal Cross-Connects, and Telecommunication Rooms.

8. Main Telecommunications MDF Room (MDF) - is the central connection point between the Campus and the Local Exchange Carrier (LEC), Competitive Local Exchange Carriers (CLEC) or Internet Service Provides (ISP). This room or space is considered by the carriers

as the Minimum Point of Entry (MPOE) and demarcation point for communication services delivered to the Campus from external service providers and is located in B1900A.

9. Building Telecommunications Room (BDF) - is the main point of connectivity from the building to the outside plant infrastructure.

10. Telecommunications IDF Room (IDF) - located on each floor or building quadrant, and houses telecommunications equipment, cable terminations, and network equipment.

11. Intermediate Cross-Connect (IC): Area or location that contains telecommunications equipment for connecting backbone cable from the MC to backbone cable distributing to one or many Horizontal Cross-Connects. This location may contain active telecommunications equipment.

12. Horizontal Cross-Connect (HC): Area or location that contains telecommunications equipment, cable terminations and cross-connect wiring. HC is the recognized connection point between backbone and horizontal pathway facilities.

13. Telecommunications Room (TR): Area or location containing telecommunications equipment, cable terminations and cross-connect wiring. Three applications serviced by TRs are horizontal cable connections, backbone system interconnection and entrance facilities. The TR provides facilities (space, power, grounding, etc.) for housing telecommunications equipment. TR may contain a MC, IC or HC and a demarcation point or an interbuilding entrance facility.

14. Interbuilding Cable: Backbone cable associated with connecting buildings together in a multibuilding or campus environment.

15. Intrabuilding Cable: Backbone cable associated with connecting Entrance Facility, Equipment Rooms, Main Cross-Connects, Intermediate Cross-Connects, Horizontal Cross-Connects, and Telecommunication Rooms together on single floor or multifloor building.

1.2 RELATED SECTIONS

A. Contents of Section applies to Division 27, Communications Contract Documents.

B. Related Work:

1. Additional conditions apply to this Division including, but not limited to:

a. Specifications including Division 00, Procurement and Contracting Requirements and Division 01, General Requirements.

b. Drawings

c. Addenda

d. Owner/Architect Agreement

e. Owner/Contractor Agreement

f. Codes, Standards, Public Ordinances and Permits

C. Related Products/Systems within Division 28, Electronic Safety and Security:

1. Section 28 10 00, Access Control and Intrusion Detection

2. Section 28 23 00, Video Surveillance

1.3 REFERENCES AND STANDARDS

A. References and Standards per Division 00, Procurement and Contracting Requirements and Division 01, General Requirements, individual Division 27, Communications Sections and those listed in this Section.

B. Codes to include latest adopted editions, including current amendments, supplements and local jurisdiction requirements in effect as of the date of the Contract Documents, of/from:

1. State of California:

a. CBC - California Building Code

b. CEC - California Electrical Code

c. CEC T24 - California Energy Code Title 24

d. CFC - California Fire Code

e. CMC - California Mechanical Code

f. CPC - California Plumbing Code

g. CSFM - California State Fire Marshal

h. DSA - Division of State Architect Regulations and Requirements

C. Reference standards and guidelines include but are not limited to the latest adopted editions from:

1. ABA - Architectural Barriers Act

2. ADA - Americans with Disabilities Act

3. ANSI - American National Standards Institute

a. ANSI/TIA-568-0.E - Generic Telecommunications Cabling for Customer Premises

b. ANSI/TIA-568-0.E - Commercial Building Telecommunications Cabling Standard

c. ANSI/TIA-568-2.D - Balanced Twisted-Pair Telecommunications Cabling and Components Standard

d. ANSI/TIA-568-3.D-1 - Optical Fiber Cabling Components Standard. Commercial Building Telecommunicating Cabling Standard

e. ANSI/TIA-569-E - Commercial Building Standard for Telecommunications Pathways and Spaces

f. ANSI/TIA-570-D - Residential Telecommunications Infrastructure

g. ANSI/TIA-942 - Telecommunications Infrastructure Standard for Data Centers

h. ANSI/TIA/EIA-606-C - Administration Standard for Commercial Telecommunications Infrastructure

i. ANSI-J-STD-607-D - Commercial Building Grounding (Earthing) and Bonding Requirements for Telecommunications

4. APWA - American Public Works Association

5. ASCE - American Society of Civil Engineers

6. ASHRAE Guideline 0, the Commissioning Process

7. ASTM - ASTM International

8. BICSI - Building Industry Consulting Service International

   a. BICSI TDMM - Telecommunications Distribution Methods Manual current edition

   b. BICSI ESSDRM - Electronic Safety & Security Design Reference Manual current edition

   c. BICSI AVDRM - AV Design Reference Manual current edition

9. CFR - Code of Federal Regulations

10. EIA - Electronic Industries Association

11. EPA - Environmental Protection Agency

12. ETL - Electrical Testing Laboratories

13. FCC - Federal Communications Division

14. FM - FM Global

15. IBC - International Building Code

16. IEC - International Electrotechnical Commission

17. IEEE - Institute of Electrical and Electronics Engineers

18. ISO - International Organization for Standardization

19. MSS - Manufacturers Standardization Society

20. NEC - National Electric Code

21. NEMA - National Electrical Manufacturers Association

22. OSHA - Occupational Safety and Health Administration

23. TIA - Telecommunications Industry Association

24. UL - Underwriters Laboratories Inc.

D. See Division 27, Communications individual Sections for additional references.

1.4 SUBMITTALS

A. See Division 01, General Requirements for Submittal Procedures.

B. Provide drawings in format and software release equal to the design documents. Drawings to be the same sheet size and scale as the Contract Documents.

C. In addition:

1. "No Exception Taken" constitutes that review is for general conformance with the design concept expressed in the Contract Documents for the limited purpose of checking for conformance with information given. Any action is subject to the requirements of the Contract Documents. Contractor is responsible for the dimensions and quantity and will confirm and correlate at the job site, fabrication processes and techniques of construction, coordination of the work with that of all other trades, and the satisfactory performance of the work.

2. Provide product submittals and shop drawings in electronic format only. Electronic format must be submitted via zip file via e-mail. For electronic format, provide one file per division containing one bookmarked PDF file with each bookmark corresponding to each Specification Section. Arrange bookmarks in ascending order of Specification Section number. Individual submittals sent piecemeal in a per Specification Section method will be returned without review or comment. Copy Architect on all transmissions/submissions.

3. Product Data: Provide manufacturer's descriptive literature for products specified in Division 27, Communications Sections.

4. Identify/mark each submittal in detail. Note what differences, if any, exist between the submitted item and the specified item. Failure to identify the differences will be considered cause for disapproval. If differences are not identified and/or not discovered during the submittal review process, Contractor remains responsible for providing equipment and materials that meet the specifications and Drawings.

a. Label submittal to match numbering/references as shown in Contract Documents. Highlight and label applicable information to individual equipment or cross out/remove extraneous data not applicable to submitted model. Clearly note options and accessories to be provided, including field installed items. Highlight connections by/to other trades.

b. Include technical data, installation instructions and dimensioned drawings for products, fixtures, equipment and devices installed, furnished or provided. Reference individual Division 27, Communications specification Sections for specific items required in product data submittal outside of these requirements.

c. See Division 27, Communications individual Sections for additional submittal requirements outside of these requirements.

5. Maximum of two reviews of complete submittal package. Arrange for additional reviews and/or early review of long-lead items; Bear costs of additional reviews at Engineer's hourly rates. Incomplete submittal packages/submittals will be returned to contractor without review.

6. Resubmission Requirements: Make corrections or changes in submittals as required, and in consideration of Engineer’s comments. Identify Engineer’s comments and provide an individual response to each of the Engineer’s comments. Cloud changes in the submittals and further identify changes which are in response to Engineer’s comments.

7. Structural/Seismic: Provide weights, dimensions, mounting requirements and like information required for mounting, seismic bracing, and support. Indicate manufacturer's installation and support requirements to meet ASCE 7-10 requirements for non-structural components. Provide engineered seismic drawings and equipment seismic certification. Equipment Importance Factor as specified in Division 01 and in Structural documents.

8. Trade Coordination: Include physical characteristics, electrical characteristics, device layout plans, wiring diagrams, and connections as required per Division 27, Communications Coordination Documents. For equipment with electrical connections, furnish copy of approved submittal for inclusion in Division 26, Electrical submittals.

9. Make provisions for openings in building for admittance of equipment prior to start of construction or ordering of equipment.

10. Substitutions and Variation from Basis of Design:

a. The Basis of Design designated product establishes the qualities and characteristics for the evaluation of any comparable products by other listed acceptable manufacturers if included in this Specification or included in an approved Substitution Request as judged by the Design Professional.

b. If substitutions and/or equivalent equipment/products are being proposed, it is the responsibility of parties concerned, involved in, and furnishing the substitute and/or equivalent equipment to verify and compare the characteristics and requirements of that furnished to that specified and/or shown. If greater capacity and/or more

materials and/or more labor is required for the rough-in, circuitry or connections than for the item specified and provided for, then provide compensation for additional charges required for the proper rough-in, circuitry and connections for the equipment being furnished. No additional charges above the Base Bid, including resulting charges for work performed under other Divisions, will be allowed for such revisions. Coordinate with the requirements of "Submittals." For any product marked "or approved equivalent," a substitution request must be submitted to Engineer for approval prior to purchase, delivery or installation.

11. Shop Drawings:

    a. Provide coordinated Shop Drawings which include physical characteristics of all systems, device layout plans, and control wiring diagrams. Reference individual Division 27, Communications specification Sections for additional requirements for Shop Drawings outside of these requirements.

    b. Provide Shop Drawings indicating access panel locations, size and elevation for approval prior to installation.

12. Samples: Provide samples when requested by individual Sections.

13. Resubmission Requirements:

    a. Make any corrections or change in submittals when required. Provide submittals as specified. The engineer will not be required to edit and/or interpret the Contractor's submittals. Changes made for the resubmittal will be indicated in a cover letter with reference to page(s) changed and will reference response to comment. Indicate changes for the resubmittal in a cover letter with reference to page(s) changed and reference response to comment. Cloud changes in the submittals.

    b. Resubmit for review until review indicates no exception taken, or "make corrections as noted."

    c. When submitting Drawings for Engineers re-review, clearly indicate changes on Drawings and "cloud" any revisions. Submit a list describing each change.

14. Operation and Maintenance Manuals, Owner's Instructions:

    a. Submit, at one time, electronic files (PDF format) of manufacturer's operation and maintenance instruction manuals and parts lists for equipment or items requiring servicing. Submit data when work is substantially complete and in same order format as submittals. Include name and location of source parts and service for each piece of equipment.

        1) Include copy of approved submittal data along with submittal review letters received from Engineer. Data to clearly indicate installed equipment model numbers. Delete or cross out data pertaining to other equipment not specific to this project.

2) Include copy of manufacturer's standard Operations and Maintenance for equipment. At front of each tab, provide routine maintenance documentation for scheduled equipment. Include manufacturer's recommended maintenance schedule and highlight maintenance required to maintain warranty. Furnish list of routine maintenance parts, including part numbers, sizes, quantities, relevant to each piece of equipment: batteries, lamp lenses, speakers and filters.

3) Include Warranty per Division 00, Procurement and Contracting Requirements and Division 01, General Requirements, Section 27 00 00, Communications Basic Requirements and individual Sections.

4) Include product certificates of warranties and guarantees.

5) Include copy of complete parts list for equipment. Include available exploded views of assemblies and subassemblies.

6) Include copy of burn-in and test reports specific to each piece of equipment.

7) Include copy of software/appliance programming.

8) Include commissioning reports.

9) Engineer will return incomplete documentation without review. Engineer will provide one set of review comments in Submittal Review format. Contractor must arrange for additional reviews; Contractor to bear costs for additional reviews at Engineer's hourly rates.

b. Thoroughly instruct Owner in proper operation of equipment and systems. Where noted in individual Sections, training will include classroom instruction with applicable training aids and systems demonstrations. Submit copy of material used for Owner instruction. Field instruction per Section 27 00 00, Communications Basic Requirements Article titled "Demonstration."

c. Copies of certificates of code authority inspections, acceptance, code required acceptance tests, letter of conformance and other special guarantees, certificates of warranties, specified elsewhere or indicated on Drawings.

15. Record Drawings:

a. Maintain at site at least one set of drawings for recording “as-constructed” conditions. Indicate on Drawings changes to original documents by referencing revision document, and include buried elements, location of conduit, and location of concealed communication items. Include items changed by field orders, supplemental instructions, and constructed conditions.

b. Record Drawings are to include equipment and fixture/connection schedules that accurately reflect "as constructed or installed" for project.

c. At completion of project, input changes to original project on CAD Drawings and make one set of black-line Drawings created from CAD Files in version/release equal to Contract Drawings. Submit CAD disk and Drawings upon substantial completion.

d. Invert elevations and dimensioned locations for incoming utilities and site raceways below grade extending to 5-feet outside building line.

e. See Division 27, Communications individual Sections for additional items to include in Record Drawings.

1.5 QUALITY ASSURANCE

A. Regulatory Requirements: Work and materials installed to conform with all local, State and Federal codes, and other applicable laws and regulations. Where code requirements are at variance with Contract Documents, meet code requirements as a minimum requirement and include costs necessary to meet these in Contract. Machinery and equipment are to comply with OSHA requirements, as currently revised and interpreted for equipment manufacturer requirements. Install equipment provided per manufacturer recommendations.

B. Whenever this Specification calls for material, workmanship, arrangement or construction of higher quality and/or capacity than that required by governing codes, higher quality and/or capacity take precedence.

C. Drawings are intended to be diagrammatic and reflect the Basis of Design manufacturer's equipment. They are not intended to show every item in its exact dimensions, or details of equipment or proposed systems layout. Verify actual dimensions of systems (i.e., conduit) and equipment proposed to assure that systems and equipment will fit in available space. Contractor is responsible for design and construction costs incurred for equipment other than Basis of Design, including, but not limited to, architectural, structural, electrical, HVAC, fire sprinkler, and plumbing systems.

D. Manufacturer's Instructions: Follow manufacturer's written instructions. If in conflict with Contract Documents, obtain clarification. Notify Engineer/Architect, in writing, before starting work.

E. Items shown on Drawings are not necessarily included in Specifications or vice versa. Confirm requirements in all Contract Documents.

F. Provide products that are UL listed.

G. Contractor Qualifications:

1. Minimum of five years experience in the design, installation, testing and maintenance of communications systems.

2. Must employ at least one full time BICSI certified Registered Communications Distribution Designer (RCDD) who is involved in reviewing work performed by contractor on this project.

3. Maintain a local service facility which stocks spare devices and/or components for servicing systems.

4. Have performed successful installation and maintenance of at least three projects similar in scope and size. Be able to provide project references for these three projects, including scope of Work, project type, Owner/user contact name and telephone number.

5. The contractor selected for this project must be certified by the manufacturer of the approved products and utilize these components for completion of work.

1.6 WARRANTY

A. Provide written warranty covering the work for a period of one year from date of Substantial Completion in accordance with Division 00, Procurement and Contracting Requirements and Division 01, General Requirements, Section 27 00 00, Communications Basic Requirements and individual Division 27, Communications Sections.

B. For Backbone and Horizontal Cabling: Provide:

1. Labor, materials and documentation according to selected manufacturer requirements necessary to ensure that the Owner will be furnished with Commscope Extended Product Warranty and Application Assurance of a minimum of 25 years in length. The Application Assurance Warranty will cover the failure of the wiring system to support current or future applications that are designed for the link/channel specifications of ANSI/TIA/EIA-568-C.

2. Provide a warranty on the physical installation.

3. Furnish necessary documentation required by the manufacturer immediately following 100 percent testing of cables.

4. Administer the warranty process with the responsible manufacturer's representative. Provide warranty directly to the Owner from the manufacturer. Ensure that the manufacturer provides the Owner with the appropriate warranty certification within 90 calendar days of the final project completion

C. Sections under this Division can require additional and/or extended warranties that apply beyond basic warranty under Division 01, General Requirements and the General Conditions. Confirm requirements in all Contract Documents.

1.7 COORDINATION DOCUMENTS

A. Prior to construction, prepare and submit coordinated layout Drawings (composite drawings), to coordinate installation and location of ductwork, grilles, diffusers, piping, fire sprinklers, plumbing, lights, and electrical services. Composite Drawings show services on single sheet. Key Drawings to structural column identification system. Prior to completion of Drawings, coordinate proposed installation with architectural and structural requirements, and other trades (including plumbing, HVAC, fire protection, electrical, ceiling suspension, and ceiling tile systems, etc.), and provide maintenance access requirements. Coordinate with submitted architectural systems (i.e. roofing, ceiling, finishes) and structural systems as submitted,

including footings and foundation. Identify zone of influence from footings and ensure systems are not routed within the zone of influence. Unless otherwise required by Division 00, Procurement and Contracting Requirements and/or Division 01, General Requirements, Division 27, Communications to combine information furnished by other trades onto master coordination documents.

B. Prepare Drawings as follows:

1. Drawings in CAD Format. CAD format release equal to design documents. Drawings to be same sheet size and scale as Contract Drawings and indicate location, size and elevation above finished floor of equipment and distribution systems.

2. Review and revise, as necessary, section cuts in Contract Drawings after verification of field conditions.

3. Incorporate addenda items and change orders.

4. Provide additional coordination as requested by other trades.

C. Advise Architect in event conflict occurs in location or connection of equipment. Bear costs resulting from failure to properly coordinate installation or failure to advise Architect of conflict.

D. Verify in field exact size, location, invert, and clearances regarding existing material, equipment and apparatus, and advise Architect of discrepancies between that indicated on Drawings and that existing in field prior to installation related thereto.

E. Submit final Coordination Drawings with changes as Record Drawings at completion of project.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Articles, fixtures, and equipment of a kind to be standard product of one manufacturer, including but not limited to jacks, patch panels, equipment connection cords and wall plates.

2.2 STANDARDS OF MATERIALS AND WORKMANSHIP

A. Base contract upon furnishing materials as specified. Materials, equipment, and fixtures used for construction are to be new, latest products as listed in manufacturer's printed catalog data and are to be UL approved or have adequate approval or be acceptable by State, County, and City authorities. Equipment/fixture supplier is responsible for obtaining state, county, and city acceptance on equipment/fixture not UL approved or not listed for installation.

B. Names and manufacturer's names denote character and quality of equipment desired and are not to be construed as limiting competition.

C. Hazardous Materials:

1. Comply with local, State of California, and Federal regulations relating to hazardous materials.

2. Comply with Division 00, Procurement and Contracting Requirements and Division 01, General Requirements for this project relating to hazardous materials.

3. Do not use any materials containing a hazardous substance. If hazardous materials are encountered, do not disturb; immediately notify Owner and Architect. Hazardous materials will be removed by Owner under separate contract.

PART 3 - EXECUTION

3.1 ACCESSIBILITY AND INSTALLATION

A. Confirm Accessibility and Installation requirements in Division 00, Procurement and Contracting Requirements, Division 01, General Requirements, Section 27 00 00, Communications Basic Requirements and individual Division 27, Communications Sections.

B. Install equipment requiring access (i.e., amplifiers, taps, zone controllers, volume controls, and storage devices) so that they may be serviced, reset, replaced or recalibrated by service people with normal service tools and equipment. Do not install equipment in obvious passageways, doorways, scuttles or crawlspaces which would impede or block intended usage.

C. Install equipment and products complete as directed by manufacturer's installation instructions. Obtain installation instructions from manufacturer prior to rough-in of equipment and examine instructions thoroughly. When requirements of installation instructions conflict with Contract Documents, request clarification from Architect prior to proceeding with installation. This includes proper installation methods, sequencing and coordination with other trades and disciplines.

D. Earthwork:

1. Confirm Earthwork requirements in Contract Documents. In absence of specific requirements, comply with individual Division 27, Communications Sections and the following:

a. Perform excavation, dewatering, shoring, bedding, and backfill required for installation of work in this Division in accordance with related earthwork divisions. Contact utilities and locate existing utilities prior to excavation. Repair any work damaged during excavation or backfilling.

b. Excavation: Do not excavate under footings, foundation bases, or retaining walls.

c. Provide protection of underground systems. Review the project Geotechnical Report for references to corrosive or deleterious soils which will reduce the performance or service life of underground systems materials.

E. Firestopping:

1. Confirm Firestopping requirements in Division 07, Thermal and Moisture Protection. In absence of specific requirements, comply with individual Division 27, Communications Sections and the following:

a. Coordinate location and protection level of fire and/or smoke rated walls, ceilings, and floors. When these assemblies are penetrated, seal around piping, ductwork and equipment with approved firestopping material. Install firestopping material complete as directed by manufacturer's installation instructions. Meet requirements of ASTM E814, Standard Test Method for Fire Tests of Through-Penetration Fire Stops.

F. Plenums: In plenums, provide plenum rated materials that meet the requirements to be installed in plenums. Immediately notify Architect/Engineer of discrepancy.

3.2 SEISMIC CONTROL

A. Confirm Seismic Control requirements in Division 01, General Requirements, Structural documents, and individual Division 27 Communications Sections.

B. General:

1. Earthquake resistant designs for Communications (Division 27) equipment and distribution, i.e. cabinets and racks, ceiling assemblies, raceways, ladder racking, etc. to conform to regulations of jurisdiction having authority.

2. Restraints which are used to prevent disruption of function of piece of equipment because of application of horizontal force to be such that forces are carried to frame of structure in such a way that frame will not be deflected when apparatus is attached to a mounting base and equipment pad, or to structure in normal way, utilizing attachments provided. Secure equipment and distribution systems to withstand a force in direction equal to value defined by jurisdiction having authority.

3. Provide stamped Shop Drawings from licensed Structural Engineer of seismic bracing and seismic movement assemblies for cabinets, racks, major equipment and overhead raceways. Engineer to design and provide stamped Shop Drawings cabinets, racks, major equipment and overhead raceway. Submit Shop Drawings along with equipment submittals.

4. Provide stamped Shop Drawings from licensed Structural Engineer of seismic flexible joints for piping and crossing building expansion or seismic joints. Submit Shop Drawings along with seismic bracing details.

5. Provide means to prohibit excessive motion of communications equipment during earthquake.

3.3 REVIEW AND OBSERVATION

A. Confirm Review and Observation requirements in Division 00, Procurement and Contracting Requirements and Division 01, General Requirements, Section 27 00 00, Communications Basic Requirements and individual Division 27, Communications Sections.

B. Notify Architect, in writing, at following stages of construction so that they may, at their option, visit site for review and construction observation:

1. Underground conduit installation prior to backfilling.

2. Prior to ceiling cover/installation.

3. When main systems, or portions of, are being tested and ready for inspection by AHJ.

C. Final Punch: Costs incurred by additional trips required due to incomplete systems will be the responsibility of the Contractor.

3.4 CONTINUITY OF SERVICE

A. Confirm requirements in Division 00, Procurement and Contracting Requirements and Division 01, General Requirements. In absence of specific requirements, comply with individual Division 27, Communications Sections and the following:

1. During remodeling or addition to existing structures, or addition of a structure to existing structure, while existing structure is occupied, current services to remain intact until new construction, facilities or equipment is installed.

2. Prior to changing over to new service, verify that every item is thoroughly prepared. Install new wiring to point of connection.

3. Coordinate transfer time to new service with Owner. If required, perform transfer during off peak hours. Once changeover is started, pursue to its completion to keep interference to a minimum. If overtime is necessary, there will be no allowance made by Owner for extra expense for such overtime or shift work.

4. Organize work to minimize duration of power interruption.

3.5 CUTTING AND PATCHING

A. Confirm Cutting and Patching Requirements in Division 00, Procurement and Contracting Requirements and Division 01, General Requirements. In absence of specific requirements, comply with individual Division 27, Communications Sections and the following:

1. Proposed floor cutting/core drilling/sleeve locations to be approved by Project Structural Engineer. Submit proposed locations to Architect/Project Structural Engineer. Where slabs are of post tension construction, perform x-ray scan of proposed penetration locations and submit scan results including proposed penetration locations to Project Structural Engineer/Architect for approval. Where slabs are of waffle type construction, show column cap extent and cell locations relative to proposed penetration(s).

2. Cutting, patching and repairing for work specified in this Division including plastering, masonry work, concrete work, carpentry work, and painting included under this Section will be performed by skilled craftsmen of each respective trade in conformance with appropriate Division of Work.

3. Additional openings required in building construction to be made by drilling or cutting. Use of jack hammer is specifically prohibited. Patch openings in and through concrete and masonry with grout.

4. Restore new or existing work that is cut and/or damaged to original condition. Patch and repair specifically where existing items have been removed. This includes repairing and painting walls, ceilings, etc. where existing conduit and devices are removed as part of this project. Where alterations disturb lawns, paving, and walks, surfaces to be repaired, refinished and left in condition matching existing prior to commencement of work.

5. Additional work required by lack of proper coordination will be provided at no additional cost to the Owner.

3.6 EQUIPMENT SELECTION AND SERVICEABILITY

A. Replace or reposition equipment which is too large or located incorrectly to permit servicing, at no additional cost to Owner.

3.7 DELIVERY, STORAGE AND HANDLING

A. Confirm requirements in Division 00, Procurement and Contracting Requirements and Division 01, General Requirements. In absence of specific requirements, comply with individual Division 27, Communications Sections and the following:

1. Handle materials delivered to project site with care to avoid damage. Store materials on site inside building or protected from weather, dirt and construction dust. Insulation and lining that becomes wet from improper storage and handling to be replaced before installation. Products and/or materials that become damaged due to water, dirt and/or dust as a result of improper storage to be replaced before installation.

2. Protect all equipment and conduit to avoid damage. Close conduit openings with caps or plugs. Keep motors and bearings in watertight and dustproof covers during entire course of installation.

3.8 DEMONSTRATION

A. Confirm Demonstration requirements in Division 00, Procurement and Contracting Requirements and Division 01, General Requirements, Section 27 00 00, Communications Basic Requirements and individual Division 27, Communications Sections.

B. Upon completion of work and adjustment of equipment and test systems, demonstrate to Owner's Authorized Representative, Architect and Engineer that equipment furnished and installed or connected under provisions of these Specifications functions in manner required. Provide field instruction to Owner's Maintenance Staff as specified in Division 01, General Requirements, Section 27 00 00, Communications Basic Requirements and individual Division 27, Communications Sections.

C. Manufacturer's Field Services: Furnish services of a qualified person at time approved by Owner, to instruct maintenance personnel, correct defects or deficiencies, and demonstrate to

satisfaction of Owner that entire system is operating in satisfactory manner and complies with requirements of other trades that may be required to complete work. Complete instruction and demonstration prior to final job site observations.

3.9 CLEANING

A. Confirm Cleaning requirements in Division 00, Procurement and Contracting Requirements, Division 01, General Requirements, Section 27 00 00, Communications Basic Requirements and individual Division 27, Communications Sections.

B. Upon completion of installation, thoroughly clean exposed portions of equipment, removing temporary labels and traces of foreign substances. Throughout work, remove construction debris and surplus materials accumulated during work.

3.10 INSTALLATION

A. Confirm Installation requirements in Division 00, Procurement and Contracting Requirements and Division 01, General Requirements, Section 27 00 00, Communications Basic Requirements and individual Division 27, Communications Sections.

B. Install equipment and devices in accordance with manufacturer's installation instructions, plumb and level and firmly secured to mounting surfaces. Maintain manufacturer's recommended clearances.

C. Start up equipment, in accordance with manufacturer's start-up instructions, and in presence of manufacturer's representative. Test operation and demonstrate compliance with requirements. Replace damaged or malfunctioning equipment.

D. Provide miscellaneous supports/metals required for installation of equipment.

3.11 PAINTING

A. Confirm Painting requirements in Division 01, General Requirements and Division 09, Finishes. In absence of specific requirements, comply with individual Division 27, Communications Sections and the following:

1. Ferrous Metal: After completion of communications work, thoroughly clean and paint exposed supports constructed of ferrous metal surfaces in telecommunications rooms, i.e., hangers, hanger rods, equipment stands, with one coat of black asphalt varnish for exterior or black enamel for interior, suitable for hot surfaces.

2. In a telecommunications room, on roof or other exposed areas, equipment not painted with enamel to receive two coats of primer and one coat of rustproof enamel, colors as selected by Architect.

3. See individual equipment Specifications for other painting.

4. Structural Steel: Repair damage to structural steel finishes or finishes of other materials damaged by cutting, welding or patching to match original.

5. Conduit: Clean, primer coat and paint interior conduit exposed in finished areas with two coats paint suitable for metallic surfaces. Color selected by Architect.

6. Covers: Covers such as manholes, vaults and the like will be furnished with finishes which resist corrosion and rust.

3.12 ACCEPTANCE

A. Confirm requirements in Division 00, Procurement and Contracting Requirements and Division 01, General Requirements. In absence of specific requirements, comply with individual Division 27, Communications Sections and the following:

1. System cannot be considered for acceptance until work is completed and demonstrated to Architect that installation is in strict compliance with Specifications, Drawings and manufacturer's installation instructions, particularly in reference to following:

a. Testing Reports

b. Cleaning

c. Operation and Maintenance Manuals

d. Training of Operating Personnel

e. Record Drawings

f. Warranty and Guaranty Certificates, including extended manufacturer's warranties.

g. Start-up/test Documents and Commissioning Reports

3.13 FIELD QUALITY CONTROL

A. Confirm Field Quality Control requirements in Division 00, Procurement and Contracting Requirements and Division 01, General Requirements, Section 27 00 00, Communications Basic Requirements and individual Division 27, Communications Sections.

B. Tests:

1. Conduct tests of equipment and systems to demonstrate compliance with requirements specified. Reference individual Specification Sections for required tests. Document tests and include in Operation and Maintenance Manuals.

2. During site evaluations by Architect or Engineer, provide appropriate personnel with tools to remove and replace trims, covers, and devices so that proper evaluation of installation can be performed.

3.14 LETTER OF CONFORMANCE

A. Provide Letter of Conformance, copies of manufacturers' warranties and extended warranties with a statement that Communications items were installed in accordance with manufacturer's recommendations, UL listings and FM Global approvals. Include Letter of Conformance, copies of manufacturers' warranties and extended warranties in Operation and Maintenance Manuals.

END OF SECTION 27 0000

SECTION 27 0528

PATHWAYS FOR COMMUNICATIONS SYSTEMS

PART 1 - GENERAL

1.1 SUMMARY

A. Work Included:

1. Electrical Metallic Tubing and Fittings

2. Telecommunications Outlet Boxes

3. J-Hooks

B. This Section specifies the requirements to provide communications conduit raceways, boxes, cable trays, innerduct and fittings.

1.2 RELATED SECTIONS

A. Contents of Division 27, Communications and Division 01, General Requirements apply to this Section.

1.3 REFERENCES AND STANDARDS

A. References and Standards as required by Section 27 00 00, Communications Basic Requirements and Division 01, General Requirements.

1.4 SUBMITTALS

A. Submittals as required by Section 27 00 00, Communications Basic Requirements and Division 01, General Requirements.

B. Provide plan drawings showing completions and as-built corrections which indicate type, size, placement, routing and/or length for raceway and cable tray components; e.g., manholes, handholes, conduit, boxes, enclosures, etc.

1.5 QUALITY ASSURANCE

A. Quality assurance as required by Section 27 00 00, Communications Basic Requirements and Division 01, General Requirements.

1.6 WARRANTY

A. Warranty of materials and workmanship as required by Section 27 00 00, Communications Basic Requirements and Division 01, General Requirements.

1.7 DEFINITIONS

A. Cabinet: A freestanding floor-mounted modular enclosure designed to house and protect rack-mounted electronic equipment.

B. Conduit: Round raceway.

C. Pull Box Enclosure: Box with a cover installed in one or more runs of raceway to facilitate pulling conductors through the raceway system. There are no openings in the cover.

D. Raceway: Enclosed channel designed expressly for holding wires or cables. Metal or insulating material and the term includes conduit, tubing, wireways, underfloor raceways and surface raceways; does not include cable tray.

E. Surface Raceway: Surface-mounted metal channel or plastic duct with snap-in removable covers for housing and protecting electrical wires and cables. Raceway and fittings are designed so sections can be electrically and mechanically coupled together without subjecting cables to abrasion.

F. Wire Basket Runway Systems: Includes, but are not limited to straight sections of type wire basket runway cable trays, bends, tees, elbows, drop-outs, supports and accessories.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Electrical Metallic Tubing and Fittings:

1. Allied Tube and Conduit

2. Wheatland Tube

3. Appleton

4. Or approved equivalent.

B. Telecommunications Outlet Boxes:

1. RANDL

2. Or approved equivalent.

C. J-Hooks:

1. Erico

2. Or approved equivalent.

2.2 ELECTRICAL METALLIC TUBING AND FITTINGS

A. Type EMT: Electrogalvanized steel tubing.

B. Fittings:

1. In-line straight-through steel or malleable iron fittings only; do not use bends or tees, e.g. Lbs.

2. Wet Areas: Steel compression-type couplings and nipples.

3. Dry Areas: Set screw-type couplings and nipples.

4. Bonding Locknuts:

a. Malleable iron with set screws and lug screws.

b. Insulated Bushing: Malleable iron with integral insulated throat, rated for 150C.

c. Bonding and Grounding Bushing: Malleable iron with integral insulated throat, rated for 150C, with solderless lugs or lug screws.

2.3 TELECOMMUNICATIONS OUTLET BOXES

A. Five Square Outlet Boxes: Minimum 5-inch square by 2-7/8-inch deep with built-in cable management for use with single- or double-gang plaster rings. Randl P/N T-55017 approved.

B. Plaster Rings: Single- or Double-gang as shown on the Drawings.

2.4 J-HOOKS

A. Constructed of galvanized steel, stainless steel or hot dipped zinc.

B. Wires or all-thread supports mounted to structure.

C. Cable sling is acceptable, such as Arlington or Eaton B-line.

PART 3 - EXECUTION

3.1 GENERAL INSTALLATION REQUIREMENTS

A. Workmanship:

1. Provide, condition, apply, install, connect and test manufactured products, materials, equipment and components in accordance with the manufacturer's specifications and printed instructions.

2. The installation of system components to be carried out under the direction of qualified personnel. Appearance to be considered as important as mechanical and electrical efficiency. Workmanship to meet or exceed industry standards.

3. Place support for raceways, cable trays, backboards, equipment racks and cabinets.

B. Protection During Construction: Protect products from the effects of moisture, corrosion and physical damage during construction. Except during installation activity in a section, keep openings in conduit, tubing and wireway capped with manufactured seals during construction.

C. Concrete Sleeves: Conduits routed perpendicular through floors, walls, or other concrete structures to pass through cast-in-place conduit sleeve openings wherever possible, or appropriate size holes to be bored to accommodate the installation of conduit sleeves. The size and location of the holes to not impair the structure's integrity.

1. Concrete Boring: Bore a hole in the concrete with a diameter of 1/2 to 1-inch larger than the conduit sleeve to be installed. Grout around the conduit sleeve and finish to match existing surroundings.

2. Conduits that rise vertically through a slab to be stubbed 6-inches above the floor and capped pending future use.

D. Drywall/Gypsum Board Sleeves: Install insulating throat bushings on both ends of conduit sleeves placed in fire-rated walls using drywall construction.

E. Where conduit enters a structure through a concrete roof or membrane waterproofed wall or floor:

1. Provide a watertight seal.

2. With Concrete Encasement: Install watertight entrance seal device on the accessible side.

3. Securely anchor malleable iron body of watertight entrance seal device into construction with one or more integral flanges.

4. Secure membrane waterproofing to watertight entrance seal device in a permanent, watertight manner.

F. Provide continuous sleeving through walls, floors and ceilings separating each telecom outlet from its respective MER/TR room, using sleeve conduit size as required per Standards. Restore penetrations through rated assemblies to original fire rating per NFPA and local codes.

G. Locate sleeves as shown on Drawings. Where sleeves are not shown on Drawings, install sleeves above suspended ceilings and locate to minimize length of pathway for future cable from telecom outlet to MER/TR rooms.

H. Where sleeves are routed between rooms with floating ceilings, extend conduits horizontally 2-feet over edge of floating ceiling to avoid exposed cabling from being seen at floor level.

I. Make floor penetrations no more than 4-inches from wall. Install conduit stubs to extend 4-inches from floor base. Cap conduits for protection.

J. Provide removable heat-expanding pillows at fire barrier penetrations as specified in Firestopping section and described as Firestop Material Type 7 (indicated as FSM-7).

K. Grounding: Provide ground connections and bonding continuity between raceway and wire basket runway sections, boxes, enclosures, cabinets and fittings as required per code and industry standard.

L. Provide plenum rated products, components and accessories for installation in plenums.

3.2 ELECTRICAL METALLIC TUBING AND FITTINGS

A. Reference 3.01, General Installation Requirements.

B. Install per manufacturer's written instructions and recommendations.

C. Minimum Conduit Size: Size recessed conduits to surface raceway serving multiple data outlets as follows. Sizing is based on TIA/EIA 569-B for 28 percent conduit fill, assuming Category Cat 6A cables (nominal outer diameter 0.24-inch) to each data outlet. Provide recessed backbox between surface raceway and recessed conduit sized for conduit.

1 to 6 cables	1-1/4 inch conduit
7 to 10 cables	2-inch conduit
11 to 15 cables	3-inch conduit
16 to 20 cables	4-inch conduit
Above 20 cables	Use multiple runs of conduit from surface raceway based on above table

D. Minimum Backbone Conduit Requirements: Install three 4-inch conduits from MER to each TR, unless otherwise noted on Drawings.

E. Conduit Type:

1. Install the following types of circular communications raceway in the locations listed unless otherwise indicated on the Drawings.

a. Interior Dry Locations, Exposed: EMT with set screw fittings.

b. Interior Dry Locations, Concealed (Not Embedded in Concrete): EMT with set screw fittings.

c. Interior Wet Locations: EMT with compression fittings.

F. Conduit Bends and Sweeps:

1. Make changes in direction of communications conduit runs with sweeps of the longest possible radius.

2. Make sweeps in parallel or banked runs of conduits, 2-inches and larger in diameter, from the same center or centerline so that sweeps are parallel and of neat appearance.

3. Field-Made Bends and Sweeps:

a. Use an acceptable hickey or conduit-bending machine.

b. Do not heat metal raceways to facilitate bending.

c. Before installing 4-inch field-made sweeps in duct banks, pull a 3-1/2-inch diameter by 12-inch long mandrel through duct sections to verify circularity and sweep radius.

4. The angular sum of the bends between pull points and/or pull boxes to not exceed 180 degrees.

5. Minimum Inside Bend Radius for Communications Conduit Bends, Sweeps, Boxes and Fittings:

a. One-inch conduit, 11-inches

b. Two-inch conduit, 21-inches

c. Three-inch conduit, 36-inches

d. Four-inch conduit, 48-inches

e. Other sizes, 10 times the inside diameter of the conduit.

6. Do not install boxes, bends, elbows, tees, and other conduit fittings, which do not provide for the minimum inside cable bend radius specified in paragraph E above.

a. Conduit Bodies: Conduit fittings, which include direction changes such as E, L, LB, LR, LL, LRT, TA, TB and X, are not allowed.

b. Refer design or installation conflicts with these requirements to the Architect.

3.3 TELECOMMUNICATIONS OUTLET BOXES

A. Reference 3.01, General Installation Requirements.

B. Install per manufacturer's written instructions and recommendations.

C. Provide 5-inch by 5-inch by 2-7/8-inch deep outlet boxes for wall mounting telecommunications outlets with single-gang or double-gang plaster rings as required, or as indicated on the Drawings.

D. Do not install outlet boxes back to back in walls. Provide minimum 6-inch separation, except provide minimum 24-inch separation in acoustic-rated walls.

E. Locate outlet boxes in masonry walls to require cutting of masonry unit corner only. Coordinate masonry cutting to achieve neat openings for outlet boxes. Use boxes with sufficient depth to permit conduit hubs to be located in masonry void spaces.

F. Provide knockout closures for unused openings.

G. Support telecommunications outlet boxes independently of conduit.

H. Use multiple-gang boxes where more than one device is mounted together; do not use sectional outlet boxes.

I. Install outlet boxes in walls without damaging wall insulation.

J. Coordinate mounting heights and locations of outlet boxes mounted above counters, benches and backsplashes.

K. Provide recessed outlet boxes in finished areas; secure boxes to interior wall and partition studs, accurately positioning to allow for surface finish thickness. Use stamped steel stud bridges for flush outlet boxes in hollow stud wall.

L. Provide cast outlet boxes in exterior and wet locations.

M. Coordinate all telecommunications outlet such that there is an electrical outlet within 2 feet.

3.4 J-HOOKS

A. Install J-hooks rated for Category 6A cable for support of cabling from the wire basket tray to the outlet location.

B. Cable slings or saddles are also acceptable.

C. J-hooks are to be installed on dedicated wires or all thread rods mounted to structure at 4-feet intervals. J-hooks are not to attach to ceiling grid wires.

D. J-Hooks, slings or saddles for telecommunications cabling are not to be used for any other system cabling.

E. The maximum number of cables per J-Hook, sling or saddle pathway is 50.

END OF SECTION 27 0528

SECTION 27 0528.01

COMMUNICATIONS RACEWAY SYSTEM

PART 1 - GENERAL

1.1 SUMMARY

A. Work Included:

1. EMT Conduit
2. PVC Conduit
3. Outlet Boxes
4. Pull Tape
5. Terminal Boards

1.2 RELATED SECTIONS

A. Contents of Division 27, Communications and Division 01, General Requirements apply to this Section.

1.3 REFERENCES AND STANDARDS

A. References and Standards as required by Section 27 00 00, Communications Basic Requirements and Division 01, General Requirements.

1.4 SUBMITTALS

A. Submittals as required by Section 27 00 00, Communications Basic Requirements and Division 01, General Requirements.

1.5 QUALITY ASSURANCE

A. Quality assurance as required by Section 27 00 00, Communications Basic Requirements and Division 01, General Requirements.

1.6 WARRANTY

A. Warranty of materials and workmanship as required by Section 27 00 00, Communications Basic Requirements and Division 01, General Requirements.

B. Contractor to meet the qualification set out in CLPCCD ITS Design Standards.

1.7 SYSTEM DESCRIPTION

A. Provide an empty TIA-569-B compliant raceway system for building telephone/data cabling as indicated on Drawings and as specified.

B. Provide a complete raceway system from data outlet to Main Equipment Room/Telecommunications Room (MER/TR) designated to serve that outlet. Raceway system to include, but not limited to, wall/floor penetrations, boxes, sleeves, conduits and surface raceway. Provide independent support from building structure for raceway components.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. EMT Conduit:

1. Allied Tube and Conduit
2. Beck Manufacturing
3. Wheatland Tube Company
4. Appleton
5. Or approved equivalent.

B. PVC Conduit:

1. JM Eagle
2. AFC Cable Systems
3. International Metal Hose
4. Or approved equivalent.

C. Outlet Boxes:

1. Randl; Model P/N T-55017.
2. Cooper Industries
3. Allied Moulded Products, Inc.
4. Or approved equivalent.

D. Pull Tape:

1. Greenlee

2. George Ingraham; Model 9216-JK.

3. Or approved equivalent.

E. Terminal Boards:

1. Gravitech

2. Diligent, Inc.

3. Advantech

4. Or approved equivalent.

2.2 EMT CONDUIT

A. 1-inch to 4-inch electrogalvanized steel tubing.

2.3 PVC CONDUIT

A. 1-inch to 4-inch polyvinylchloride conduit.

2.4 OUTLET BOXES

A. Minimum 4-inch square by 2-1/8-inch deep, with single or double gang plaster ring with correct rating for use.

B. Five Square Outlet Boxes: Minimum 5-inch square by 2-7/8-inch deep with built-in cable management for use with single or double gang plaster rings.

2.5 PULL TAPE

A. Measuring and pulling tape constructed of synthetic fiber with plastic jacket, printed with accurate sequential footage marks.

2.6 TERMINAL BOARDS

A. 3/4-inch-thick, void-free, fire retardant plywood, finished with two coats of enamel, white or ANSI grey.

PART 3 - EXECUTION

3.1 GENERAL INSTALLATION REQUIREMENTS

A. Install electrical work in telecommunications equipment rooms as shown on Drawings. Coordinate with incoming utilities, Owner and with other trades working in area.

B. Provide independent support from building structure for raceway components and cable supports.

C. Install plastic-jacketed pull tape printed with accurate sequential footage in empty conduits.

D. Provide copper grounding bus bars and listed copper conductors at each terminal board, bonded to the main electrical distribution panel and to building ground grid, per ANSI-J-STD-607-A.

E. Provide insulated bushings on conduits and sleeves.

F. Conduit bodies (condulets) are not to be used in data raceway system.

G. Furnish and install plywood terminal boards, sized as shown on Drawings.

H. Raceway and Pull Boxes:

1. Install no more than two 90 degree bends or maximum of 180 degrees of curvature between pullboxes.

2. Install pull boxes along conduit at maximum 100-foot spacing.

3. Provide minimum 12-inch by 12-inch by 4-inch pull boxes with screw type lids, minimum four screws to secure lid.

4. Use long radius elbows for raceway bends; do not use pull boxes in place of raceway bend.

5. Size recessed conduits to surface raceway serving multiple data outlets as follows. Sizing is based on TIA/EIA 569-A for 28 percent conduit fill, assuming Category 5e cables (nominal outer diameter 0.24-inch) to each data outlet. Provide recessed backbox between surface raceway and recessed conduit sized for conduit.

   a. 1 to 6 Cables: 1-inch conduit.

   b. 7 to 10 Cables: 1-1/4-inch conduit.

   c. 11 to 15 Cables: 1-1/2-inch conduit.

   d. 16 to 20 Cables: 2-inch conduit.

   e. Above 20 Cables: Use multiple runs of conduit from surface raceway based on above table.

6. Provide continuous sleeving through walls, floors and ceilings separating each data outlet from its respective MER/TR room, using sleeve conduit size as required on Drawings. Restore penetrations through rated assemblies to original fire rating per NFPA and local codes.

7. Locate sleeves as shown on Drawings. Where sleeves are not shown on Drawings, install sleeves above suspended ceilings and locate to minimize length of pathway for future cable from data outlet to MER/TR rooms.

8. Where sleeves are routed between rooms with floating ceilings, extend conduits horizontally 2-feet over edge of floating ceiling to avoid exposed cabling from being seen at floor level.

9. Furnish and install three 4-inch conduits from MER to each TR, unless otherwise noted on Drawings.

I. Equipment Mounting Boards:

1. Mount plywood backboard vertically 4-inches from floor.

2. Install boards plumb, level and secured to studs or solid concrete or masonry walls. Anchors for attaching equipment boards include:

a. Material/Substrate:

1) Concrete/Masonry.

2) Gypsum Wallboard.

b. Anchor Type:

1) Expansion anchors; wedge type with washer located on backside of board.

2) Togglebolts; use pan head type.

3. Power drive anchors, molly bolts and tappets are not allowed.

4. Make floor penetrations no more than 4-inches from wall. Install conduit stubs to extend 4-inches from floor base. Cap conduits for protection.

5. Mount telecommunications ground busbar 24-inches above finished floor.

3.2 EMT CONDUIT

A. Reference 3.01, General Installation Requirements.

B. Install per manufacturer's instructions and recommendations.

3.3 PVC CONDUIT

A. Reference 3.01, General Installation Requirements.

B. Install per manufacturer's instructions and recommendations.

3.4 OUTLET BOXES

A. Reference 3.01, General Installation Requirements.

B. Install per manufacturer's instructions and recommendations.

C. Install conduit no smaller than 1-inch trade size from any signal outlet box, no smaller than 3/4-inch trade size from any wall phone outlet box.

D. Wall Boxes: Install double-gang box with single-gang trim ring and minimum 1-inch conduit to accessible space. Use double-gang trim ring where required for 4-to 6-jack installation in one wall box.

E. Mount center of outlet boxes as required by ADA, or noted on Drawings, following distance above floor:

1. Wall phones: 46-inches.

2. Telecom Outlets: 18-inches.

3. Other Outlets: As detailed on Drawings.

3.5 PULL TAPE

A. Reference 3.01, General Installation Requirements.

B. Install per manufacturer's instructions and recommendations.

3.6 TERMINAL BOARDS

A. Reference 3.01, General Installation Requirements.

B. Install per manufacturer's instructions and recommendations.

END OF SECTION 27 0528.01

SECTION 27 0528.28

FIRESTOPPING FOR COMMUNICATIONS SYSTEMS

PART 1 - GENERAL

1.1 SUMMARY

A. Work Included:

1. Fire Rated Cable Pathways

1.2 RELATED SECTIONS

A. Contents of Division 27, Communications and Division 01, General Requirements apply to this Section.

B. In addition, reference the following:

1. Division 07, Thermal and Moisture Protection.

1.3 REFERENCES AND STANDARDS

A. References and Standards as required by Section 27 00 00, Communications Basic Requirements, Communications Basic Requirements and Division 01, General Requirements.

1.4 SUBMITTALS

A. Submittals as required by Section 27 00 00, Communications Basic Requirements and Division 01, General Requirements.

B. In addition, provide:

1. Product Data: Provide manufacturer's standard catalog data for specified products demonstrating compliance with referenced standards and listing numbers of systems in which each product is to be used.

2. Schedule of UL System Drawings: Submit schedule of expected opening locations and sizes, penetrating items and required listed design numbers to seal openings to maintain fire resistance ratings. If engineering recommendations are necessary, list these in the schedule too.

3. UL System Drawings: Furnish copies of UL Systems identified in schedule above. Include any engineering recommendations.

4. Certificates: Product Certificate of Compliance from the firestop system manufacturer certifying material compliance with applicable code and specified performance characteristics.

5. Installation Instructions: Submit manufacturer's printed installation instructions.

1.5 QUALITY ASSURANCE

A. Quality assurance as required by Section 27 00 00, Communications Basic Requirements and Division 01, General Requirements.

B. In addition, meet the following:

1. Products/Systems: Provide firestopping systems that comply with the following requirements:

a. Firestopping tests are performed by a qualified, testing and inspection agency. A qualified testing and inspection agency is UL, or another agency performing testing and follow-up inspection services for firestop system acceptable to authorities having jurisdiction.

b. Firestopping products bear the classification marking of qualified testing and inspection agency.

2. Installer Qualifications: Experience in performing work of this Section who is qualified by the firestopping manufacturer as having been provided the necessary training to install firestop products in accordance with specified requirements.

3. General: Use only firestopping products that have been tested for specific fire resistance rated construction conditions conforming to construction assembly type, penetrating item type, annular space requirements and fire rating involved for each separate instance.

1.6 WARRANTY

A. Warranty of materials and workmanship as required by Section 27 00 00, Communications Basic Requirements and Division 01, General Requirements.

1.7 PERFORMANCE REQUIREMENTS

A. Fire rated cable pathway devices to be used for ALL low-voltage, video, data and voice cabling, optical fiber raceways and certain high voltage cabling where frequent cable moves, adds and changes may occur. Pathways required for high voltage cabling will be detailed on the Drawings. Such devices will:

1. Meet the hourly fire rating of fire rated wall and or floor penetrated.

2. Be tested for the surrounding construction and cable types involved.

3. Have UL Systems permitting cable loads from “Zero to 100 percent Visual Fill.” This requirement eliminates need for fill-ratio calculations to be made by cable technicians to ensure cable load is within maximum allowed by UL System.

4. Not have inner fabric liner that tightens around and compresses cables tightly together encouraging alien cross-talk interference.

5. Be "Zero-Maintenance" defined as: No action required by cabling technician to open and/or close pathway for cable moves, adds, or changes, such as:

    a. Opening or closing of doors.

    b. Spinning rings to open or close fabric liner.

    c. Removal and/or replacement of any material such as firestop caulk, putty, pillows, bag foam muffins, foam blocks, or foam closures of any sort.

    d. Furnish letter from manufacturer certifying compliance with this definition of Zero-Maintenance.

        1) Pathways will be engineered such that two or more devices may be ganged together for larger cable capacities.

        2) Pathways will be engineered to be re-enterable so they can be retrofitted and removed from around existing cables without cutting and resplicing them.

        3) Affix adhesive wall label immediately adjacent to devices to communicate to future cable technicians, authorities having jurisdiction and others the manufacturer of the device and the corresponding UL System number installed.

    e. Where nonmechanical pathways must be utilized, such as sealing (caulking) around single or grouped conduits, provide products that upon curing do not re-emulsify, dissolve, leach, breakdown, or otherwise deteriorate over time from exposure to atmospheric moisture, sweating pipes, ponding water, or other forms of moisture characteristic during or after construction. Provide letter from manufacturer certifying compliance with this Section.

    f. Cable pathway to replace conduit sleeves in walls and floors and;

        1) When installed individually in floors, devices to pass through core-drilled opening utilizing tested floor plates.

        2) When multiple units are ganged in floors, devices to be anchored by means of a tested grid.

        3) When installed individually in walls, devices to pass through core-drilled opening utilizing tested wall plates.

        4) When multiple units are ganged in walls, devices to be anchored by means of a tested grid.

    g. Cable tray will terminate at each fire barrier and resume on the other side such that cables pass independently through devices. Cable tray will be properly supported on each side of fire barrier.

1.8 PROJECT CONDITIONS

A. Do not install firestopping products when ambient or substrate temperatures are outside limitations recommended by manufacturer.

B. Do not install firestopping products when substrates are wet due to rain, frost, condensation, or other causes.

C. Maintain minimum temperature before, during and for a minimum 3 days after installation of materials.

D. Do not use materials that contain flammable solvents.

E. Coordinate construction of openings and penetrating items to ensure that through-penetration firestop systems are installed according to specified requirements.

F. Coordinate sizing of sleeves, openings, core-drilled holes, or cut openings to accommodate through-penetration firestop systems.

G. Schedule installation of firestopping after completion of penetrating item installation but prior to covering or concealing of openings

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Fire Rated Cable Pathways:

1. Basis of Design: Specified Technologies Inc. (STI).

2. Or approved equivalent.

2.2 FIRE RATED CABLE PATHWAYS

A. STI EZ-PATH™ Brand device modules comprised of steel raceway with intumescent foam pads allowing 0 to 100 percent cable fill, the following products are acceptable:

1. Specified Technologies Inc. (STI) EZ-PATH™ Fire Rated Pathway.

B. Single Source: Obtain firestop systems for each type of penetration and construction condition indicated only from a single manufacturer.

C. Basis of Design: Firestop components shown on Drawings and listed in this specification Section are designed based on Specified Technologies, Inc. product line. Manufacturer listed is allowed on condition of meeting the specified conditions including the available space for the equipment (including code-required working clearances). Remove and replace components installed not meeting these conditions at no cost to Owner.

PART 3 - EXECUTION

3.1 GENERAL INSTALLATION REQUIREMENTS

A. Examination:

1. Before beginning installation, verify that substrate conditions previously installed under other Sections are acceptable for installation of firestopping in accordance with manufacturer's installation instructions and technical information.

2. Surfaces will be free of dirt, grease, oil, scale, laitance, rust, release agents, water repellants and any other substances that may inhibit optimum adhesion.

3. Provide masking and temporary covering to protect adjacent surfaces.

4. Do not proceed until unsatisfactory conditions have been corrected.

B. Install through-penetration firestop systems in accordance with Performance Criteria and in accordance with the conditions of testing and classification as specified in the published design.

C. Manufacturer's Instructions: Comply with manufacturer's instructions for installation of firestopping products.

D. Field Quality Control:

1. Inspections: Owner will engage qualified independent inspection agency to inspect through-penetration firestop systems.

2. Keep areas of work accessible until inspection by authorities having jurisdiction.

3. Where deficiencies are found, repair firestopping products so they comply with requirements.

E. Adjusting and Cleaning:

1. Remove equipment, materials and debris, leaving area in undamaged, clean condition.

2. Clean surfaces adjacent to sealed openings to be free of excess firestopping materials and soiling as work progresses.

F. Schedules:

Penetrant Type	**Concrete Floor**	**Concrete Wall**	**Gypsum Board Wall**
Blank Opening	C-AJ-0100, C-AJ-0101	C-AJ-0100, C-AJ-0101	
Metal Conduits	C-AJ-1080, C-AJ-1240, C-AJ-1353	C-AJ-1080, W-J-1098, W-J-1100	W-L-1049, W-L-1222, W-L-1168
Plastic Conduits/Raceways	C-AJ-2140, C-AJ-2292	W-J-2018, W-J-2076	W-L-2093, W-L-2241

Cables	C-AJ-3214, C-AJ-3231, F-A-3015	C-AJ-3214, C-AJ-3231, W-J-3098, W-J-3099	W-L-3218, W-L-3219
Cable Trays	C-AJ-4029	W-J-4021, W-J-4022, W-J-4033	W-L-4008, W-L-4029, W-L-4043

G. Documentation:

1. Place system stickers on each side of wall penetrations.

2. Place a reproduction (photocopy) of the UL System description in a document protector and mount to the wall next to the wall penetration. Highlight the Section of the system description that list the allowed cable types.

3.2 FIRE RATED CABLE PATHWAYS

A. Reference 3.01, General Installation Requirements.

B. Install per manufacturer's instructions and recommendations.

END OF SECTION 27 0528.28

SECTION 27 0543

UNDERGROUND DUCTS AND RACEWAYS FOR COMMUNICATION SYSTEMS

PART 1 - GENERAL

1.1 SUMMARY

A. Work Included:

1. Vaults

2. Vault Covers

3. Precast Vault Concrete Materials

4. Vault Components

5. Handholes

1.2 RELATED SECTIONS

A. Contents of Division 27, Communications and Division 01, General Requirements apply to this Section.

B. In addition, reference the following:

1. Section 27 05 28, Pathways for Communications Systems

1.3 REFERENCES AND STANDARDS

A. References and Standards as required by Section 27 00 00, Communications Basic Requirements and Division 01, General Requirements.

1.4 SUBMITTALS

A. Submittals as required by Section 27 00 00, Communications Basic Requirements and Division 01, General Requirements.

B. In addition, provide:

1. Shop drawings detailing items provided under this Section:

a. Vault cover assigned designators

b. Duct entry schedule

c. Pulling iron working load

d. ASTM load designation and percentage increase in live load for impact

e. Vault Section weights.

f. Rebar and piling support details.

1.5 QUALITY ASSURANCE

A. Quality assurance as required by Section 27 00 00, Communications Basic Requirements and Division 01, General Requirements.

B. In addition, meet the following:

1. Installer will have documented experience in the placement of vaults for a minimum of 3 years.

2. Manufacturer will have documented experience in the manufacturer of vaults for minimum of three years.

1.6 WARRANTY

A. Warranty of materials and workmanship as required by Section 27 00 00, Communications Basic Requirements and Division 01, General Requirements.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Vaults:

1. Oldcastle Precast

2. Or approved equivalent.

B. Vault Covers:

1. Oldcastle Precast

2. Neenah Foundry

3. Or approved equivalent.

C. Precast Vault Concrete Materials:

1. Oldcastle Precast

2. Or approved equivalent.

D. Vault Components:

1. Pull-In Irons:

a. McGraw-Edison

b. Joslyn

c. Oliver

d. Or approved equivalent.

2. Vault Cable Rack Hardware:

a. Chance

b. Or approved equivalent.

3. Grade Rings:

a. Neenah Foundry

b. Or approved equivalent.

E. Handholes:

1. Oldcastle Precast

2. Chapman Electric Supply, Inc.

3. Jensen Precast

4. Or approved equivalent.

2.2 VAULTS

A. Vaults will be precast, reinforced concrete Sections (top, base and where required, extension Sections) with knockouts or duct terminators PVC end bells or Carlon (utility vault Term-A-Duct) for main conduit entrances with recessed keyways and subsidiary duct entrances.

B. Concrete inserts will be set in interior surfaces of walls of each Section to provide for cable rack mounting. Base Section will be equipped with pulling-in irons located opposite each main cable entrance.

2.3 VAULT COVERS

A. Manufactured from metal casting, conforming to ASTM A48-83.

B. Class 35B gray cast iron, with machine finished flat bearing surface.

2.4 PRECAST VAULT CONCRETE MATERIALS

A. Concrete:

1. Conforms to ASTM C478.

2. Compressive Strength: 5000-PSI minimum at 28 days.

3. Air Content: 4 percent minimum.

4. Cementitious Materials: Minimum of 564-lbs/cu yd.

5. Course Aggregates: ASTM C33. Sound, Crushed, Angular Granite Stone only. Smooth or rounded stone will not be used.

6. Fine Aggregates: ASTM C33. Free from organic impurities.

7. Chemical Admixtures: ASTM C494. Calcium chloride or admixtures containing calcium chloride will not be used.

8. Air Entraining Admixtures: ASTM C260.

B. Reinforcing Steel: ASTM A615 grade 60 deformed bar, ASTM A82 wire, or ASTM A185 welded wire fabric.

C. Lift Loops:

1. ASTM A416 steel strand.

2. Lifting loops made from deformed bars are not allowed.

D. Flexible Joint Sealants:

1. Butyl rubber based conforming to Federal Specification SS-S-210A, AASHTO-198, Type B-Butyl Rubber and maximum of 1 percent volatile matter.

2. Suitable for application temperatures between 10 and 100 degrees F.

E. Epoxy Gels:

1. 2-component, solvent-free, moisture-insensitive, high modulus, high strength, structural epoxy paste adhesive.

2. Must meet requirements of ASTM C-881, Type I and II, Grade 3, Class B and C, epoxy resin adhesive.

2.5 VAULT COMPONENTS

A. Lifting inserts, holes and devices to comply with OSHA Standard 1926.704. Size lift holes and inserts for precision fit with lift devices and will not penetrate through structure wall. Precast manufacturer will provide lifting devices.

B. Internally seal joints between tongue and groove; additionally, seal around external perimeter of the joint as follows:

1. External seals to consist of polyethylene backed flat butyl rubber sheet no less than 1/16-inch thick and 6-inches wide applied to outside perimeter of joint.

2. Internal seals to consist of plastic or paper-backed butyl rubber rope no less than 14 feet long and having cross-sectional area no less than annular space times height of joint.

3. At option of Contractor, internal seals on round joints may consist of O-ring gasket conforming to ASTM C443, installed according to Precast Manufacturer's recommendation.

C. Precast base Sections will be cast monolithically without construction joints or with approved galvanized or PVC water stop cast in the cold joint between base slab and walls.

D. Wall and inside slab finish resulting from casting against forms standard for industry will be acceptable. Form ties through the wall are not allowed. Exterior slab surfaces below grade will have float finish. Small surface holes, normal color variations, normal form joint marks and minor depressions, chips and spalls will be tolerated. Dimensional tolerances will be as set forth in appropriate references.

E. Conduit openings will not extend into corners of structures, but may extend across joint with Engineer's approval.

F. Knockout panel dimensions will be as required by structural design at their maximum burial depth using design loads specified.

G. Design components in accordance with ACI, ASTM C890 and the following loads:

1. Horizontal load on walls and knockout panels will be load of 80 psf per foot of burial depth (using a burial depth of 20-feet) plus a live lateral surcharge due to HS20 traffic load of 80 psf.

2. Vertical load on below grade adaptor slabs and tops will be fill height of 20-feet assuming soil unit weight of 100 lbs/ft, plus live HS20 traffic load.

3. Vertical load on covers supported around perimeter will be live HS20 traffic load.

H. Rectangular sub-grade components to be designed and manufactured in conformance with ASTM C913 and as follows:

1. Joints between precast components will be keyways or tongue and groove. Joints to accept cast iron frames will be flat and no less than 5-inches wide.

2. Construct access vault structures to sizes and elevations shown on Drawings.

3. Manholes and Hardware:

a. Each manhole will be provided with one galvanized 3/4-inch rebar x 16-inches wide bolt-on ladder, mounting pads and mounting hardware. Rungs will be at 12-inches centers. Side rails will be 2-inches x 5/16-inches flat bar.

b. Each manhole entrance will be supplied with one galvanized 3/4-inch x 16-inches wide bolt-on manhole step.

I. Pull-In Irons:

1. Each wall of each vault will have a 7/8-inch hot-dipped galvanized pull-in iron centered under the new and future duct line openings. Pull-in irons will be McGraw-Edison, Joslyn, or Oliver.

J. Vault Cable Rack Hardware:

1. Cable Rack: Chance #1225

2. Cable Rack Hooks: Chance #1231

3. Cable Rack Insulators: Chance #1121

K. Grade Rings:

1. Rings, covers and frames will be Class 35 gray iron. Covers and frames will be equal to Neenah Foundry #R-1530 manhole frame Type B non-rocking lid.

2.6 HANDHOLES

A. Housing: Polyester pre-mix with calcium carbonate and polyester resins interlaced with fiber fiberglass and ultraviolet inhibitors.

B. Extension Rings: Capable of accepting up to 18-inches of extension rings to adapt to re-leveling of grade during Phase 2 construction (see site plans for phased site construction).

C. Lid: Reinforced concrete with concrete leading lid same size as opening of housing for as much hand space as possible for cable access.

PART 3 - EXECUTION

3.1 GENERAL INSTALLATION REQUIREMENTS

A. Requirements for Precast Concrete Vaults: Coordinate delivery of precast concrete manhole components to jobsite with manufacturer. Handling of materials will be done in accordance with ASTM C891 and manufacturer's recommendations. Handle and store components on job site using methods that will prevent damage.

B. Cleaning Vaults: Vaults will be clean and left free of debris, silt and rocks from installation work.

3.2 VAULTS

A. Excavate to required depth and remove materials that are unstable or unsuitable for good foundation. Prepare level, compacted foundation extending 6-inches beyond base. Some vaults may be piling supported. Check structural drawings and details.

B. Set base plumb and level.

C. Provide minimum 18-inches of pea gravel below pull vault for stability and drainage.

D. Thoroughly clean bells and spigots to remove dirt and other foreign materials that may prevent sealing. Unroll butyl sealant rope directly against spigot or keyway. Leave protective wrapper attached until sealant is entirely unrolled. Do not stretch. Overlap from side to side, not top to bottom.

E. When recommended by manufacturer, fill void between horizontal joint surfaces with sand cement grout around the outside perimeter.

F. After joining Sections, apply butyl sealant sheet around outside perimeter of joint.

G. Lift holes leaving less than 2-inches of wall thickness will be plugged from outside using sand cement mortar then covered with butyl rubber sheet. Lift holes penetrating wall will be additionally sealed with epoxy gel on interior.

H. Set frames or tops to required elevation sealing joints with butyl sealant rope and sheet.

I. Provide pulling-in irons opposite and above each conduit entrance.

J. Provide cable racks in each vault for support of conductors.

K. Provide 3/4-inch by 10-foot copper ground rod at each vault.

3.3 VAULT COVERS

A. Reference 3.01, General Installation Requirements and 3.02, Vaults, above.

B. Install per manufacturer's instructions and recommendations.

3.4 PRECAST VAULT CONCRETE MATERIALS

A. Reference 3.01, General Installation Requirements and 3.02, Vaults, above.

B. Install per manufacturer's instructions and recommendations.

3.5 VAULT COMPONENTS

A. Reference 3.01, General Installation Requirements and 3.02, Vaults, above.

B. Install per manufacturer's instructions and recommendations.

3.6 HANDHOLES

A. Excavate to required depth and remove materials that are unstable or unsuitable for good foundation. Prepare level, compacted foundation extending 6-inches beyond base. Some vaults may be piling supported. Check structural drawings and details.

B. Set base plumb and level.

C. Provide minimum 12-inches of pea gravel below handhole for stability and drainage.

D. Turn conduits up into handhold with required bend radius per guidance in 27 05 28, Pathways for Communications Systems; and TIA/EIA standards for fiber optic cabling.

E. Engrave cover of handhole to identify its purpose (examples: “Power," “Emergency Power,” “Signal,” “Fire Alarm”).

END OF SECTION 27 0543

SECTION 27 1001

BACKBONE AND HORIZONTAL COMMUNICATIONS SYSTEM

PART 1 - GENERAL

1.1 SUMMARY

A. Work Included:

1. Jacks
2. Faceplates
3. Cable
4. Circuit Protectors
5. Termination Blocks
6. Equipment Racks
7. Patch Panels
8. Wire Management
9. Patch Cords
10. Power Strips

1.2 RELATED SECTIONS

A. Contents of Division 27, Communications and Division 01, General Requirements apply to this Section.

1.3 REFERENCES AND STANDARDS

A. References and Standards as required by Section 27 00 00, Communications Basic Requirements and Division 01, General Requirements.

1.4 SUBMITTALS

A. Submittals as required by Section 27 00 00, Communications Basic Requirements and Division 01, General Requirements.

1.5 QUALITY ASSURANCE

A. Quality assurance as required by Section 27 00 00, Communications Basic Requirements and Division 01, General Requirements.

1.6 WARRANTY

A. Warranty of materials and workmanship as required by Section 27 00 00, Communications Basic Requirements and Division 01, General Requirements.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturer to have a recognized installer program in place for the system components proposed. Cable to be approved for the system installed. Provide UL listed products.

B. Jacks:

1. CommScope

C. Faceplates:

1. CommScope

D. Cable:

1. CommScope

E. Circuit Protectors:

1. Systimax, Model 489A.

2. Porta Systems, Series 24.

3. Or approved equivalent.

F. Termination Blocks:

1. CommScope

G. Equipment Racks:

1. Free-Standing:

a. Chatsworth, Model 48353-703.

b. Or approved equivalent.

2. Wall Mount:

a. Chatsworth, Model 11791-718.

b. Or approved equivalent.

H. Patch Panels:

1. CommScope

I. Wire Management:

1. Leviton

2. Hubbell

3. Or approved equivalent.

J. Patch Cords:

1. CommScope

K. Power Strips:

1. Tripp Lite

2. Belkin

3. Kensington

4. Or approved equivalent.

2.2 JACKS

A. ANSI/TIA/EIA-568-C 1-3, T568B, CAT6, screened or unshielded.

2.3 FACEPLATES

A. Coordinate faceplate color and finish with Architect.

B. Four port, thermoplastic faceplate with label windows.

2.4 CABLE

A. Horizontal: 100 ohm, CAT6, 23 AWG or 24 AWG, 4-pair, screened or unshielded twisted pair.

B. Twisted Pair Backbone: 100 ohm, CAT3, 24AWG, multiple-pair cable with an overall shield, ARMM or GFMW.

C. Fiber Backbone: 24-strand or 6-strand 9/125 micron premise distribution cable with maximum attenuation of 3.0 dB/km at 850 nm and 1.0 dB/km at 1300 nm. Minimum bandwidth is 220 MHz-km at 850 nm and 500 MHz-km at 1300 nm.

2.5 CIRCUIT PROTECTORS

A. panels with 110-style termination blocks for input and output connections, with wide-gap gas-tube or solid state surge arresters.

2.6 TERMINATION BLOCKS

A. CAT6, 110-style, with mounting legs and wire management troughs, wall or rack-mount, as shown on drawings.

2.7 EQUIPMENT RACKS

A. Free-Standing Equipment Racks: 19-inches wide by 84-inch high, double-sided. Supply as many racks as are necessary to hold equipment with minimum of 20 percent expansion space at each TR.

B. Wall Mount Equipment Racks: 19-inch wide by 18-inch deep by 38.5-inches high, wall-mounted equipment rack, UL listed. Supply as many racks as are necessary to hold all equipment with minimum of 20 percent expansion space at each TR.

2.8 PATCH PANELS

A. Twisted Pair: Provide fully loaded 48 port patch panel with ANSI/TIA/EIA-568-B T568B , CAT6, screened or unshielded jacks.

B. Fiber Optic: Provide 19-inch rack mounted fiber distribution units in each TR to terminate all fibers. MER to have high density fiber optic 19-inch rack mount distribution unit. Fully load distribution units with LC style bulkhead connectors.

2.9 WIRE MANAGEMENT

A. Termination Blocks: Provide minimum of one wire manager block between each 300-pair set of 110-style termination blocks. Provide at least one wire manager block at top and at least one at bottom of each column of termination blocks. Square off empty column spaces with wire manager blocks to provide continuous wire management path across width of termination field.

B. Panels: Provide minimum of one double row wire management panel between each patch panel and equipment item that uses patch cords. Provide at least one single row wire management panel at top and at bottom of each column of patch panels and equipment. For enclosed cabinets or wall mounted racks, patch panels to have wire management as an integral part of panel. Back management must be provided where not integral to connector patch panels.

C. Equipment Racks: Provide minimum of one 3-inch wide vertical wire manager between adjacent equipment racks and at each end of each row of adjacent racks.

2.10 PATCH CORDS

A. Twisted Pair: Provide unshielded, CAT6 patch cords for data applications and single pair S110 to 8-pin modular patch cords for voice applications. Provide cable lengths for neat and organized equipment rack at each TR and 10-feet at each workstation. Provide at least one set of patch cords (one data cord, one telephone patch cord and one workstation connection cord) for each telecom location shown on drawings.

B. Fiber Optic: Provide sufficient duplex fiber optic jumpers (patch cords) at each fiber termination point to cross-connect one-half number and type of fibers terminated there. Provide lengths for neat appearance not to exceed 15-feet. Some jumpers may require SC to LC connections to support existing or readily available hardware. Coordinate connector requirements with Owner.

C. Cross-Connect Wire: CAT3, 24AWG twisted pair.

2.11 POWER STRIPS

A. Supply 15 amp, 120VAC power outlet plug strips for each equipment rack. Plug strips to have built-in solid state surge protection and resettable circuit breakers.

B. Provide enough outlets for each anticipated piece of active hardware with at least four spare outlets per rack.

2.12 MISCELLANEOUS

A. Provide supporting hardware, cable ties, labels and racking. Provide cable supports rated for CAT6 cable.

PART 3 - EXECUTION

3.1 GENERAL INSTALLATION REQUIREMENTS

A. Manufacturers to have a recognized certified installer program in place for system components proposed. Cable approved with system installed.

B. Provide supporting hardware, cable ties, labels and racking. Provide cable supports rated for CAT6 cable.

C. Acceptable Installers: Installers must be certified, individually registered and trained by manufacturer for products submitted to meet Specifications.

D. Twisted Pair Backbone Cabling:

1. Install CAT3 24AWG multiple twisted pair backbone cable with overall shield for close-coupled grounding and bonding per ANSI/TIA/EIA-607.

2. Terminate twisted pair backbone cabling on 110-style termination blocks mounted on 3/4-inch fire rated plywood backboards at MC and rack-mounted 110-style termination

blocks at the TR's. Terminate and support cables in compliance with ANSI/TIA/EIA-568 and ANSI/TIA/EIA-569-B standards. Label cables in accordance with ANSI/TIA/EIA-606-A.

3. Cable sizes are shown on drawings. Verify that as minimum, two cable pairs are provided for each telephone user outlet plus an additional 20 percent spare pairs in backbone cables from MC to each TR.

4. Determine requirements for plenum rated cable. When doubt exists, seek prior determination in writing by AHJ.

E. Fiber Optic Backbone Cabling:

1. Install specified fiber optic cable between MC and each other TR, as shown on drawings.

2. Terminate fiber optic cable in rack-mounted fiber optic distribution units at each end using standard LC style bulkhead connectors.

3. Provide innerduct for fiber optic cable runs.

4. Install, terminate and support cables in compliance with ANSI/TIA/EIA-568-C and TIA-569-B standards.

F. Horizontal Twisted Pair Cabling:

1. Install horizontal cabling consisting of 4-pair 24 AWG or 23 AWG, CAT6, screened or unshielded twisted pair cable for each user outlet.

2. Terminate cables onto ANSI/TIA/EIA-568-C, T568B, screened or unshielded 8-pin modular jacks at each end. Modular jacks will mount in 48-port patch panels at TR and in 4-port single gang faceplates or an approved substitute at each user location.

3. Determine requirement for plenum rated cable. When doubt exists, seek prior determination in writing by AHJ.

G. Supporting Hardware, Labeling and Identification:

1. Provide equipment racks with sufficient rack space and surge-protected power receptacles to support 120 percent of patch panels, termination blocks, hubs and wire management panels for number of user outlets wired to each location.

2. Bond cabling, equipment racks and other hardware to ground bus in each TR per ANSI-J-STD-607-A.

3. Provide proper bracing and wire management from backboard to any freestanding equipment racks, per IBC.

4. Support, identify and label cabling per TIA-569-B and ANSI/TIA/EIA-606-A Specifications.

5. Seal conduits entering from outside building and install listed firestop material in conduits and sleeves to satisfy CEC and local codes.

H. Coordination of Conditions: Structured Cabling for wireless access points of given description may be used in more than one type of ceiling or wall structure. Coordinate ceiling construction, wall types, recessing depth and other construction details prior to ordering special components indicated in details for shipment. Where materials supplied do not match ceiling construction replace them at no cost to Owner.

3.2 JACKS

A. Reference 3.01, General Installation Requirements.

B. Install per manufacturer's instructions and recommendations.

3.3 FACEPLATES

A. Reference 3.01, General Installation Requirements.

B. Install per manufacturer's instructions and recommendations.

C. Coordinate color and finish with Architect.

3.4 CABLE

A. Reference 3.01, General Installation Requirements.

B. Install per manufacturer's instructions and recommendations.

3.5 CIRCUIT PROTECTORS

A. Reference 3.01, General Installation Requirements.

B. Install per manufacturer's instructions and recommendations.

3.6 TERMINATION BLOCKS

A. Reference 3.01, General Installation Requirements.

B. Install per manufacturer's instructions and recommendations.

3.7 EQUIPMENT RACKS

A. Reference 3.01, General Installation Requirements.

B. Install per manufacturer's instructions and recommendations.

3.8 PATCH PANELS

A. Reference 3.01, General Installation Requirements.

B. Install per manufacturer's instructions and recommendations.

3.9 WIRE MANAGEMENT

A. Reference 3.01, General Installation Requirements.

B. Install per manufacturer's instructions and recommendations.

3.10 PATCH CORDS

A. Reference 3.01, General Installation Requirements.

B. Install per manufacturer's instructions and recommendations.

3.11 POWER STRIPS

A. Reference 3.01, General Installation Requirements.

B. Install per manufacturer's instructions and recommendations.

END OF SECTION 27 1001

SECTION 27 1101

COMMUNICATION EQUIPMENT ROOMS

PART 1 - GENERAL

1.1 SUMMARY

A. Work Included:

1. Telecommunications Backboards

2. Equipment Cabinet

3. Telecommunications Grounding

B. The telecommunications equipment room is intended to house racks, cabinets and equipment necessary for the support of the voice and data cabling infrastructure as well as other low-voltage systems.

1.2 RELATED SECTIONS

A. Contents of Division 27, Communications and Division 01, General Requirements apply to this Section.

1.3 REFERENCES AND STANDARDS

A. References and Standards as required by Section 27 00 00, Communications Basic Requirements and Division 01, General Requirements.

B. Use this Section in conjunction with the other Division 27, Communications Sections and related Contract Documents to establish the total general requirements for the project technology systems and equipment.

1.4 SUBMITTALS

A. Submittals as required by Section 27 00 00, Communications Basic Requirements and Division 01, General Requirements.

B. In addition, provide:

1. Shop Drawings that include, but are not limited to, the following: Telecommunication Room layout, Telecommunication Room wall elevations, equipment rack elevations, cable routing, cable connecting diagrams, termination pin outs, supporting hardware details, block diagrams, riser diagrams and cable pathways. Work may not begin until shop drawings are approved. Note: Intent of submitting shop drawings is for contractors to display a conceptual understanding of the issued Engineer drawings. Do not submit Engineer Drawings on your title block.

2. Procedures for cable labeling and identification, long term documentation methods and numbering scheme in accordance with ANSI/TIA/EIA- 606-A.

3. A copy of certified installer certificates and warranty certificates for products proposed.

1.5 QUALITY ASSURANCE

A. Quality assurance as required by Section 27 00 00, Communications Basic Requirements and Division 01, General Requirements.

1.6 WARRANTY

A. Warranty of materials and workmanship as required by Section 27 00 00, Communications Basic Requirements and Division 01, General Requirements.

1.7 SYSTEM DESCRIPTION

A. The communications room distribution subsystem refers to the passive components used to terminate cabling subsystems and distribute technology services. This subsystem includes but is not limited to installations in the BDF and IDFs.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Telecommunications Backboards:

1. Reference 2.2A for requirements.

2. Or approved equivalent.

B. Equipment Cabinet:

1. Chatsworth. Part # M2050-711

2. Or approved equivalent.

C. Telecommunications Grounding:

1. Telecommunications Main Grounding Busbar (TMGB):

a. Chatsworth.

b. B-Line.

c. Or approved equivalent.

2. Telecommunications Grounding Busbar (TGB):

a. Chatsworth.

b. B-Line.

c. Or approved equivalent.

2.2 TELECOMMUNICATIONS BACKBOARDS

A. Only the wall beside the IDF will have back board.

1. The walls shall be capable of support up to 200 lbs per linear foot of wall space.

B. All walls will be covered with rigidly fixed 3/4-inch void free, fire-rated A-C plywood.

2.3 EQUIPMENT CABINETS

A. All racks will be floor-mounted, self-standing cabinets. Cabinets shall meet the following physical specifications:

1. 19-inch wide rack mounting space.

2. 84 inches high.

3. Locking front and rear doors and solid sides. The side adjacent to the wall will be removed to provide better airflow.

4. Black polyurethane finish.

5. Each cabinet shall have double-sided tapped holes with standard EIA hole pattern.

6. Each cabinet will be supplied with a bag of 50 bolts matching rack color and threading.

2.4 TELECOMMUNICATIONS GROUNDING

A. Telecommunications Main Grounding Busbar (TMGB) shall be located in the BDF.

1. The TMGB shall be a predrilled copper busbar provided with standard NEMA bolt hole sizing and spacing.

2. The TMGB shall be electrotin-plated for reduced contract resistance.

3. The TMGB shall be a minimum size of 5 mm thick, 100 mm wide and 300 m.

4. The TMGB shall be insulated from its support by a two (2) inch separation.

B. In each Telecommunications room, a Telecommunications Grounding Busbar (TGB) shall be installed.

1. The TMGB shall be a predrilled copper busbar provided with standard NEMA bolt hole sizing and spacing.

2. The TMGB shall be electrotin-plated for reduced contract resistance.

3. The TGB shall be a minimum size of 5 mm thick and 50 mm wide and 150 mm long.

PART 3 - EXECUTION

3.1 GENERAL INSTALLATION REQUIREMENTS

A. Provide all components of the telecommunications system from a single manufacturer.

B. Make floor penetrations no more than 4-inches from wall. Install conduit stubs to extend 4-inches from floor base. Cap conduits for protection.

C. Seismic installations require additional bracing of cabinets and overhead cable runways to building structure, as advised by and certified by a licensed structural engineer.

D. Ladder Rack Cable Tray:

1. Provide cable tray as shown in drawing package. The locations shown may need to be adjusted slightly in the field to assure proper placement.

2. Field cut to length tray Sections with a minimum number of splice points. Make field cuts using the manufacturers recommended equipment.

3. Deburr and file rough edges on cable tray.

4. Provide seismic bracing for installed cable trays.

E. Labeling:

1. Label racks with the equipment room number and a unique identifier beginning with the telecom room number and the number one, i.e. TR1-1.

2. Label the telecommunications grounding busbar and bonding conductor with the equipment room number and a unique identifier, beginning with the number one, i.e. TGB-SVR1. The designation for the Telecommunications Main Ground Busbar begins with TMGB.

3. Submit labeling schemes to the Owner for approval prior to testing and labeling.

3.2 TELECOMMUNICATIONS BACKBOARDS

A. All walls in telecommunications spaces will be covered with rigidly fixed 3/4-inch void free, fire-rated A-C plywood.

B. The visible side of the plywood shall be painted with two coats of white (or other light-colored) paint.

C. At least one (1) Fire-Rated stamp must be visible per sheet or partial sheet of plywood when painting is completed.

D. Plywood shall be installed from flush to the ceiling line, usually plus 2-feet to plus 10-feet AFF, but dependent on the ceiling height.

E. Install boards plumb, level and secured to studs or solid concrete or masonry walls. Use a minimum of six appropriate fasteners for every 16 SF of backboard. Anchors for attaching equipment boards include:

1. Material/Substrate: Anchor type.

2. Concrete/Masonry: Expansion anchors; wedge type with washer located on the backside of the board.

3. Gypsum Wallboard: Togglebolts; use pan head type.

F. Powder drive anchors, molly bolts and tappets are not allowed.

3.3 EQUIPMENT CABINETS

A. Fasten free-standing equipment cabinets to the floor using a minimum of four 1/2-inch anchors.

B. All cabinets will be installed with a minimum of 4-feet of clearance from the equipment mounting holes on front and 5-feet from the equipment mounting holes on the rear sides.

C. Provide proper seismic bracing and wire management from backboard to freestanding.

D. Rack placement and elevations shall be finalized and approved by CLPCCD District ITS prior to final installation.

3.4 TELECOMMUNICATIONS GROUNDING

A. Bond equipment racks and ladder racking to each equipment room TGB (one per equipment room minimum) with #6 AWG or larger, stranded copper conductor.

B. Connect each TGB to the TMGB and building steel using a 3/0 AWG or larger, stranded copper conductor.

C. All metallic structures (racks, cabinets, cable runway, etc.) shall be attached to the TGB using grounding straps.

1. Use minimum of #6 AWG, green jacket, stranded grounding wire between all equipment racks and the existing telecommunications grounding busbars.

2. Metallic straps shall be used to join individual segments of cable runway, relay racks, equipment and other metallic structures.

3. All metallic structures will be stripped of the paint coating at the point of grounding connection to ensure that the metallic straps and ground wires mate to the metal structure with sufficient contact.

D. The electrical contractor shall install and bond the main components of the system (busbar, ground rod, ground wire to grounding source, etc.).

1. The cabling contractor shall install the connectivity to the metal components of the cabling system, including voice protectors, racks, cable runway, cabinets, patch panels, etc.

E. Two hole lugs are required on all ground cable connecting to the TMGB and TGB.

F. The TMGB will be bonded to the electrical panel ground bus bar and to building steel or ground rod by conventional welds, exothermic welds clamp-and-braze method, or UL approved compression type connectors where practical. Exothermic welds are the preferred method. Because of the high temperatures involved, copper materials may be bonded to iron or steel. The mold size must match the cable or conductor cross section. The size of the weld metal charge must match the size of the mold being used

END OF SECTION 27 1101

SECTION 27 1300

COMMUNICATIONS BACKBONE CABLING

PART 1 - GENERAL

1.1 SUMMARY

A. Work included:

1. Copper Backbone Cable

2. Fiber Optic Backbone Cable

3. Copper Termination Hardware

4. Fiber Optic Termination Hardware

1.2 RELATED SECTIONS

A. Contents of Division 27, Communications and Division 01, General Requirements apply to this Section.

1.3 REFERENCES AND STANDARDS

A. References and Standards as required by Section 27 00 00, Communications Basic Requirements and Division 01, General Requirements.

B. Meet requirements of NFPA 780, Standards for Installation of Lightning Protection Systems.

1.4 SUBMITTALS

A. Submittals as required by Section 27 00 00, Communications Basic Requirements and Division 01, General Requirements.

B. In addition, provide:

1. Procedures for cable labeling and identification, long term documentation methods and numbering scheme in accordance with ANSI/TIA/EIA- 606-A.

2. A copy of certified installer certificates and warranty certificates for products proposed.

1.5 QUALITY ASSURANCE

A. Quality assurance as required by Section 27 00 00, Communications Basic Requirements and Division 01, General Requirements.

B. Manufacturers to have a recognized certified installer program in place for system components proposed. Cable will be approved with manufacturer system installed.

1.6 WARRANTY

A. Warranty of materials and workmanship as required by Section 27 00 00, Communications Basic Requirements and Division 01, General Requirements.

B. In addition, provide:

1. Labor, materials and documentation according to selected manufacturer requirements necessary to ensure that the Owner will be furnished with an Extended Product Warranty and Application Assurance of a minimum of 25 years in length. The Application Assurance Warranty will cover the failure of the wiring system to support current or future applications that are designed for the link/channel specifications of ANSI/TIA/EIA-568-C.

2. Provide a warranty on the physical installation.

3. Furnish necessary documentation required by the manufacturer immediately following 100 percent testing of cables.

4. Administer the warranty process with the responsible manufacturer's representative. Provide warranty directly to the Owner from the manufacturer. Ensure that the manufacturer provides the Owner with the appropriate warranty certification within 90 calendar days of the final project completion.

1.7 SYSTEM DESCRIPTION

A. Provide a standards-based cable system to serve backbone communication systems requirements as specified in these specifications and shown on Drawings. Closely follow ANSI/TIA/EIA, IEEE and ISO standards which apply to backbone communication systems.

B. Install intrabuilding backbone cables from BDF to IDF rooms through raceway systems as shown on Drawings.

C. Install interbuilding (OSP) backbone cables from existing MDF to BDF room through new raceway systems as shown on Drawings.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Copper Backbone Cable:

1. Superior Essex

B. Fiber Optic Backbone Cable:

1. CommScope/SYSTIMAX TeraSPEED

C. Copper Termination Hardware:

1. General:

    a. CommScope

2. Communication Entrance Protection:

    a. Porta Systems BET with solid state fuses

    b. Circa with solid state fuses

D. Fiber Optic Termination Hardware:

1. CommScope/SYSTIMAX

2.2 COPPER BACKBONE CABLE

A. Backbone UTP copper cables shall consist of a core of 24 AWG solid annealed copper conductors, color-coded in accordance with telephone industry standards.

B. As a minimum, UTP copper backbone cables will be UL Verified Category 3 and will meet or exceed the Category 3 requirements in ISO/IEC 11801, CENELEC EN50173 and EIA/TIA 568B.

C. Conductors shall be twisted to form pairs. Cable having more that 25 pairs shall be assembled in units, each individually identified by color-coded unit binders.

D. The mutual capacitance of any pair shall not exceed 5.6 nF per 100 m at 1 kHz. The core shall be covered with a plastic tape.

E. The cable will be designed for use in the outdoor environment, with a gel-filled design to be used in wet locations. This includes an aluminum steel with polyethylene (ASP) sheath and a core of solid-copper conductors, dual insulated with foam skin and plastic, and surrounded by a gel filling compound.

F. ANMW cabling is preferred.

G. Outside Plant Cable installations will meet all ISO/IEC 11801 requirements for a horizontal link. No more than four connections are allowed, including the protection devices at each end.

H. Refer to drawings for pair counts.

2.3 FIBER OPTIC BACKBONE CABLE

A. The single mode fiber shall be CommScope SYSTIMAX TeraSPEED fiber.

B. CommScope LazrSPEED OM4 LOMMF for the fire alarm loop. The 12 strand indoor-outdoor cable will run from the FA panel in building 5 to the IT building FA panel for connection to the campus loop. The data contractor is to install. To be terminated on 12 LC connectors at each end. In the IT building it will use an available slot in the SME. In Building 5 it will terminate on a wall-mount SME.

C. Class IVa Dispersion-Unshifted single mode optical fibers complying with ANSI/EIA/TIA-492BAAA.

1. The zero dispersion wavelength shall be between 1300 nm and 1324 nm. The ANSI/EIA/TIA-455-168 maximum value of the dispersion slope shall be no greater than 0.093 ps/km-nm.

2. Dispersion measurements shall be made in accordance with ANSI/EIA/TIA-455-169 or NSI/EIA/TIA-455-175.

D. The nominal core diameter shall be 8.3 µm to 10.0 µm with a tolerance of plus/minus 0.5 um at 1300 nm when measured in accordance with ANSI/EIA/TIA-455-164 or ANSI/EIA/TIA-455-167

E. Meet the graded performance specifications below.

Transmission Characteristics	
Maximum Attenuation	**Cable Type**
1.0 dB/km at 1310/1550 nm	Riser (inside) Plant
0.50 dB/km at 1310/1550 nm	Outside Plant

2.4 COPPER TERMINATION HARDWARE

A. Patch Panels:

1. 48-port - 8-position jack panel, high density with 8 port modules with IDC terminals, T568A/B wiring scheme.

2. Install quantity required to terminate copper backbone cabling, 1-pair per port.

3. Wire management will be integrated in the copper patch panels.

B. Communications Entrance Protection (BET)

1. Available in 25, 50 and 100 pair counts.

2. Industry standard 5-pin sealed protector field.

3. Available with factory install solid state protectors.

4. IDC connections.

2.5 FIBER OPTIC TERMINATION HARDWARE

A. High Density Fiber Termination Shelf:

1. 7-inch high shelf designed for mounting in 19-inch equipment racks and capable of accepting 12 adapter panels. The shelf will contain built-in slack management and be

accessible from the front or rear with locking doors for use in IDFs. Commscope part # HD-4U

a. 19-inch rack mount, 13-inches deep.

2. 3.5-inch high shelf designed for mounting in 19-inch equipment racks and capable of accepting 6 adapter panels. The shelf will contain built-in slack management and be accessible from the front or rear with locking doors for use in IDFs. Commscope part # HD-2U

a. 19-inch rack mount, 13-inches deep.

3. Fiber patch panels will have integrated cable management in the front and cable guides in the rear.

4. Fiber Adapter Panels:

a. Adapter panel for high density termination shelf with 6 duplex SC phosphor-bronze alignment sleeves.

B. Singlemode Connector:

1. All connectors are to be glass-in-ceramic SC-compatible field-installable duplex connectors.

a. 568SC connectors shall meet ANSI/EIA/TIA-604-3 standards.

b. Connectors must have a locking feature to the coupler to prevent optical disconnect.

c. The connector shall have an optical axial pull strength of 2.2 N at 0 degree angle and an optical off axial pull strength of 2.2 N at a 90 degree angle, with a maximum 0.5 dB increase in attenuation for both tests when tested in accordance with ANSI/EIA/TIA-455-6B.

d. Adhere to all manufacturer installation guidelines.

e. Single mode duplex connectors shall be blue.

f. The maximum optical attenuation per each mated field installed connector pair shall not exceed 0.75 dB.

g. The total optical attenuation through the cross-connect from any terminated optical fiber to any other terminated fiber shall not exceed 1.5 dB

PART 3 - EXECUTION

3.1 GENERAL INSTALLATION REQUIREMENTS

A. Miscellaneous Hardware: Provide supporting hardware, cable ties, labels, underground vault racking, bullet bonds, gel blocking kits, pull rope and other miscellaneous hardware for a complete and operable system.

B. Provide like items from one manufacturer, such as cable, patch panels, connectors, and equipment connection cords.

C. Communications Backbone Cabling includes cables, connectors, patch panels, connecting blocks and patch cords, as well as the necessary support systems, such as cable managers, tie wraps and D-rings.

D. Furnish and install materials necessary for a complete and working system.

E. Contractor must be a Certified Installer for selected manufacturer prior to, during and through completion of the system installation and must be able to provide the manufacturer's extended warranty.

F. Perform work in a neat and workmanlike manner.

G. Firestopping: Install all firestop systems in accordance with manufacturer's recommendations. Firestop systems to be completely installed and available for inspection by local inspection authorities prior to cable system acceptance.

H. Install cable after interior of building has been physically protected from the weather and mechanical work likely to damage cabling has been completed.

I. Before installing cabling, ensure cable pathways are completely and thoroughly cleaned:

1. Inspect conduit, wireway, cable trays and innerduct systems prior to installation.

2. Swab any additional enclosed raceway and innerduct systems.

J. Provide protection for exposed cables where subject to damage. Provide abrasion protection for any cable or wire bundles, which pass through holes or across edges of sheet metal.

K. Install cable ties and other cable management clamps via hand so they fit snugly. Do not over tighten or use mechanical tools which could compress, crimp, or otherwise change the physical characteristics of the cable jacket or distort the placement of twisted-pair components. Replace any cable exhibiting stresses due to over tightening of cable management devices.

L. Where possible, route cables in overhead cable trays and inside wire management systems attached to the equipment cabinets and racks. Use Velcro ties or ducts to restrain cabling installed outside of wire management systems on racks or in cabinets.

M. Limit cable raceway fill to less than the TIA/EIA-569-B maximum fill for the particular raceway type.

N. If a J-hook or trapeze system is used to support cable bundles, support cables at a maximum of 48-inch intervals. Cables are prohibited to rest on acoustic ceiling grids or panels.

O. Install cable above fire-sprinkler systems and ensure the cable does not attach to the system or any ancillary equipment or hardware. Install cable system and support hardware so it does not obscure any valves, fire alarm conduit, boxes, or other control devices.

P. Do not attach cables to ceiling grid or lighting fixture wires. Where support for cable is required, install appropriate carriers to support the cabling.

Q. Any cable damaged or exceeding recommended installation parameters during installation will be replaced by the contractor prior to final acceptance at no cost to the Owner.

R. Unshielded Twisted Pair Cable Installation Practices:

1. Install cable in accordance with manufacturer's recommendations and best industry practices.

2. Do not exceed the cable's minimum bend radius and maximum pulling tension.

3. Install unshielded twisted pair cable so there are no bends smaller than four times the cable outside diameter at any point in the run and at the termination field.

S. Provide the following minimum separation distances between pathways for copper communications cables and power wiring of 480 volts or less:

1. Open or Nonmetal Communications Pathways:

a. 12-inches from electric motors, fluorescent light fixtures and unshielded power lines carrying up to 3 kVA.

b. 36-inches from electrical equipment and unshielded power lines carrying more than 5 kVA.

c. 48-inches from large electrical motors or transformers.

2. Grounded Metal Conduit Communications Pathways:

a. 2-1/2-inches from electrical equipment and unshielded power lines carrying up to 2 kVA.

b. 6-inches from electrical equipment and unshielded power lines carrying from 2 kVA to 5 kVA.

c. 12-inches from electrical equipment and unshielded power lines carrying more than 5 kVA.

d. 3-inches from power lines enclosed in a grounded metal conduit (or equivalent shielding) carrying from 2 kVA to 5 kVA.

e. 6-inches from power lines enclosed in a grounded metal conduit (or equivalent shielding) carrying more than 5 kVA.

T. Determine requirements for plenum rated cable and devices. When doubt exists, seek prior determination in writing by AHJ.

U. Seal conduits entering from outside the building and install listed firestop material in conduits and sleeves to satisfy CEC and local codes.

V. Unshielded Twisted Pair Termination:

1. Dress and terminate cables in accordance with the recommendations made in the ANSI/TIA/EIA-568-C.1 document, manufacturer's recommendations and best industry practices.

2. Maintain the cable jacket within 1-inch of the termination point.

3. Do not exceed 0.5-inch of pair untwist at the termination point.

4. Do not exceed 4 times the outside diameter of the cable in the termination area for bend radiance compliance.

5. Neatly bundle and dress cables to their respective panels or blocks. Feed each panel or block by an individual bundle separated and dressed back to the point of cable entrance into the rack or frame.

W. Testing Procedures:

1. Test cables and termination hardware for defects in installation and to verify cabling system performance under installed conditions according to the requirements of ANSI/TIA/EIA-568-C. Verify pairs of each installed cable prior to system acceptance. Repair or replace any defect in the cabling system installation including but not limited to cable, connectors, feed through couplers, patch panels and connector blocks in order to ensure 100 percent useable conductors in cables installed.

2. Test cables in accordance with this document, the ANSI/TIA/EIA standards, the manufacturer's procedures and best industry practice. If any of these are in conflict, bring any discrepancies to the attention of the project team for clarification and resolution.

3. Test Unshielded Twisted Pair cables as follows:

a. Test twisted-pair copper cable links for continuity, pair reversals, shorts, opens and performance as indicated below. Additional testing is required to verify Category performance.

b. Continuity: Test each pair of each installed cable using a test unit that shows opens, shorts, polarity and pair-reversals, crossed pairs and split pairs. Test shielded/screened cables with a device that verifies shield continuity in addition to the above stated tests. Record the test as pass/fail as indicated by the test unit in accordance with the manufacturers' recommended procedures and referenced to

the appropriate cable identification number and circuit or pair number. Correct or repair any faults in the wiring and re-test the cable prior to final acceptance.

c. Length: Test each installed cable link for installed length using a TDR type device. Test the cables from patch panel to patch panel, block to block, patch panel to outlet or block to outlet as appropriate. The cable length will conform to the maximum distances set forth in the ANSI/TIA/EIA-568-C standard. Record cable lengths, referencing the cable identification number and circuit or pair number. For multi-pair cables, record the shortest pair length as the length for the cable.

4. Follow the Standards requirements established in ANSI/TIA/EIA-568-C.

5. Provide test results in electronic format, with the following minimum information per cable:

   a. Circuit ID

   b. Test result, "Pass" or "Fail"

   c. Date and Time of test

   d. Project Name

6. The technician will examine open and shorted pairs to determine if the error is a termination issue. If not correctable, the technician shall tag bad pairs at both ends, and make note on the as-built documentation. If copper backbone cable contains more than one (1) percent bad pairs, the Contractor shall remove and replace the cable at the Contractor's expense.

7. Test fiber backbone cabling as follows:

   a. The tester shall be capable of performing the tests required by ANSI/TIA/EIA-568-C, ANSI/TIA/EIA-526-14A, and ANSI/TIA/EIA-526-7.

   b. A manufacturer-certified calibration facility shall have calibrated the tester dated no more than 60 days prior to the start of testing.

   c. All testing procedures and testers shall comply with applicable requirements of ANSI/TIA/EIA 568-C.

   d. End-to-end attenuation testing using an approved Power Meter and Light Source per ANSI/EIA/TIA 455-53A.

   e. Backbone single mode fiber shall be tested at both 1310nm and 1550 nm in accordance with ANSI/EIA/TIA-526-14A method A.1.

   f. The acceptable link attenuation for backbone 8.3 to 9/125 single mode fiber based on distance shall be 1.0 dB/km at 1310 nm and 1550 nm for inside plant.

   g. All fiber optic cables will be tested and results will be submitted for all fibers in an electronic format and provide one (1) soft copy of the test results showing

graphically, the entire length of the fiber. The Contractor shall submit (1) copy of software capable of viewing the electronic test result files.

8. Fiber Test Documentation: Provide electronic test reports from ANSI/TIA/EIA-526-14A Method B Standards. Calculate a "Loss Budget" for each cable length based on cable length and connectors. Provide as a minimum, OTDR test results in the form of a printed waveform and text table for 1350 nm and 1510 nm for singlemode fiber. Test fibers and connector systems for end-to-end attenuation. Provide a power meter test on fiber optic strands at both wavelengths A to B, B to A and OSPL (OSPL is as defined as La + Lb). Include the results of unsatisfactory tests, with an explanation of how the problem was corrected. Clearly label connector and fiber loss on test waveforms.

9. Provide test results to CLPCCD ITS in electronic format, including native tested software format, and PDF.

10. Provide a fully functional version of the tester software for use by CLPCCD ITS in reviewing the test results.

3.2 COPPER BACKBONE CABLE

A. Use pulling compound when necessary; pulling compound must be a water-base pulling lubricant that will not deteriorate cable or conduit. Adhere to all manufacturers' requirements regarding pulling tension and allowable lubricants.

B. All cable/cabling shall be kept 30 inches away from any heat source; i.e., steam valves, etc.

C. Cables shall be pulled free of sharp bends, kinks, twists, or impact damage to the sheath.

D. Cables shall not be pulled across sharp edges. All conduits and sleeve with rough edges will be provided with bushings on both ends. Cables shall not be forced or jammed between metal parts, assemblies, etc.

E. Cables shall not be pulled across access doors and pull box covers. Access to all equipment and systems must be maintained.

F. Cable splicing will not be permitted at any point within a cable run.

G. All outside plant backbone cables will be installed in conduit.

H. Aerial runs are not permitted.

I. Conduits will not be filled to greater than a 40 percent fill.

J. Conduits must have appropriately size pull-boxes every 300 feet. When the conduit routes through up to a total of two 90 degree bends (180 degrees total) in any dimensional plane, pull-boxes are also required. Cabling will not be installed in conduits that do not meet these specifications.

K. Backbone cables will be installed with a 30 foot service loop. At each building , the service loops will be coiled neatly in the pull box or nearest hand hole on the building's exterior wall.

Cable mountings and service loops on backboards will be installed efficiently to minimize the backboard space consumed. All cables will be routed at right angles, in accordance with the bend radius specifications for the type of cable being routed. Cables will be tie-wrapped every 4 to 6 feet.

L. Cable shall be continuous and without splices (Splices imply same pair count cable splices: i.e.: 200-pair to 200-pair).

M. Verify all actual cable distances.

N. All outside plant cables will be terminated within 50 feet of the entrance point. This is a maximum cable measurement and includes lengths for service loops, routing, backboard and patch panel mounting inside the building.

O. Labeling:

1. 1. All riser copper cables will be labeled at each end of the cable bundle at the furthest point where the sheath is intact (before breakout). If the riser cables pass through multiple pull points, Telecommunication rooms and riser openings, the cables will be labeled at each opening.

2. All outside plant backbone copper cables will be labeled at each end and in each handhole/maintenance hole that they pass through. Labels will be heat and water-proof so they do not decay when exposed to the elements. All labels must be visible at every point of access.

3. All cables will be labeled according to the guidelines as set forth in the EIA/TIA 606-A standard. This shall include:

    a. The origination point

    b. The destination point

    c. The type of cable

    d. The pair count

3.3 FIBER OPTIC BACKBONE CABLE

A. Permanent buildings will be equipped with outside plant backbone cables to the Main Telecommunications MDF Room at each campus.

B. For each building, outside plant backbone fiber will consist of, as a minimum, a 24-strand, single mode fiber bundle.

C. Where diverse pathways exist and need dictates, a redundant set of backbone fiber cables may be specified for building connectivity. Redundant backbone cabling will be of the same type and composition as the primary fiber backbone cabling.

D. Fiber backbone cabling is to be installed between the IDF rooms and the BDF.

1. All riser fiber backbones will consist of 12-strand single mode fiber, CommScope SYSTIMAX TeraSPEED.

2. The type of riser cable will be UL listed OFNP rated.

3. This type of cable can be placed in vertical shafts and plenum spaces without the use of conduit or innerduct.

E. All fiber optic cable shall be installed in the following manner:

1. Use pulling compound when necessary; pulling compound must be a water-base pulling lubricant that will not deteriorate the cable or conduit.

2. All cable/cabling shall be kept 30 inches away from any heat source; i.e., steam valves, etc.

3. Cables shall be pulled free of sharp bends, kinks, twists, or impact damage to the sheath.

4. Cables shall not be pulled across sharp edges. All conduits and sleeve with rough edges will be provided with bushings on both ends. Cables shall not be forced or jammed between metal parts, assemblies, etc.

5. Cables shall not be pulled across access doors and pull box covers. Access to all equipment and systems must be maintained.

6. Cable splicing will not be permitted at any point within a cable run.

7. Conduits will not be filled to greater than a 40 percent fill.

8. Outside Plant Conduits must have appropriately size pull-boxes every 400 feet. When the conduit routes through up to a total of two 90 degree bends (180 degrees total) in any dimension plane, additional pull-boxes are also required. Cabling will not be installed in conduits that do not meet these specifications.

9. Backbone cables will be installed with a 30 foot service loop. The service loops will be coiled neatly in the nearest pull box or hand-hole to the building's exterior wall.

10. Cable mountings and service loops on backboards inside Telecommunication Rooms will be installed efficiently to minimize the backboard space consumed. All cables will be routed at right angles, in accordance with the bend radius specifications for the type of cable being routed. Cables will be tie-wrapped every 4 to 6 feet.

11. All outside plant cables will be terminated within 50 feet of the entrance point. This is a maximum cable measurement and includes lengths for service loops, routing, backboard and patch panel mounting inside the building.

12. Polarization for entire system shall be maintained as described in ANSI/EIA/TIA-568-B section 12.7.1.

13. All optical fiber cables shall be terminated on rack-mounted optical fiber patch panels using six (6) SC connectors per slot.

14. No fiber will be left unterminated.

F. Labeling:

1. All backbone fiber cables (riser cables) will be labeled at each end of the cable bundle at the furthest point where the sheath is intact (before breakout). If the riser cables pass through multiple pullboxes, Telecommunication rooms and riser openings, they will be labeled at each opening.

2. All outside plant backbone fiber cables will be labeled at each end and in each handhole/maintenance hole that they pass through.

3. Labels will be heat and water-proof so they do not decay when exposed to the elements.

4. All labels must be visible at point of access.

5. All cables will be labeled according to the guidelines as set forth in the EIA/TIA 606-A standard. This shall include:

a. The origination point

b. The destination point

c. The type of cable (SMF, 50MMF)

d. The fiber strand count

3.4 COPPER TERMINATION HARDWARE

A. Install per manufacturer's instructions and recommendations.

B. Reference 3.01, General Installation Requirements.

C. Dress and terminate cables in accordance with the recommendations made in the ANSI/TIA/EIA-568-B standard, manufacturer's recommendations and best industry practices.

D. Pair untwist at the termination is not to exceed 0.125-inch.

E. Bend radius of the cable in the termination area is not to exceed four times the outside diameter of the cable.

F. Dress cables to their respective panels or blocks. Feed each panel or block by an individual bundle, separated and dressed back to the point of cable entrance into the rack or frame.

G. Maintain the cable jacket to the termination point.

3.5 COMMUNICATIONS ENTRANCE PROTECTION

A. Only the copper backbone cables that extend from the BDF to the IT buildings will be terminated at both ends on protector blocks.

B. All pairs at both ends of the copper backbone cable shall be protected.

C. The protector blocks will be housed within a covered case. Protectors will be sized for the termination of all pairs in the copper backbone cable.

D. The protector blocks shall be fully populated with solid-state or gas-tube protection fuses.

E. The protector blocks will contain an integrated 110 block for extension to the building cross connect fields or patch panels.

F. The Protection Block Shall Have an integrated 26 AWG stub.

G. the protection blocks shall be grounded with a #6 AWG copper bonding conductor between the protector ground lug and Telecommunications Grounding Busbar.

H. Copper extension cables shall be installed from the protector blocks to the copper patch panels, extending one pair per jack.

I. CLPCCD uses the Porta Systems BET with solid state fuses for its standard products.

J. Each building is provisioned with a wall-mount BET of sufficient quantity, fully-fused at the building end.

K. In the MPOE rooms, CLPCCD has installed the Porta Systems XLBET racking system. The campuses use a tail-in, tail-out product where the output tails are extended by the contractor to RJ-45 patch panels, one pair per jack.

L. Labeling:

1. Copper protectors shall be marked using adhesive labels indicating the range of copper backbone pairs installed in it.

2. Each panel shall be labeled with the origination and destination Telecommunication Spaces and the pair count.

3. All protectors will be labeled according to the guidelines as set forth in the EIA/TIA 606-A standard. This shall include:

    a. The origination point

    b. The destination point

    c. The type of cable

    d. The pair count

    e. Where protectors terminate multiple backbone pairs, each backbone will be clearly and discretely labeled.

4. Backbone cables will be labeled in the following locations:

a. 12-inch from each end

b. At each service loop

c. In each pullbox/maintenance hole/pull can

5. Data fiber will have YELLOW labels. Copper will have WHITE labels. FA fiber will have RED labels.

3.6 FIBER OPTIC TERMINATION HARDWARE

A. Install per manufacturer's instructions and recommendations.

B. Reference 3.01, General Installation Requirements.

C. Neatly coil fiber slack within the fiber space tray or enclosure.

D. All fiber patch panels shall be placed at the highest point possible in the rack or cabinet.

E. Individually attach each cable to its respective fiber enclosure by mechanical means. Securely attach the cable strength member to the cable strain-relief bracket in the enclosure.

F. Clearly label each cable at the entrance to the enclosure. Cables labeled within the bundle will not be accepted.

G. Labeling: Fiber patch panels shall be marked using adhesive labels indicating the range of fibers installed in it. Each panel shall be labeled with the origination and destination Telecommunication Spaces and the strand count. Each fiber strand shall be labeled with a unique strand ID. All fiber patch panels will be labeled according to the guidelines as set forth in the EIA/TIA 606-A standard. This shall include:

1. Name of destination Telecommunication space.

2. Fiber pair number.

3. CLPCCD will approve label format before installation.

END OF SECTION 27 1300

SECTION 27 1500

COMMUNICATIONS HORIZONTAL CABLING

PART 1 - GENERAL

1.1 SUMMARY

A. Work Included:

1. Station Cabling

2. Telecommunications Jacks

3. Work Area Outlets

4. Patch Panels

1.2 RELATED SECTIONS

A. Contents of Division 27, Communications and Division 01, General Requirements apply to this Section.

B. Use this Section in conjunction with other Division 27, Communications specifications and related Contract Documents to establish the total general requirements for the project communications systems and equipment.

1.3 REFERENCES AND STANDARDS

A. References and Standards as required by Section 27 00 00, Communications Basic Requirements and Division 01, General Requirements.

B. Meet requirements of NFPA 780, Standard for the Installation of Lightning Protection Systems.

1.4 SUBMITTALS

A. Submittals as required by Section 27 00 00, Communications Basic Requirements and Division 01, General Requirements.

B. In addition, provide:

1. Procedures for cable labeling and identification, long term documentation methods and numbering scheme in accordance with ANSI/TIA/EIA-606A.

2. A copy of certified installer certificates and warranty certificates for products proposed.

1.5 QUALITY ASSURANCE

A. Quality assurance as required by Section 27 00 00, Communications Basic Requirements and Division 01, General Requirements.

B. Manufacturers to have a recognized certified installer program in place for system components proposed. Cable will be approved with manufacturer system installed.

1.6 WARRANTY

A. Warranty of materials and workmanship as required by Section 27 00 00, Communications Basic Requirements and Division 01, General Requirements.

B. In addition, provide:

1. Labor, materials and documentation according to selected manufacturer requirements necessary to ensure that the Owner will be furnished with an Extended Product Warranty and Application Assurance of a minimum of 25 years in length. The Application Assurance Warranty will cover the failure of the wiring system to support current or future applications that are designed for the link/channel specifications of ANSI/TIA/EIA-568-C.1. These applications include, but are not limited to, 10BASE-T, 100BASE-T, 1000BASE-T, 10GBASE-T and 155 Mb/s ATM.

2. A warranty on the physical installation.

3. Necessary documentation required by the manufacturer immediately following 100 percent testing of cables.

C. Administer the warranty process with the responsible manufacturer's representative. Provide warranty directly to the Owner from the manufacturer. Ensure that the manufacturer provides the Owner with the appropriate warranty certification within 90 calendar days of the final project completion.

1.7 SYSTEM DESCRIPTION

A. Provide a standards-based cable system to serve horizontal communication systems requirements as specified and as shown on Drawings. Closely follow ANSI/TIA/EIA, IEEE and ISO standards.

B. The horizontal distribution subsystem refers to intrabuilding twisted-pair communications cabling connecting telecommunications room (BDF and IDFs) to telecommunications outlets located at individual work areas and consists of the following:

1. Category 6A 100 ohm, 4-pair, unshielded twisted pair cables from the telecom rooms to the outlets.

2. The horizontal system includes cables, jacks, patch panels and patch cords, as well as the necessary support systems, such as cable managers and faceplates.

3. Cables are routed through conduit, spaces below raised floors, open ceiling areas, non-ventilated spaces above ceiling tile and through plenum air-handling spaces above ceiling tile.

4. Furnish and install materials necessary for a complete and working system.

C. Telecommunications Outlets are provisioned with 5-inch square style Randl Telecommunications backboxes and single gang faceplates.

D. Each Telecommunications outlet will have one (1) 1-1/4-inchconduit for every four cables that extends from the backbox to the accessible ceiling space, communications J-Hook or within 6-inch of a cable tray run.

E. The following telecommunication outlet standards are in use:

1. Type A – one voice, one data (1V1D) in four-port faceplate, unused ports blanked.

2. Type B – two data (2D) in four-port faceplate, unused ports blanked.

3. Type C – two voice, two data (2V2D) in four-port faceplate.

4. Type D – four data (4D) in four-port faceplate.

5. Type E – one voice (1V) in one port faceplate with knobs for hanging wall phones.

F. Any outlets provisioned above ceiling for projector, access point or other device connectivity, shall be finished on a plenum surface mount box.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Station Cabling:

1. CommScope/SYSTIMAX

B. Telecommunications Jacks:

1. CommScope/SYSTIMAX

C. Work Area Outlets:

1. CommScope/SYSTIMAX

D. Patch Panels:

1. CommScope/SYSTIMAX

2.2 STATION CABLING

A. To support a complete Category 6A channel, all cabling components will be certified for Category 6A transmission. This includes patch panels, cross-connect blocks, patch cords and outlet jacks.

B. All station cabling is to be Category 6A Unshielded Twisted Pair: 100 ohm, Category 6A, 23 AWG, 4-pair unshielded twisted pair, with a CMP rated jacket. Indoor/Outdoor rated UTP cable is required for cabling between Building 2 and Building 6.

C. Station cabling for different transmissions systems shall be cabled with different colors cable sheaths for ready identification. The cable sheaths will be blue for data and white for voice.

D. Other low-voltage subsystems must specify cabling with different color sheaths, so as to avoid confusion with voice/data cabling.

E. Cable colours will be

1. Blue for data

2. White for voice

3. Black where OSP cabling is required

2.3 TELECOMMUNICATIONS JACKS

A. Category 6A Jacks:

1. Eight-position jack, Category 6A, IDC terminals, T568A/B wiring scheme

2. Each jack must be stamped or have icons to identify it as CAT 6A.

3. Commscope/SYSTIMAX MGS 600 (White for Voice and Blue for Data)

2.4 WORK AREA OUTLETS

A. Flush Mounted Faceplate:

1. Four-port faceplate, constructed from high impact thermo-plastic, with recessed label fields; mounts within a single-gang mud ring as indicated on the drawings.

2. Coordinate faceplate color with building finishes. Submit to Architect for approval prior to installation.

B. Flush Mounted Stainless Steel Faceplates:

1. One-port stainless steel faceplate, with recessed label fields and lugs; mount within a single gang wall box as indicated on the drawings at phone locations only.

C. Surface Mounted Outlet Boxes:

1. Two-port surface mount box plenum rated, constructed from high impact thermo-plastic, with recessed label fields.

D. For modular furniture locations, install the jacks using manufacturer-supplied faceplates and/or adapters that accommodate the CommScope SYSTIMAX MGS-600 jacks.

E. Dust Covers: Single port dust cover for modular openings, color to match faceplate.

2.5 PATCH PANELS

A. Category 6A patch panels will be used for termination of all voice and data station cabling.

B. Category 6A patch panels shall meet or exceed the following specifications:

1. EIA/TIA Category 6A standard.

2. Rack mounted with front-facing RJ-45 patch panels and rear-facing 110 blocks.

3. Will be T568-B wired.

4. Have a paired punch down sequence with termination managers to allow pair-twist within 1/2-inch of the termination.

5. RJ-45 jacks will be modular to allow discrete removal and replacement of jacks without removal of the entire patch panel, as maintenance issues arise.

6. UL listed.

7. Must have 48 ports Angled Patch Panels with integrated front cable management hooks and rear cable suspension racks.

8. Must be from the same manufacturer as the other connectivity products (cable, jacks, faceplates, etc.).

C. Rear patch panel cable management should include the 2-inch or 5-inch cable support bars.

D. The cable is required to enter perpendicular to the termination.

E. All cable bundles on cable support bars will be managed with Velcro straps. Tie-wraps are not acceptable. CLPCCD also permits the use of cable “sock” for cable management.

PART 3 - EXECUTION

3.1 GENERAL INSTALLATION REQUIREMENTS

A. Miscellaneous Hardware: Provide supporting hardware, velcro ties, labels, pull rope and other miscellaneous hardware for a complete and operable system.

B. Provide like items from one manufacturer, such as jacks, patch panels, equipment connection cords and wall plates.

C. Horizontal cabling includes cables, jacks, patch panels, connecting blocks and patch cords, as well as the necessary support systems, such as cable managers and faceplates.

D. Furnish and install materials necessary for a complete and working system.

E. Contractor must be a Certified Installer for selected manufacturer prior to, during and through completion of the system installation and must be able to provide the manufacturer's extended warranty.

F. Perform work in a neat and workmanlike manner.

G. Install velcro after interior of building has been physically protected from the weather and mechanical work likely to damage cabling has been completed.

H. Before installing cabling, ensure cable pathways are completely and thoroughly cleaned.

1. Inspect conduit, wireway, cable trays and innerduct systems prior to installation.

2. Swab any additional enclosed raceway and innerduct systems.

I. Provide protection for exposed cables where subject to damage. Provide abrasion protection for any cable or wire bundles, which pass through holes or across edges of sheet metal.

J. Install cable ties and other cable management clamps via hand so it fits snugly. Do not over tighten or use mechanical tools which could compress, crimp, or otherwise change the physical characteristics of the cable jacket or distort the placement of twisted-pair components. Replace any cable exhibiting stresses due to over tightening of cable management devices.

K. Where possible, route cables in overhead cable trays and inside wire management systems attached to the equipment cabinets and racks. Use Velcro ties or ducts to restrain cabling installed outside of wire management systems on racks or in cabinets.

L. Co-install a pull cord (nylon; 1/8-inch minimum) with cable installed in conduit.

M. Limit cable raceway fill to less than the TIA/EIA-569-B maximum fill for the particular raceway type.

N. If a J-hook or trapeze system is used to support cable bundles, support horizontal cables at a maximum of 48-inch intervals. Cables are prohibited to rest on acoustic ceiling grids or panels.

O. Bundle horizontal distribution cables in groups of no more than 50 cables. Cable bundle quantities in excess of 50 cables may cause deformation of the bottom cables within the bundle and degrade cable performance.

P. Install cable above fire-sprinkler systems and ensure that the cable does not attach to the system or any ancillary equipment or hardware. Install cable system and support hardware such that it does not obscure any valves, fire alarm conduit, boxes, or other control devices.

Q. Do not attach cables to ceiling grid or lighting fixture wires. Where support for horizontal cable is required, install appropriate carriers to support the cabling.

R. Any cable damaged or exceeding recommended installation parameters during installation will be replaced by the contractor prior to final acceptance at no cost to the Owner.

S. Determine requirements for plenum rated cable and devices. When in doubt, seek determination in writing by Authority Having Jurisdiction (AHJ) prior to ordering. Without written confirmation from the AHJ, Contractor to assume that a plenum rating is required.

T. Unshielded Twisted Pair Cable Installation Practices:

1. Install cable in accordance with manufacturer's recommendations and best industry practices.

2. Install cables in continuous lengths from origin to destination (no splices).

3. Do not exceed the cable's minimum bend radius and maximum pulling tension.

4. Install unshielded twisted pair cable so that there are no bends smaller than four times the cable outside diameter at any point in the run and at the termination field.

5. Do not exceed 25-lbf pulling tension on 4-pair UTP cable.

U. Provide the following minimum separation distances between pathways for copper communications cables and power wiring of 480 volts or less:

1. Open or Nonmetal Communications Pathways:

a. 12-inches from electric motors, fluorescent light fixtures and unshielded power lines carrying up to 3 kVA.

b. 36-inches from electrical equipment and unshielded power lines carrying more than 5 kVA.

c. 72-inches from large electrical motors or transformers.

2. Grounded Metal Conduit Communications Pathways:

a. 2-1/2-inches from electrical equipment and unshielded power lines carrying up to 2 kVA.

b. 6-inches from electrical equipment and unshielded power lines carrying from 2 kVA to 5 kVA.

c. 12-inches from electrical equipment and unshielded power lines carrying more than 5 kVA.

d. 3-inches from power lines enclosed in a grounded metal conduit (or equivalent shielding) carrying from 2 kVA to 5 kVA.

e. 6-inches from power lines enclosed in a grounded metal conduit (or equivalent shielding) carrying more than 5 kVA.

V. Unshielded Twisted Pair Termination:

1. Coil cables in the in-wall or surface-mount boxes if adequate space is present to house the cable coil without exceeding the manufacturers bend radius. In hollow wall installations where box-eliminators are used, excess wire can be stored in the wall. Do not store more than 12-inches of UTP in an in-wall box, modular furniture raceway, or insulated walls. Loosely coil and store excess slack in accessible ceiling space above each drop location when there is not enough space present in the outlet box to store slack cable.

2. Dress and terminate cables in accordance with the recommendations made in the ANSI/TIA/EIA-568-C.1 document.

3. Terminate four pair cables on the jack and patch panels using T568B wiring scheme.

4. Maintain the cable jacket within 1/2-inch of the termination point.

5. Do not exceed 0.5-inch of pair untwist at the termination point.

6. Do not exceed four times the outside diameter of the cable in the termination area for bend radiance compliance.

7. Neatly bundle and dress cables to their respective panels or blocks. Feed each panel or block by an individual bundle separated and dressed back to the point of cable entrance into the rack or frame.

W. Testing Procedures:

1. Test cables and termination hardware for defects in installation and to verify cabling system performance under installed conditions according to the requirements of ANSI/TIA/EIA-568-C. Verify pairs of each installed cable prior to system acceptance. Repair or replace any defect in the cabling system installation including but not limited to cable, connectors, feed through couplers, patch panels and connector blocks in order to ensure 100 percent useable conductors in cables installed.

2. Test cables in accordance with this document, the ANSI/TIA/EIA standards, the manufacturer's procedures and best industry practice. If any of these are in conflict, bring any discrepancies to the attention of the project team for clarification and resolution.

3. Test Unshielded Twisted Pair Cables as Follows:

   a. Test twisted-pair copper cable links for continuity, pair reversals, shorts, opens and performance as indicated below. Additional testing is required to verify Category performance. Test horizontal cabling using a Level IV test unit for Category 6A performance compliance as specified in ANSI/TIA/EIA-568 C.

   b. Continuity: Test each pair of each installed cable using a test unit that shows opens, shorts, polarity and pair-reversals, crossed pairs and split pairs. Test shielded/screened cables with a device that verifies shield continuity in addition to the above stated tests. Record the test as pass/fail as indicated by the test unit in accordance with the manufacturers' recommended procedures and referenced to

the appropriate cable identification number and circuit or pair number. Correct or repair any faults in the wiring and retest the cable prior to final acceptance.

c. Length: Test each installed cable link for installed length using a TDR type device. Test the cables from patch panel to patch panel, block to block, patch panel to outlet or block to outlet as appropriate. The cable length will conform to the maximum distances set forth in the ANSI/TIA/EIA-568-C Standard. Record cable lengths, referencing the cable identification number and circuit or pair number. For multipair cables, record the shortest pair length as the length for the cable.

4. Follow the Standards requirements established in ANSI/TIA/EIA-568-C.

5. Perform testing with a Level IV tester. The basic tests required are:

   a. Wire Map

   b. Length

   c. Attenuation

   d. NEXT (Near-end Crosstalk)

   e. Return Loss

   f. ELFEXT Loss

   g. Propagation Delay

   h. Delay Skew

   i. PSNEXT (Power Sum Near-end Crosstalk Loss)

   j. PSELFEXT (Power Sum Equal Level Far-end Crosstalk Loss)

6. Provide test results in electronic format, with the following minimum information per cable:

   a. Circuit ID

   b. Test Result, “Pass” or “Fail” (NOTE: any "Fail" is not acceptable - re-terminate or replace the cable until a "Pass" is achieved)

   c. Date and Time of Test

   d. Project Name

7. Provide an electronic copy of the test results, in the native tester software format, to the Architect or Engineer along with the printed test results.

8. Provide a fully functional version of the tester software for use by the Architect or Engineer in reviewing the test results.

9. Cable Testing Validation: After installation is completed and the Telecommunication Contractor has completed testing, the CLPCCD District ITS reserves the right to separately test the installed cables, up to 100 percent using the Telecommunication Contractor testing equipment or with CLPCCD-provided computer/network equipment. Cables that have been tested and fail to meet performance requirements as stated in the specifications shall be removed and replaced with all new material and re-tested at no cost to the College.

X. Labeling:

1. Station cables shall be marked at each end, on the sheath indicating the Telecommunications Room and jack number to which the cable is wired.

2. Backbone cables shall be marked at each endpoint and at all intermediate pull/ access points or junction boxes. Label shall indicate origination and destination Telecommunication Rooms, sheath ID and strand or pair range.

3. Meet the legibility, defacement, exposure and adhesion requirements of UL 969.

4. Be pre-printed or laser printed type.

5. Where used for cable marking, a label with a vinyl substrate and white printing area and a clear "tail" that self laminates the printed area when wrapped around the cable shall be provided. The label color shall be different than that of the cable to which it is attached.

6. Where insert type labels are used, provide clear plastic covers to go over label.

7. The Contractor shall confirm specific labeling requirements with the Owner or Owner's Representative prior to cable installation or termination.

Y. Coordination of Conditions: Structured cabling for wireless access points of a given description may be used in more than one type of ceiling or wall structure. Coordinate ceiling construction, wall types, recessing depth and other construction details prior to ordering special components indicated in the details for shipment. Where materials supplied do not match ceiling construction replace them at no cost to Owner.

3.2 STATION CABLING

A. Reference 3.01, General Installation Requirements.

B. Install per manufacturer's instructions and recommendations.

C. Labeling: All station cables will be labeled at each end of the cable within 6-inches of the termination. At the patch panel end, all labels must be visible and not be placed inside wire management. Station cables will also be labeled on the faceplate. All cables will be labeled according to the guidelines as follows:

1. Name of the Telecommunications Space where the cables terminate.

2. Faceplate/outlet number

3. Jack label – alpha (A, B, C, D) labeled left to right, top to bottom.

4. All labeling will be reviewed and approved by CLPCCD before cable installation.

3.3 TELECOMMUNICATIONS JACKS

A. Reference 3.01, General Installation Requirements.

B. Install per manufacturer's instructions and recommendations.

3.4 WORK AREA OUTLETS

A. Reference 3.01, General Installation Requirements.

B. Install per manufacturer's instructions and recommendations.

C. Labeling: All faceplates/outlets for station cable terminations will be labeled. This includes wall outlets, wall phones, faceplates in floor boxes and all other termination points. For faceplates equipped with a label trough and plastic cover, the Contractor shall include the jack designation in the label trough. If upper and lower troughs are available, the Contractor shall divide the jack labeling horizontally, labeling the top two jacks in the upper trough and the bottom two jacks in the lower trough. All faceplates/outlets will be labeled according to the following guidelines:

1. Name of Telecommunication Space the cable routes to.

2. Unique faceplate/outlet number, incrementing numerically.

3.5 PATCH PANELS

A. Reference 3.01, General Installation Requirements.

B. Install per manufacturer's instructions and recommendations.

C. Labeling: All ports on the station patch panels shall be labeled with the station cable labels described above. Cables will be terminated in ascending outlet and jack order, and be so labeled. Patch panels which provide cabling connection to voice riser and backbone pairs shall be labeled using a similar convention as the backbone/riser cable labeling. The patch panel will be labeled with the cable name including:

1. The origination point

2. The type of cable

3. Each jack will be labeled for each pair in the riser/backbone cable

END OF SECTION 27 1500

SECTION 28 0001

ELECTRONIC SAFETY BASIC REQUIREMENTS

PART 1 - GENERAL

1.1 DESIGN-BUILD SUMMARY

A. Work included in 28 00 01 applies to Division 28, Electronic Safety work to provide materials, labor, tools, permits and incidentals to make electronic safety systems ready for Owner's use for proposed project.

1.2 DESIGN-BUILD INSTRUCTIONS

A. This document is issued to give Bidders a basis for preparing a proposal to design and install a complete Electronic Safety system for this project.

B. Alternates to this Document may be offered as a separate proposal.

1.3 DESIGN-BUILD DESIGN APPROACH

A. Use this Specification as a guide for design/engineering requirements, workmanship and materials or construction. Utilize design-build concept throughout construction phase of project.

B. Investigate and be apprised of applicable codes, rules, and regulations as enforced by AHJ.

C. Visit the Site of the proposed construction. Verify and inspect the existing site to determine conditions that affect this work.

1.4 DESIGN-BUILD DESIGN CRITERIA/CALCULATIONS

A. Related Work Specified Elsewhere:

1. Contents of Section apply to Division 28, Electronic Safety Specifications.

2. Requirements of Section are a minimum for Division 28, Electronic Safety Sections, unless otherwise stated in each Section, in which case that Section's requirements take precedence.

B. Fire Alarm Design Criteria: Refer to Section 28 31 00, Fire Detection and Alarm, for fire alarm system design criteria.

C. Fire Alarm Equipment: Refer to Section 28 31 00, Fire Detection and Alarm, for fire alarm equipment requirements.

1.5 SECTION INCLUDES

A. Work included in 28 00 01, Electronic Safety Basic Requirements applies to Division 28, Electronic Safety work to provide materials, labor, tools, permits, incidentals, and other services to provide and make ready for Owner's use of electronic safety systems for proposed project.

B. Contract Documents include, but are not limited to, Specifications including Division 00, Procurement and Contracting Requirements and Division 01, General Requirements, Drawings, Addenda, Owner/Architect Agreement, and Owner/Contractor Agreement. Confirm requirements before commencement of work.

C. Definitions:

1. Provide: To furnish and install, complete and ready for intended use.

2. Furnish: Supply and deliver to project site, ready for unpacking, assembly and installation.

3. Install: Includes unloading, unpacking, assembling, erecting, installing, applying, finishing, protecting, cleaning and similar operations at project site as required to complete items of work furnished.

4. Approved or Approved Equivalent: To possess the same performance qualities and characteristics and fulfill the utilitarian function without any decrease in quality, durability or longevity. For equipment/products defined by the Contractor as "equivalent," substitution requests must be submitted to Engineer for consideration, in accordance with Division 01, General Requirements, and approved by the Engineer prior to submitting bids for substituted items.

5. Authority Having Jurisdiction (AHJ): Indicates reviewing authorities having jurisdiction, including local fire marshal, Owner's insurance underwriter, Owner's Authorized Representative, and other reviewing entity whose approval is required to obtain systems acceptance.

1.6 RELATED SECTIONS

A. Contents of Section apply to Division 28, Electronic Safety Contract Documents.

B. Related Work:

1. Additional conditions apply to this Division including, but not limited to:

a. Specifications including Division 00, Procurement and Contracting Requirements and Division 01, General Requirements.

b. Drawings

c. Addenda

d. Owner/Architect Agreement

e. Owner/Contractor Agreement

f. Codes, Standards, Public Ordinances and Permits

C. Contents of Division 26, Electrical apply to this Section.

1.7 REFERENCES AND STANDARDS

A. References and Standards per Division 00, Procurement and Contracting Requirements and Division 01, General Requirements, individual Division 28, Electronic Safety Sections and those listed in this Section.

B. Codes to include latest adopted editions, including current amendments, supplements and local jurisdiction requirements in effect as of the date of the Contract Documents, of/from:

1. State of California:

a. CBC - California Building Code

b. CEC - California Electrical Code

c. CEC T24 - California Energy Code Title 24

d. CFC - California Fire Code

e. CMC - California Mechanical Code

f. CPC - California Plumbing Code

g. CSFM - California State Fire Marshal

h. DSA - Division of State Architect Regulations and Requirements

C. Reference standards and guidelines include but are not limited to the latest adopted editions from:

1. ABA - Architectural Barriers Act

2. ADA - Americans with Disabilities Act

3. ANSI - American National Standards Institute

4. ASCE - American Society of Civil Engineers

5. ASHRAE - American Society of Heating, Refrigerating and Air-Conditioning Engineers

6. ASHRAE Guideline 0, the Commissioning Process

7. ASME - American Society of Mechanical Engineers

8. ASTM - ASTM International

9. CFR - Code of Federal Regulations

10. EPA - Environmental Protection Agency

11. ETL - Electrical Testing Laboratories

12. FM - FM Global

13. ISO - International Organization for Standardization

14. NEC - National Electric Code

15. NEMA - National Electrical Manufacturers Association

16. NFPA - National Fire Protection Association

17. OSHA - Occupational Safety and Health Administration

18. SMACNA - Sheet Metal and Air Conditioning Contractors' National Association

19. UL - Underwriters Laboratories Inc.

D. See Division 28, Electronic Safety individual Sections for additional references.

1.8 SUBMITTALS

A. See Division 01, General Requirements for Submittal Procedures.

B. Provide drawings in format and software release equal to the design documents. Drawings to be the same sheet size and scale as the Contract Documents.

C. "No Exception Taken" constitutes that review is for general conformance with the design concept expressed in the Contract Documents for the limited purpose of checking for conformance with information given. Any action is subject to the requirements of the Contract Documents. Contractor is responsible for the dimensions and quantity and will confirm and correlate at the job site, fabrication processes and techniques of construction, coordination of the work with that of all other trades, and the satisfactory performance of the work.

D. Provide product submittals and shop drawings in electronic format only. Electronic format must be submitted via zip file via e-mail. For electronic format, provide one file per division containing one bookmarked PDF file with each bookmark corresponding to each Specification Section. Arrange bookmarks in ascending order of Specification Section number. Individual submittals sent piecemeal in a per Specification Section method will be returned without review or comment. Copy Architect on all transmissions/submissions.

E. Product Data: Provide manufacturer's descriptive literature for products specified in Division 28, Electronic Safety Sections.

F. Identify/mark each submittal in detail. Note what difference, if any, exist between the submitted item and the specified item. Failure to identify the differences will be considered cause for disapproval. If differences are not identified and/or not discovered during the submittal review process, Contractor remains responsible for providing equipment and materials that meet the specifications and drawings.

1. Label submittal to match numbering/references as shown in Contract Documents. Highlight and label applicable information to individual equipment or cross out/remove extraneous data not applicable to submitted model. Clearly note options and accessories to be provided, including field installed items. Highlight connections by/to other trades.

2. Include technical data, installation instructions and dimensioned drawings for products, equipment and devices installed, furnished or provided. Reference individual Division 28, Electronic Safety specification Sections for specific items required in product data submittal outside of these requirements.

3. See Division 28, Electronic Safety individual Sections for additional submittal requirements outside of these requirements.

G. Maximum of two reviews of complete submittal package. Arrange for additional reviews and/or early review of long-lead items; Bear costs of additional reviews at Engineer's hourly rates. Incomplete submittal packages/submittals will be returned to contractor without review.

H. Resubmission Requirements: Make corrections or changes in submittals as required, and in consideration of Engineer's comments. Identify Engineer's comments and provide an individual response to each of the Engineer's comments. Cloud changes in the submittals and further identify changes which are in response to Engineer's comments.

I. Structural/Seismic: Provide weights, dimensions, mounting requirements and like information required for mounting, seismic bracing, and support. Indicate manufacturer's installation and support requirements to meet ASCE 7-10 requirements for non-structural components. Provide engineered seismic drawings and equipment seismic certification. Equipment Importance Factor as specified in Division 01 and in Structural documents.

J. Trade Coordination: Include physical characteristics, electrical characteristics, device layout plans, wiring diagrams, and connections as required per Division 28, Electronic Safety Coordination Documents. For equipment with electrical connections, furnish copy of approved submittal for inclusion in Division 26, Electrical and Division 28, Electronic Safety submittals.

K. Make provisions for openings in building for admittance of equipment prior to start of construction or ordering of equipment.

L. Substitutions and Variation from Basis of Design:

1. The Basis of Design designated product establishes the qualities and characteristics for the evaluation of any comparable products by other listed acceptable manufacturers if included in this Specification or included in an approved Substitution Request as judged by the Design Professional.

2. If substitutions and/or equivalent equipment/products are being proposed, it is the responsibility of parties concerned, involved in, and furnishing the substitute and/or equivalent equipment to verify and compare the characteristics and requirements of that furnished to that specified and/or shown. If greater capacity and/or more materials and/or more labor are required for the rough-in, circuitry or connections than for the item specified and provided for, then provide compensation for additional charges required for the proper rough-in, circuitry and connections for the equipment being furnished. No additional charges above the Base Bid, including resulting charges for work performed under other Divisions, will be allowed for such revisions. Coordinate with the requirements of "Submittals." For any product marked "or approved equivalent," a substitution request must be submitted to Engineer for approval prior to purchase, delivery orinstallation.

3. Where manufacturer equipment or model numbers are indicated with no exceptions, substitutions will be rejected.

M. Shop Drawings:

1. Provide coordinated shop drawings which include physical characteristics of all systems, device layout plans, and control wiring diagrams. Reference individual Division 28, Electronic Safety specification Sections for additional requirements for shop drawings outside of these requirements.

2. Provide Shop Drawings indicating access panel locations, size and elevation for approval prior to installation.

N. Samples: Provide samples when requested by individual Sections.

O. Resubmission Requirements:

1. Make any corrections or change in submittals when required by Architect/Engineer review comments. Provide submittals as specified. The engineer will not be required to edit and/or interpret the Contractor's submittals. Indicate changes for the resubmittal in a cover letter with reference to page(s) changed and reference response to comment. Cloud changes in the submittals.

2. Resubmit for review until review indicates no exception taken or "make corrections noted."

3. When submitting drawings for Engineers re-review, clearly indicate changes on drawings and "cloud" any revisions. Submit a list describing each change.

P. Operation and Maintenance Manuals, Owner's Instructions:

1. Reference individual Division 28, Electronic Safety Specification Sections for additional requirements for operations and maintenance manuals.

2. Submit, at one time, electronic files (PDF format) of manufacturer's operation and maintenance instruction manuals and parts lists for equipment or items requiring servicing. Submit data when work is substantially complete and in same order format as

submittals. Include name and location of source parts and service for each piece of equipment.

a. Include copy of approved submittal data along with submittal review letters received from Engineer. Data to clearly indicate installed equipment model numbers. Delete or cross out data pertaining to other equipment not specific to this project.

b. Include copy of manufacturer's standard Operations and Maintenance for equipment. At front of each tab, provide routine maintenance documentation for scheduled equipment. Include manufacturer's recommended maintenance schedule and highlight maintenance required to maintain warranty. Furnish list of routine maintenance parts, including part numbers, sizes and quantities relevant to each piece of equipment.

c. Include copy of complete parts list for equipment. Include available exploded views of assemblies and sub-assemblies.

d. Include Warranty per Division 00, Procurement and Contracting Requirements, Division 01, General Requirements, Section 28 00 01, Electronic Safety Basic Requirements and individual Sections.

e. Include product certificates of warranties and guarantees.

f. Include copy of start-up and test reports specific to each piece of equipment.

g. Include commissioning reports.

h. Engineer will return incomplete documentation without review.

i. Engineer will provide one set of review comments in Submittal Review format. Arrange for additional reviews; Bear costs for additional reviews at Engineer's hourly rates.

3. Thoroughly instruct Owner in proper operation of equipment and systems. Where noted in individual Sections, training will include classroom instruction with applicable training aids and systems demonstrations. Field instruction per Section 28 00 01, Electronic Safety Basic Requirements Article titled "Demonstration."

4. Copies of certificates of code authority inspections, acceptance, code required acceptance tests, letter of conformance and other special guarantees, certificates of warranties, specified elsewhere or indicated on Drawings.

Q. Record Drawings:

1. Maintain at site at least one set of drawings for recording “as-constructed” conditions. Indicate on drawings changes to original documents by referencing revision document, and include buried elements and location of concealed items. Include items changed by addenda, field orders, supplemental instructions, and constructed conditions.

2. Record Drawings are to include equipment locations, calculations, and schedules that accurately reflect "as constructed or installed" for project.

3. At completion of project, input changes to original project on CAD Drawings and make one set of black-line drawings created from CAD Files in version/release equal to contract drawings. Submit CAD disk and drawings upon substantial completion.

4. See Division 28, Electronic Safety individual Sections for additional items to include in Record Drawings.

1.9 QUALITY ASSURANCE

A. Regulatory Requirements: Work and materials installed to conform with all local, State and Federal codes, and other applicable laws and regulations. Where code requirements are at variance with Contract Documents, meet code requirements as a minimum requirement and include costs necessary to meet these in Contract. Machinery and equipment are to comply with OSHA requirements, as currently revised and interpreted for equipment manufacturer requirements. Install equipment provided per manufacturer recommendations.

B. Whenever this Specification calls for material, workmanship, arrangement or construction of higher quality and/or capacity than that required by governing codes, higher quality and/or capacity take precedence.

C. Drawings are intended to be diagrammatic and reflect the Basis of Design manufacturer's equipment. They are not intended to show every item in its exact dimensions, or details of equipment or proposed systems layout. Verify actual dimensions of systems (e.g. cable tray, panels, etc.) and equipment proposed to assure that systems and equipment will fit in available space. Contractor is responsible for design and construction costs incurred for equipment other than Basis of Design, including, but not limited to, architectural, structural, electrical, HVAC, fire sprinkler, and plumbing systems.

D. Manufacturer's Instructions: Follow manufacturer's written instructions. If in conflict with Contract Documents, obtain clarification. Notify Engineer/Architect, in writing, before starting work.

E. Items shown on Drawings are not necessarily included in Specifications or vice versa. Confirm requirements in all Contract Documents.

F. Provide products that are UL listed.

1.10 WARRANTY

A. Provide written warranty covering the work for a period of one year from date of Substantial Completion in accordance with Division 00, Procurement and Contracting Requirements and Division 01, General Requirements, Section 28 00 01, Electronic Safety Basic Requirements and individual Division 28, Electronic Safety Sections.

B. Sections under this Division can require additional and/or extended warranties that apply beyond basic warranty under Division 01, General Requirements and the General Conditions. Confirm requirements in all Contract Documents.

1.11 COORDINATION DOCUMENTS

A. Prior to construction, prepare and submit coordinated layout drawings (composite drawings), to coordinate installation and location of ductwork, grilles, diffusers, piping, fire sprinklers, plumbing, lights, and electrical services. Composite Drawings show services on single sheet. Key Drawings to structural column identification system. Prior to completion of Drawings, coordinate proposed installation with architectural and structural requirements, and other trades (including plumbing, HVAC, fire protection, electrical, ceiling suspension, and ceiling tile systems, etc.), and provide maintenance access requirements. Coordinate with submitted architectural systems (i.e. roofing, ceiling, finishes) and structural systems as submitted, including footings and foundation. Identify zone of influence from footings and ensure systems are not routed within the zone of influence. Unless otherwise required by Division 00, Procurement and Contracting Requirements and/or Division 01, General Requirements, Division 28, Electronic Safety to combine information furnished by other trades onto master coordination documents.

B. Prepare Drawings as follows:

1. Drawings in CAD Format. CAD format release equal to design documents. Drawings to be same sheet size and scale as Contract Drawings and indicate location, size and elevation above finished floor of equipment and distribution systems.

2. Review and revise, as necessary, section cuts in Contract Drawings after verification of field conditions.

3. Indicate fittings, hangers, access panels, and elevation of bottom of cable tray above finished floor.

4. Drawings to indicate proposed ceiling grid and lighting layout as shown on electrical drawings and architectural reflected ceiling drawings and HVAC equipment, ductwork.

5. Incorporate Addenda items and change orders.

6. Provide additional coordination as requested by other trades.

C. Advise Architect in event conflict occurs in location or connection of equipment. Bear costs resulting from failure to properly coordinate installation or failure to advise Architect of conflict.

D. Verify in field exact size, location, and clearances of existing material, equipment and apparatus, and advise Architect of discrepancies between that indicated on Drawings and that existing in field prior to installation related thereto.

E. Submit final Coordination Drawings with changes as Record Drawings at completion of project.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Articles, fixtures, and equipment of a kind to be standard product of one manufacture, including but not limited to panels, devices and equipment unless otherwise specified in individual Division 28, Electronic Safety Sections.

2.2 STANDARDS OF MATERIALS AND WORKMANSHIP

A. Base contract upon furnishing materials as specified. Materials, equipment, and fixtures used for construction are to be new, latest products as listed in manufacturer's printed catalog data and are to be UL or FM approved or have adequate approval or be acceptable by state, county, and city authorities.

B. Names and manufacturer's names denote character and quality of equipment desired and are not to be construed as limiting competition.

C. Hazardous Materials:

1. Comply with local, State of California, and Federal regulations relating to hazardous materials.

2. Comply with Division 00, Procurement and Contracting Requirements and Division 01, General Requirements for this project relating to hazardous materials.

3. Do not use any materials containing a hazardous substance. If hazardous materials are encountered, do not disturb; immediately notify Owner and Architect. Hazardous materials will be removed by Owner under separate contract.

PART 3 - EXECUTION

3.1 ACCESSIBILITY AND INSTALLATION

A. Confirm Accessibility and Installation requirements in Division 00, Procurement and Contracting Requirements, Division 01, General Requirements, Section 28 00 01, Electronic Safety Basic Requirements and individual Division 28, Electronic Safety Sections.

B. Install equipment having components requiring access (i.e., devices, equipment, electrical boxes, panels, etc.) so that they may be serviced, reset, replaced or recalibrated by service people with normal service tools and equipment. Do not install equipment in obvious passageways, doorways, scuttles or crawlspaces which would impede or block intended usage.

C. Install equipment and products complete as directed by manufacturer's installation instructions. Obtain installation instructions from manufacturer prior to rough-in of equipment and examine instructions thoroughly. When requirements of installation instructions conflict with Contract Documents, request clarification from Architect prior to proceeding with installation. This includes proper installation methods, sequencing and coordination with other trades and disciplines.

D. Earthwork:

1. Confirm Earthwork requirements in Contract Documents. In absence of specific requirements, comply with individual Division 28, Electronic Safety Sections and the following:

a. Perform excavation, dewatering, shoring, bedding, and backfill required for installation of work in this Division in accordance with related earthwork divisions. Contact utilities and locate existing utilities prior to excavation. Repair any work damaged during excavation or backfilling.

b. Excavation: Do not excavate under footings, foundation bases, or retaining walls.

c. Provide protection of underground systems. Review the project Geotechnical Report for references to corrosive or deleterious soils which will reduce the performance or service life of underground systems materials.

E. Firestopping:

1. Confirm Firestopping requirements in Division 07, Thermal and Moisture Protection.

2. In absence of specific requirements, comply with individual Division 28, Electronic Safety Sections and coordinate location and protection level of fire and/or smoke rated walls, ceilings, and floors. When these assemblies are penetrated, seal around conduit, raceway and equipment with approved firestopping material. Install firestopping material complete as directed by manufacturer's installation instructions. Meet requirements of ASTM E814, Standard Test Method for Fire Tests of Through-Penetration Fire Stops.

F. Plenums: In plenums, provide plenum rated materials that meet the requirements to be installed in plenums.

3.2 SEISMIC CONTROL

A. Confirm Seismic Control requirements in Division 01, General Requirements, Structural documents, and individual Division 28 Electronic Safety Sections.

B. Earthquake resistant designs for Electronic Safety (Division 28) systems and equipment to conform to regulations of jurisdiction having authority.

C. Restraints which are used to prevent disruption of function of piece of equipment because of application of horizontal force to be such that forces are carried to frame of structure in such a way that frame will not be deflected when apparatus is attached to a mounting base and equipment pad, or to structure in normal way, utilizing attachments provided. Secure equipment and distribution systems to withstand a force in direction equal to value defined by jurisdiction having authority.

D. Provide means to prohibit excessive motion of safety equipment during earthquake.

3.3 REVIEW AND OBSERVATION

A. Confirm Review and Observation requirements in Division 00, Procurement and Contracting Requirements, Division 01, General Requirements, Section 28 00 01, Electronic Safety Basic Requirements and individual Division 28, Electronic Safety Sections.

B. Notify Architect, in writing, at following stages of construction so that they may, at their option, visit site for review and construction observation:

1. Underground conduit and wire installation prior to backfilling.

2. Prior to covering walls when electronic safety systems installation is started.

3. Prior to ceiling cover/installation.

4. When main systems, or portions of, are being tested and ready for inspection by AHJ.

C. Final Punch: Costs incurred by additional trips required due to incomplete systems will be the responsibility of the Contractor.

3.4 CONTINUITY OF SERVICE

A. Confirm requirements in Division 00, Procurement and Contracting Requirements and Division 01, General Requirements. In absence of specific requirements in Division 01, General Requirements, comply with individual Division 28, Electronic Safety Sections and the following:

1. During remodeling or addition to existing structures, while existing structure is occupied, current services to remain intact until new construction, facilities or equipment is installed.

2. Prior to changing over to new system, verify that every item is thoroughly prepared. Install new wiring to point of connection.

3. Coordinate transfer time to new service with Owner. If required, perform transfer during off peak hours. Once changeover is started, pursue to its completion to keep interference to a minimum.

a. If overtime is necessary, there will be no allowance made by Owner for extra expense for such overtime or shift work.

4. Organize work to minimize duration of power interruption.

3.5 CUTTING AND PATCHING

A. Confirm Cutting and Patching Requirements in Division 00, Procurement and Contracting Requirements and Division 01, General Requirements. In absence of specific requirements, comply with individual Division 28, Electronic Safety Sections and the following:

1. Proposed floor cutting/core drilling/sleeve locations to be approved by Project Structural Engineer. Submit proposed locations to Architect/Project Structural Engineer. Where slabs

are of post tension construction, perform x-ray scan of proposed penetration locations and submit scan results including proposed penetration locations to Project Structural Engineer/Architect for approval. Where slabs are of waffle type construction, show column cap extent and cell locations relative to proposed penetration(s).

2. Cutting, patching and repairing for work specified in this Division including plastering, masonry work, concrete work, carpentry work, and painting included under this Section will be performed by skilled craftsmen of each respective trade in conformance with appropriate Division of Work.

3. Additional openings required in building construction to be made by drilling or cutting. Use of jack hammer is specifically prohibited. Patch openings in and through concrete and masonry with grout.

4. Restore new or existing work that is cut and/or damaged to original condition. Patch and repair specifically where existing items have been removed. This includes repairing and painting walls, ceilings, etc. where existing conduit and devices are removed as part of this project. Where alterations disturb lawns, paving, and walks, repair, refinish and leave in condition matching existing prior to commencement of work.

5. Additional work required by lack of proper coordination will be provided at no additional cost to the Owner.

3.6 EQUIPMENT SELECTION AND SERVICEABILITY

A. Replace or reposition equipment which is too large or located incorrectly to permit servicing, at no additional cost to Owner.

3.7 DELIVERY, STORAGE AND HANDLING

A. Confirm requirements in Division 00, Procurement and Contracting Requirements and Division 01, General Requirements. In absence of specific requirements, comply with the individual Division 28, Electronic Safety Sections and the following:

1. Handle materials delivered to project site with care to avoid damage. Store materials on site inside building or protected from weather, dirt and construction dust.

2. Protect equipment and pipe to avoid damage. Close conduit openings with caps or plugs. Keep motors and bearings in watertight and dustproof covers during entire course of installation.

3. Protect devices, panels and similar items until in service.

4. Products and/or materials that become damaged due to water, dirt and/or dust as a result of improper storage to be replaced before installation.

3.8 DEMONSTRATION

A. Confirm Demonstration requirements in Division 00, Procurement and Contracting Requirements and Division 01, General Requirements, Section 28 00 01, Electronic Safety Basic Requirements and individual Division 28, Electronic Safety Sections.

B. Upon completion of work and adjustment of equipment, test systems, demonstrate to Owner's Authorized Representative, Architect and Engineer that equipment furnished and installed or connected under provisions of these Specifications functions in manner required. Provide field instruction to Owner's Staff as specified in Division 01, General Requirements, Section 28 00 01, Electronic Safety Basic Requirements and individual Division 28, Electronic Safety Sections.

C. Manufacturer's Field Services: Furnish services of a qualified factory certified instructor at time approved by Owner, to instruct maintenance personnel, correct defects or deficiencies, and demonstrate to satisfaction of Owner that entire system is operating in satisfactory manner and complies with requirements of other trades that may be required to complete work. Complete instruction and demonstration prior to final job site observations.

3.9 CLEANING

A. Confirm cleaning requirements in Division 00, Procurement and Contracting Requirements, Division 01, General Requirements, Section 28 00 01, Electronic Safety Basic Requirements and individual Division 28 Sections.

B. Upon completion of installation, thoroughly clean exposed portions of equipment, removing temporary labels and traces of foreign substances. Throughout work, remove construction debris and surplus materials accumulated during work.

3.10 INSTALLATION

A. Confirm Installation requirements in Division 00, Procurement and Contracting Requirements, Division 01, General Requirements, Section 28 00 01, Electronic Safety Basic Requirements and individual Division 28, Electronic Safety Sections.

B. Install equipment in accordance with manufacturer's installation instructions, plumb and level and firmly anchored to building structure. Maintain manufacturer's recommended clearances.

C. Start up equipment, in accordance with manufacturer's start-up instructions, and in presence of manufacturer's representative. Test controls and demonstrate compliance with requirements. Replace damaged or malfunctioning controls and equipment.

D. Provide miscellaneous supports required for installation of equipment, conduit and wiring.

3.11 PAINTING

A. Confirm Painting requirements in Division 01, General Requirements and Division 09, Finishes. In absence of specific requirements, comply with individual Division 28, Electronic Safety Sections and the following:

1. Ferrous Metal: After completion of work, thoroughly clean and paint exposed supports constructed of ferrous metal surfaces, i.e. hangers, hanger rods, equipment stands, with one coat of black asphalt varnish for exterior or black enamel for interior, suitable for hot surfaces.

2. In electrical and mechanical room, on roof or other exposed areas, equipment not painted with enamel to receive two coats of primer and one coat of rustproof enamel, colors as selected by Architect.

3. See individual equipment Specifications for other painting.

4. Structural Steel: Repair damage to structural steel finishes or finishes of other materials damaged by cutting, welding or patching to match original.

5. Conduit: Clean, primer coat and paint interior conduit exposed in finished areas with two coats paint suitable for metallic surfaces. Color selected by Architect.

3.12 ACCEPTANCE

A. Confirm requirements in Division 00, Procurement and Contracting Requirements and Division 01, General Requirements. In absence of specific requirements, comply with individual Division 28, Electronic Safety Sections and the following:

1. System cannot be considered for acceptance until work is completed and demonstrated to Architect that installation is in strict compliance with Specifications, Drawings and manufacturer's installation instructions, particularly in reference to following:

a. Cleaning

b. Operation and Maintenance Manuals

c. Training of Operating Personnel

d. Record Drawings

e. Warranty and Guaranty Certificates

f. Start-up/test Documents and Commissioning Reports

3.13 FIELD QUALITY CONTROL

A. Confirm requirements in Division 00, Procurement and Contracting Requirements and Division 01, General Requirements. In absence of specific requirements, comply with individual Division 28, Electronic Safety Sections and the following:

1. Tests:

a. Conduct tests of equipment and systems to demonstrate compliance with requirements specified. Reference individual Specification Sections for required tests. Document tests and include in Closeout Documents.

b. During site evaluations by Architect or Engineer, provide appropriate personnel with tools to remove and replace trims, covers, and devices so that proper evaluation of installation can be performed.

3.14 LETTER OF CONFORMANCE

A. Provide Letter of Conformance, copies of manufacturers' warranties and extended warranties with a statement in letter that electronic safety systems were installed in accordance with manufacturer's recommendations, UL listings and FM Global approvals. Include Letter of Conformance, copies of manufacturers' warranties and extended warranties in operating and maintenance manuals.

END OF SECTION 28 0001

SECTION 28 3100

FIRE DETECTION AND ALARM

PART 1 - GENERAL

1.1 SUMMARY

A. Work Included:

1. Fire Alarm Control Units
2. Notification Appliance Circuit Panels
3. Fire Alarm Emergency Voice/Alarm Communications System Control Units
4. Manual Pull Stations
5. Photoelectric Type Detectors
6. Control Modules
7. Speakers
8. Combination Speaker/Strobes
9. Strobes
10. Miscellaneous Accessories

B. Scope:

1. Provide a new fire alarm system.
2. Provide a new emergency voice alarm communication system.

C. In addition, provide design for the following as required in these Contract Documents:

1. Fire Alarm System
2. Emergency Voice Alarm Communication System

D. System Design:

1. Design Criteria: These are Contractor designed systems. Contact AHJ prior to bid to verify systems' requirements. Design systems in compliance with code as interpreted by the AHJ.
2. Design of Fire Alarm System:
    a. Provide design of the fire alarm system as required by code.
    b. Fire Alarm Sequence of Operation: Match existing campus wide SOO.

c. Supervisory Sequence of Operation: Match existing campus wide SOO.

d. Trouble Sequence of Operation: Match existing campus wide SOO.

3. Design of the Emergency Voice Alarm Communication System: Provide design of the emergency voice alarm communication system as required by code.

1.2 RELATED SECTIONS

A. Contents of Division 28, Electronic Safety and Division 01, General Requirements apply to this Section.

B. Division 26, Electrical requirements apply to this section.

1.3 REFERENCES AND STANDARDS

A. References and Standards as required by Division 28, Electronic Safety and Division 01, General Requirements.

B. In addition, meet the following:

1. NFPA 72, National Fire Alarm and Signaling Code, adopted edition.

2. NFPA 70, National Electrical Code, adopted edition.

1.4 SUBMITTALS

A. Submittals as required by Division 28, Electronic Safety and Division 01, General Requirements.

B. In addition, provide:

1. Shop drawings to include the following:

a. Provide system designer NICET certification number or Engineer's signature and seal on shop drawings.

b. Identification of system designer and evidence of qualification or certification of designer as required by AHJ.

c. Floor plans indicating walls, doors, partitions, room descriptions, device/component locations.

d. Ceiling height and ceiling construction details.

e. A symbol legend with device catalog number, description, back box size and mounting requirements.

f. Detailed riser diagram.

g. Device address adjacent to each device symbol. Notification appliance circuit and number adjacent to each notification appliance symbol.

h. Point to point wiring indicating the quantity and gauge of the conductors and size of conduit/raceway used.

i. Wiring connection diagrams for control equipment, annunciators, power supplies, chargers, initiating devices, notification appliances, components being connected to the system and interfaces to associated equipment.

j. Battery calculations for each battery backed fire alarm control unit.

k. Voltage drop calculations for each notification appliance circuit, indicating individual appliance current draw, conductor run length and size.

l. Complete sequence of operation.

2. Prior to final acceptance, submit a letter confirming that inspections have been completed and system is installed and functioning in accordance with Specifications. Include manufacturer representative's certification of installation and letter of warranty.

3. Operation and Maintenance Manuals. Provide manuals containing the following:

a. Catalog Cut Sheets

b. System Components, Initiating Devices and Notification Appliances' Installation Sheets

c. Manufacturer's Installation, Operation and Maintenance Manual

d. Program Data File Printout

e. Program Data File on Electronic Storage Media

f. Record Drawings

g. Record Drawings on Electronic Storage Media

h. One year warranty agreement including parts and labor. Warranty period begins upon date of completion.

i. Record of Completion

j. Test Reports

k. Instruction Chart

1.5 QUALITY ASSURANCE

A. Quality assurance as required by Division 28, Electronic Safety and Division 01, General Requirements.

B. In addition, meet City of Livermore, California requirements, ordinances and amendments.

1.6 WARRANTY

A. Warranty of materials and workmanship as required by Division 28, Electronic Safety and Division 01, General Requirements.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Fire Alarm Control Units:

1. Gamewell-FCI

2. No substitutions permitted.

B. Notification Appliance Circuit Panels:

1. Same manufacturer as fire alarm control equipment.

2. No substitutions permitted.

C. Fire Alarm Emergency Voice/Alarm Communications System Control Units: Same manufacturer as fire alarm control equipment.

D. Manual Pull Stations:

1. Same manufacturer as fire alarm control equipment.

2. No substitutions permitted.

E. Photoelectric Type Detectors:

1. Same manufacturer as fire alarm control equipment.

2. No substitutions permitted.

F. Control Modules:

1. Same manufacturer as fire alarm control equipment.

2. No substitutions permitted.

G. Speakers:

1. Wheelock

2. No substitutions permitted.

H. Combination Speaker/Strobes:

1. Wheelock

2. No substitutions permitted.

I. Strobes:

1. Wheelock

2. No substitutions permitted.

J. Miscellaneous Accessories:

1. Weatherproof/Surface Backboxes:

a. Same manufacturer as fire alarm detection devices or notification appliances.

b. No substitutions permitted.

2. Protective Guard:

a. Wire Guard:

1) Same manufacturer as fire alarm control equipment.

2) American Wire Guards

3) Chase Security Systems

4) Safety Technology International

5) Shaw-Perkins

6) Or approved equivalent.

b. Protective Cover:

1) Safety Technology International

2) Or approved equivalent.

3. Circuit Conductors:

a. Allied Wire and Cable

b. Belden

c. CCI

d. West Penn Wire

e. Or approved equivalent.

4. Surge Protection:

a. Ditek

b. Transtector

c. Or approved equivalent.

5. Batteries:

a. Same manufacturer as fire alarm control equipment.

b. Power-Sonic

c. Werker

d. Or approved equivalent.

6. Locks and Keys:

a. Same manufacturer as fire alarm control equipment.

b. Or approved equivalent.

7. Document Storage Cabinet:

a. Same manufacturer as fire alarm control equipment.

b. Meir Products

c. Space Age

d. Or approved equivalent.

8. Instruction Charts: Confirm make and model with architect prior to ordering.

9. Framed Floor Map: Confirm make and model with architect prior to ordering.

K. Substitutions:

1. For other acceptable manufacturers of specified control units, submit product data showing equivalent features and compliance with Contract Documents.

2. For substitution of products by manufacturers not listed, submit product data showing features and certification by Contractor that the design will comply with contract documents.

L. Equipment to be supplied by a certified manufacturer representative.

2.2 FIRE ALARM CONTROL UNITS

A. Provide flush mounted units where installed in finished areas; in unfinished areas, surface mounted units are acceptable, unless otherwise noted.

B. Multiprocessor Based: Configurable as an addressable, point identified system.

C. Central Processing Unit (CPU):

1. CPU continuously monitors the communications and data processing cycles of microprocessor. CPU failure generates an audible and visual trouble signal on control panel and remote annunciators.

2. House the CPU in fire alarm cabinet with sufficient space to allow maximum system expansion and to enclose alphanumeric display.

3. Retain basic life safety software in field programmable non-volatile memory. Provide CPU with capacity of minimum of 50 addressable points.

4. Equip CPU with software to provide a control-by-event feature, whereby receipt of an alarm point is programmed to operate control points within system. Provide control-by-event actions for life safety functions in programmable non-volatile memory. CPU software programming for control of systems defined in this Section is installed as part of this Section.

D. System Capabilities:

1. System capable of addressing and operating smoke detectors, manual pull stations, open contact devices and addressable auxiliary control relays on the same communication loop.

2. System capable of displaying value of each smoke detector, address and condition of fire alarm monitoring points.

E. Program Software:

1. Field configuration program provides programmable operating instructions for system. Store resident program in non-volatile memory.

2. Programmed control point activation includes selective control of HVAC, fire door release, elevator recall, elevator shunt trip, and other fire safety and auxiliary functions.

3. Devices meet criterion specified under materials.

4. Verification and display of sensitivity of each addressable smoke detector can be read using the operating software. Replace devices with readings outside of allowed value at time of system check out.

F. Control Panel Display Modules:

1. Provide keyboard display module 80-character backlit LCD. Each alarm/trouble condition appears in English language with description and location of alarm/supervisory/trouble.

2. Alarm/supervisory/trouble may be acknowledged, silenced and system reset from control panel or remote annunciator(s).

G. Power Supply: Provide power supply(s), adequate to serve control panel modules, remote annunciators, addressable devices, notification appliances and other connected devices.

H. Power Requirements:

1. Loss of 120VAC power automatically causes system to transfer to battery power. Indicate battery power operation by yellow lamp and audible annunciation at control panel and remote annunciator panels. Upon return of 120VAC power, unit recharges batteries to full capacity and maintains battery on float charge. Provide trickle charge adequate capacity to maintain battery fully charged with automatic rate charge.

2. Provide batteries in locking cabinet manufactured for purpose.

I. Auxiliary Relays: Provide sufficient SPDT auxiliary relay contacts for each function in this portion of the Specifications and for equipment interconnections required under electrical and mechanical specifications.

J. Auxiliary Switches: Provide auxiliary equipment control switches with labeled status indicating lights for each switch.

K. System Reset:

1. Key-accessible control function returns system to normal, non-alarm state, if initiating circuits have cleared.

2. Provide reset on both main fire alarm control panel and remote annunciators.

L. Lamp Test: Manual "lamp test" function causes the annunciation lamps to illuminate at fire alarm control and remote annunciator panels. Provide "lamp test" function at each annunciator panel.

M. Addressing: Provide each initiating device with its own discrete address.

2.3 NOTIFICATION APPLIANCE CIRCUIT PANELS

A. Provide power supply(s), adequate to serve modules, remote annunciators, addressable devices, notification appliances and other connected devices or appliances.

B. Loss of normal and emergency power automatically causes system to transfer to battery power. Indicate battery power operation by yellow lamp and audible annunciation at control panel and remote annunciator panels. Upon return of 120VAC power, unit recharges batteries to full capacity and maintains battery on float charge. Provide trickle charge adequate capacity to maintain battery fully charged with automatic rate charge.

C. Provide batteries in locking cabinet manufactured for purpose.

2.4 FIRE ALARM EMERGENCY VOICE/ALARM COMMUNICATIONS SYSTEM CONTROL UNITS

A. Provide flush mounted units where installed in finished areas; in unfinished areas, surface mounted units are acceptable, unless otherwise noted.

B. Multi-channeled system. Each channel operates independently. Faults on one channel will not impede operation of other.

C. UL 864 listed.

D. LED indicators for power trouble, ground trouble and signal trouble in each NAC. Also, LED indicators for manual evacuation status, clear status and "ready to talk" status for manual microphone paging.

E. Selectable audio tones (at least four different tone patterns) and voice message generation via digital recorded messages (either Owner supplied, from professionally recorded tapes or manufacturer provided library).

F. Operator controls at panel include manual evacuation (alarm signal from momentary switch activation), manual clear from momentary switch activation, local microphone manual paging, remote microphone manual paging option.

G. Integrated within fire alarm control panel.

H. Include audio amplifiers.

I. Built-in spoken diagnostic system testing program, permitting testing of individual speakers by one unassisted person.

2.5 MANUAL PULL STATIONS

A. Provide flush mounted units where installed in finished areas; in unfinished areas, surface mounted units are acceptable, unless otherwise noted.

B. Semi-flush, red finish, nongrasping operation; maximum pull strength as allowed per ADA criteria.

C. Stations do not allow closure without keyed reset.

2.6 PHOTOELECTRIC TYPE DETECTORS

A. Provide flush mounted units where installed in finished areas; in unfinished areas, surface mounted units are acceptable, unless otherwise noted.

B. Panel adjustable sensitivity, LED source, multiple cell, 360 degree smoke entry, visual latching operation indicator, insect screen, functional test switch, two-wire operation and vandal-resistant locking feature.

2.7 CONTROL MODULES

A. Signaling line circuit interface module that provides notification appliance circuits or system control outputs.

B. Module powered from control panel.

2.8 SPEAKERS

A. Flush wall and ceiling mount, white finish. Insect-proof, 4-inch multitap to 1/4, 1/2, 1 and 2 watts with back box and trim grill.

B. Provide speaker capable of transmitting tone or voice.

2.9 COMBINATION SPEAKER/STROBES

A. Multi-candela, flush wall and ceiling mount, white finish. Insect-proof, 4-inch multitap to 1/4, 1/2, 1 and 2 watts with backbox and trim grill. Provide speaker capable of transmitting tone or voice.

B. Provide with integral ANSI 117.1 and UL 1971 approved strobe light. Provide strobes that meet the latest requirements of NFPA 72, ANSI 117.1 and UL 1971. Candela rating as required by NFPA 72.

2.10 STROBES

A. Multi-candela, flush wall and ceiling mount, white finish, insect-proof.

B. Provide strobes that meet the latest requirements of NFPA 72, ANSI 117.1 and UL 1971. Candela rating as required by NFPA 72.

2.11 MISCELLANEOUS ACCESSORIES

A. Protective Guard:

1. Wire Guard: Steel wire guard.

2. Protective Cover: Polycarbonate construction.

B. Circuit Conductors: Copper or optical fiber; color code and label. Type FPL, FPLR and FPLP as required by NEC. Minimum signaling line circuit and initiating device circuit wire size: AWG18. Minimum notification appliance circuit wire size: AWG14, or as approved by Engineer. Fiber optic cable as required by manufacturer.

C. Surge Protection: In accordance with IEEE C62.41 B3 combination waveform and NFPA 70; except for optical fiber conductors.

D. Batteries: Sealed lead acid type. Provide additional cabinet, if required due to space limitations in control panels.

E. Locks and Keys:

1. Deliver keys to Owner.

2. Provide same standard lock and key for each key operated switch and lockable panel and cabinet; provide five keys of each type.

F. Document Storage Cabinet:

1. Suitable for as-built drawings, operation and maintenance manual, system data file disk and tools.

2. Constructed from steel with baked enamel finish; size adequate for full size drawings, operation and maintenance manual, spare parts and tools.

G. Instruction Charts:

1. Printed instruction chart for operators, showing steps to be taken when signal is received (normal, alarm, supervisory and trouble); easily readable from normal operator's station.

2. Frame: Stainless steel or aluminum with polycarbonate or glass cover.

H. Framed Floor Map:

1. Provide framed floor plan of facility.

2. Frame: Stainless steel or aluminum with polycarbonate or glass cover.

PART 3 - EXECUTION

3.1 GENERAL INSTALLATION REQUIREMENTS

A. Obtain Architect's approval of locations of devices, appliances and annunciators before installation.

B. Circuits:

1. Signaling Line Circuits (SLC): Class B

2. Notification Appliance Circuits (NAC): Class B.

C. Spare Capacity:

1. Notification Appliance Circuits: Minimum 25 percent spare current capacity. Utilize UL maximum current draw values for notification appliances. Maximum 10 percent voltage drop.

2. Speaker Amplifiers: Minimum 25 percent spare capacity.

3. Signaling Line Circuit: Minimum 25 percent spare capacity.

D. Power Sources:

1. Primary: Dedicated branch circuits of facility power distribution system.

2. Secondary: Storage batteries.

3. Capacity: Sufficient to operate fire alarm system under normal supervisory condition for 24 hours and operate alarm signals for five minutes at end of standby period.

E. Obtain approval of system design from AHJ prior to installation. Do not begin installation without approval from AHJ and submittal review comments from Engineer.

F. Install in accordance with applicable codes, NFPA 72, NFPA 70 and the Contract Documents.

G. In accordance with manufacturer's instructions, provide wiring, conduit and outlet boxes required for the erection of a complete system as described in these specifications, as shown on Drawings and as required by AHJ.

H. Conceal wiring, conduit, boxes and supports where installed in finished areas.

I. Provide raceway system for cabling concealed in walls and hard ceilings and in locations where cabling is exposed. Where exposed, provide surface raceway in finished areas and surface mounted EMT in non-finished areas.

J. Provide cabling and conduits system suitable for wet locations for below grade systems.

K. At junction boxes and termination points, provide identification tags on wires and cables.

L. Route wiring to avoid blocking access to equipment requiring service, access, or adjustment.

M. Fire Safety Systems Interfaces:

1. Provide conduit, wiring, boxes and terminations from fire alarm system to monitored components.

a. Alarm Inputs: Provide connection in accordance with NFPA 72 for the following systems and components:

1) Fire sprinkler water flow switches.

2) Fire sprinkler dry-pipe alarm pressure switches.

3) Kitchen hood fire suppression activation.

4) Other alarm inputs.

b. Supervisory Inputs: Provide connection in accordance with NFPA 72 for the following systems and components:

1) Fire sprinkler water control valve tamper switches.

2) Fire sprinkler dry-pipe system low air pressure switches.

3) Elevator shunt trip power monitoring circuit.

4) Other supervisory inputs.

c. Trouble Inputs: Provide connection in accordance with NFPA 72 for the following systems and components:

1) Other trouble inputs.

2. Fire Safety Functions: Provide power and control conduit, wiring, boxes and terminations to power devices and interface to fire alarm system.

a. Doors:

1) Provide smoke detectors and addressable control relays to release magnetic hold open devices and roll-down fire doors and door locks. Verify requirements and quantities prior to bidding.

2) Smoke Barrier Door Magnetic Holders: Release upon activation of smoke detectors in smoke zone on either side of door.

3) Electronic Locks or Electromagnetic Door Locks on Egress Doors: Unlock smoke zone egress doors upon activation of any alarm initiating device or suppression system in smoke zone.

4) Overhead Coiling Fire Doors: Release upon activation of smoke detectors on either side of door.

b. Elevators:

1) Provide elevator recall smoke detectors, addressable control relays and connection to elevator equipment per NFPA 72 and as required by the AHJ.

2) Provide elevator shunt trip heat detectors, addressable control relays for shunt trip operation, addressable input module for monitoring shunt trip

power and connection to elevator equipment per NFPA 72 and as required by the AHJ.

3) Elevator Lobby and Machine Room Smoke Detectors: Elevator recall for fire fighters' service.

4) Elevator Machine Room Heat Detector: Shut down elevator power prior to Elevator Machine Room sprinkler activation.

c. HVAC Systems:

1) Fire/Smoke Dampers and Smoke Dampers:

(a) Provide required smoke detectors, relays, wiring and the like.

(b) Connect control and power wiring to dampers per manufacturer's instructions.

(c) Verify quantities, location and requirements of dampers with Division 23, HVAC Drawings and Specifications and mechanical system installer.

2) Air Moving Systems:

(a) Provide duct-mounted smoke detectors on air systems with air flow rates exceeding 2000 CFM. Coordinate with Division 23, HVAC.

(b) Install duct-mounted smoke detector(s) on return side of air system.

(c) Provide control wiring from addressable relay contacts to air handling equipment controller. Connect to controller so that when duct-mounted smoke detector is activated, the air handling equipment is shut down.

(d) Provide duct-mounted smoke detectors rated for air velocity, temperature and humidity of duct. Verify quantities, locations and requirements with Division 23, HVAC Drawings and mechanical system installer.

(e) Where duct-mounted smoke detectors are mounted in inaccessible building void spaces provide access hatch. Provide access hatch with fire rating equivalent to rating of wall, ceiling, or shaft being penetrated.

N. Inspection and Testing for Completion:

1. System testing and commissioning to be performed by a certified manufacturer representative.

2. Perform inspection and testing in accordance with NFPA 72 and requirements of local authorities; document each inspection and test.

3. Document audibility measurements and verify intelligibility for each space on record drawings.

4. Provide the services of the installer's supervisor or person with equivalent qualifications to supervise inspection and testing, correction and adjustments.

5. Provide tools, software and supplies required to accomplish inspection and testing.

6. Prepare for testing by ensuring that work is complete and correct; perform preliminary tests as required to test system.

7. Correct defective work, adjust for proper operation and retest until entire system complies with Contract Documents.

8. Notify Owner seven days prior to beginning completion inspections and tests.

9. Notify authorities having jurisdiction and comply with their requirements for scheduling inspections and tests and for observation by their personnel.

10. Diagnostic Period: After successful completion of inspections and tests, operate system in normal mode for at least 14 days without any system or equipment malfunctions.

    a. Record all system operations and malfunctions.

    b. If a malfunction occurs, start diagnostic period over after correction of malfunction.

    c. Owner will provide attendant operator personnel during diagnostic period; schedule training to allow Owner personnel to perform normal duties.

    d. At end of successful diagnostic period, complete and submit NFPA 72 "Inspection and Testing Form."

O. Owner Personnel Instruction:

1. Provide the following instruction to designated Owner personnel:

    a. Hands-On Instruction: On-site, using operational system.

    b. Classroom Instruction: Owner furnished classroom, on-site or at other local facility.

2. Basic Operation: One-hour sessions for attendant personnel, security officers and engineering staff; combination of classroom and hands-on:

    a. Initial Training: One session pre-closeout.

    b. Refresher Training: One session post-occupancy.

3. Detailed Operation: Two-hour sessions for engineering and maintenance staff; combination of classroom and hands-on:

a. Initial Training: One session pre-closeout.

b. Refresher Training: One session post-occupancy.

4. Furnish the services of instructors and teaching aids; have copies of operation and maintenance data and record drawings available during instruction.

5. Provide means of evaluation of trainees suitable to type of training given; report results to Owner.

P. Closeout:

1. Closeout Demonstration:

a. Demonstrate proper operation of functions to Owner.

b. Be prepared to conduct any of the required tests.

c. Have at least one copy of operation and maintenance data, copy of project record drawings, input/output matrix and operator instruction chart(s) available during demonstration.

d. Have authorized technical representative of control unit manufacturer present during demonstration.

e. Demonstration may be combined with inspection and testing required by AHJ. Notify AHJ in time to schedule demonstration.

f. Repeat demonstration until successful.

2. Substantial Completion of the project cannot be achieved until inspection and testing is successful and:

a. Specified diagnostic period without malfunction has been completed.

b. Approved operating and maintenance data has been delivered.

c. Spare parts, extra materials and tools have been delivered.

d. All aspects of operation have been demonstrated to Architect.

e. Final acceptance of the fire alarm system has been given by authorities having jurisdiction.

f. Occupancy permit has been granted.

g. Specified pre-closeout instruction is complete.

3. Perform post-occupancy instruction within three months after date of occupancy.

3.2 FIRE ALARM CONTROL UNITS

A. Reference 3.01, General Installation Requirements.

B. Install per manufacturer's instructions and recommendations.

C. Provide control units with 120VAC dedicated circuit per NFPA requirements.

D. Do not install cabinets or equipment below the battery cabinet. Do not locate battery and charging system cabinets in ceiling space.

E. Provide instruction charts at each control unit where system operations are performed. Obtain approval from the Architect prior to mounting.

F. Perform system programming at the fire alarm control panel. Program the system without shutting the system down. Programming is done off line. Update and maintain hard copy and CD-ROM copy of program at the site.

G. Room Name Labeling: Control unit schedules, programming and labeling for electrical equipment, to use the room names and room numbers that the Architect adopts at the date of substantial completion of construction. This work is to be done at no added cost to the Owner.

H. Programmable Function Keys: Provide control panel accessible function keys for the notification bypass, fire drill, fire door bypass, elevator control bypass, and supervising station bypass.

3.3 NOTIFICATION APPLIANCE CIRCUIT PANELS

A. Reference 3.01, General Installation Requirements.

B. Install per manufacturer's instructions and recommendations.

C. Provide notification appliance circuit panel power supplies with 120VAC dedicated circuit per NFPA requirements.

D. Do not install cabinets or equipment below the battery cabinet. Do not locate battery and charging system cabinets in ceiling space.

3.4 FIRE ALARM EMERGENCY VOICE/ALARM COMMUNICATIONS SYSTEM CONTROL UNITS

A. Install instruction cards in or adjacent to control units.

B. Reference 3.01, General Installation Requirements.

C. Install per manufacturer's instructions and recommendations.

3.5 MANUAL PULL STATIONS

A. Reference 3.01, General Installation Requirements.

B. Install per manufacturer's instructions and recommendations.

C. Provide machine printed address labels on addressable devices. Labels to be visible from the floor without magnification.

D. Provide protective guard where device is subject to abuse and where required by AHJ.

3.6 PHOTOELECTRIC TYPE DETECTORS

A. Reference 3.01, General Installation Requirements.

B. Install per manufacturer's instructions and recommendations.

C. Provide machine printed address labels on addressable devices. Labels to be visible from the floor without magnification.

D. Provide protective guard where device is subject to abuse and where required by AHJ.

3.7 CONTROL MODULES

A. Reference 3.01, General Installation Requirements.

B. Install per manufacturer's instructions and recommendations.

C. Provide machine printed address labels on addressable devices. Labels to be visible from the floor without magnification.

3.8 SPEAKERS

A. Reference 3.01, General Installation Requirements.

B. Install per manufacturer's instructions and recommendations.

C. Provide machine printed labels on notification appliances with appliance circuit number and sequence. Labels to be visible from the floor without magnification.

D. Provide protective guard where device is subject to abuse and where required by AHJ.

3.9 COMBINATION SPEAKER/STROBES

A. Reference 3.01, General Installation Requirements.

B. Install per manufacturer's instructions and recommendations.

C. Provide machine printed labels on notification appliances with appliance circuit number and sequence. Labels to be visible from the floor without magnification.

D. Provide protective guard where device is subject to abuse and where required by AHJ.

3.10 STROBES

A. Reference 3.01, General Installation Requirements.

B. Install per manufacturer's instructions and recommendations.

C. Provide machine printed labels on notification appliances with appliance circuit number and sequence. Labels to be visible from the floor without magnification.

D. Provide wire guards or protective covers where device is subject to abuse and where required by AHJ.

3.11 MISCELLANEOUS ACCESSORIES

A. Reference 3.01, General Installation Requirements.

B. Install per manufacturer's instructions and recommendations.

C. Weatherproof/Surface Backboxes: Provide manufacturer's weatherproof backbox listed for use in areas where the device or appliance is subject to humidity in excess of listed rating. Provide manufacturer surface backboxes where devices cannot be installed recessed.

D. Protective Guard:

1. Wire Guard.

2. Protective Cover.

E. Circuit Conductors: Provide wiring to meet the requirements of national, state and local electrical codes. Provide color coded wiring as recommended and specified by the fire alarm and detection system manufacturer. Provide Type FPLR cable when in a riser application or FPLP cable when installed in plenums.

F. Surge Protection; Equipment Connected to Alternating Current Circuits: Maximum let through voltage of 350 V(ac), line-to-neutral and 350 V(ac), line-to-line; do not use fuses.

G. Document Storage Cabinet: Provide document storage cabinet adjacent to fire alarm control panel.

H. Instruction Charts: Install chart adjacent to fire control unit.

I. Framed Floor Map: Provide framed floor plan of facility adjacent to the annunciator panel identifying room names/numbers, device/addresses or fire zone number and description as utilized on the annunciator panel, as required by local AHJ. Check with the local fire department for size and approved mounting location.

END OF SECTION 28 3100

SECTION 31 11 00

CLEARING AND GRUBBING

PART 1 - GENERAL

1.1 SUMMARY

A. Clearing vegetation, debris, trash and other materials within limits indicated.

B. Grubbing of vegetation within limits indicated.

1.2 RELATED DOCUMENTS

A. Caltrans Standard Specifications.
   1. Section 16, Clearing and Grubbing.

B. California Building Code: Chapter 33 – Site Work, Demolition and Construction.

C. Related Sections:
   1. Section 02 41 13 – Selective Site Demolition

PART 2 - PRODUCTS

2.1 NOT USED

PART 3 - EXECUTION

3.1 PREPARATION

A. Locate and clearly flag vegetation to remain or to be relocated.

3.2 RESTORATION

A. Repair or replace vegetation indicated to remain that is damaged by construction operations, as directed by the Owner.

B. Employ a qualified arborist, licensed in jurisdiction where the Project is located, to submit details of proposed repairs and to repair damage to shrubs.

3.3 CLEARING AND GRUBBING

A. Remove obstructions, trees, shrubs, grass, and other vegetation to permit installation of new construction. Removal includes digging out stumps and obstructions and grubbing roots.

B. Remove trash, debris, logs, concrete, masonry and other waste materials.

C. Do not remove trees, shrubs, and other vegetation indicated to remain or to be relocated.

D. Completely remove stumps, roots, obstructions, and debris extending to a depth of 18-inches below subgrade.

E. Use only hand methods for grubbing within drip line of remaining trees.

END OF SECTION 31 11 00

SECTION 31 22 00

GRADING

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Excavation and/or embankment from existing ground to subgrade, including soil sterilant, for roadways, driveways, parking areas, walks, paths, or trails and any other site improvements called for on the Plans.

1.2 SECTION EXCLUDES

A. Earthwork related to underground utility installation, see Section 31 23 33 – Trenching and Backfilling.

1.3 RELATED SECTIONS

A. Section 02 40 00 – Demolition.

B. Section 31 11 00 – Clearing and Grubbing.

C. Section 31 23 33 – Trenching and Backfilling.

1.4 RELATED DOCUMENTS

A. ASTM:
1. D 1557, Test Method for Laboratory Compaction Characteristics of Soil Using Modified Effort.
2. D 1586, Method for Penetration Tests and Split-Barrel Sampling of Soils.
3. D 2487, Classification of Soils for Engineering Purposes.
4. D 3740, Practice for Evaluation of Agencies Engaged in Testing and/or Inspection of Soil and Rock as Used in Engineering Design and Construction.
5. D 4318. Test Method for Liquid Limit, Plastic Limit and Plasticity Index of Soils.
6. E 329, Specification for Minimum Requirements for Agencies Engaged in the Testing and/or Inspection of Materials Used in Construction.
7. E 548, Guide for General Criteria Used for Evaluating Laboratory Competence.

B. California Code of Regulation Title 24, Part 2, California Building Code:
1. Chapter 11B – Accessibility to Public Buildings.
2. Chapter 33 – Site Work, Demolition and Construction.

C. Caltrans Standard Specifications:
1. Section 17, Watering.
2. Section 19, Earthwork.

D. CAL/OSHA, Title 8.

1.5 DEFINITIONS

A. Borrow: Approved soil material imported from off-site for use as Structural Fill or Backfill.

B. Excavation: Removal of material encountered above subgrade elevations.
1. Authorized Over-Excavation: Excavation below subgrade elevations or beyond indicated horizontal dimensions as shown on plans.

2. Unauthorized Over-Excavation: Excavation below subgrade elevations or beyond indicated horizontal dimensions. Unauthorized excavation shall be without additional compensation.

C. Structural Backfill: Soil materials used to fill excavations resulting from removal of existing below grade facilities, including trees. See Section 31 23 33 – Trenching and Backfilling.

D. Structural Fill: Soil materials used to raise existing grades.

E. Rock: Rock material in beds, ledges, unstratified masses, and conglomerate deposits and boulders of rock material ¾-cubic yards or more in volume that, according to ASTM D 1586, exceeds a standard penetration resistance of 100 blows/2-inches.

F. Structures: Buildings, footings, foundations, retaining walls, slabs, tanks, curbs, mechanical and electrical appurtenances, or other man made stationary features constructed above or below grade.

G. Subgrade: Surface or elevation remaining after completing excavation, or top surface of a fill or backfill immediately below subbase, base or topsoil materials.

H. Unsuitable Material: Any soil material that is not suitable for a specific use on the Project.

I. Utilities: onsite underground pipes, conduits, ducts and cables.

1.6 SUBMITTALS

A. Follow submittal procedures outlined in Section 01 33 00 – Submittal Procedures.

B. Submit material certificates signed by the material producer and the Contractor, certifying that that each material item complies with, or exceeds the specified requirements.

1.7 QUALITY ASSURANCE

A. Conform all work to the appropriate portion(s) of the California Code of Regulations, Title 24 and Caltrans Standard Specifications, Sections 17 and 19.

B. Percentage of compaction specified shall be the minimum acceptable. The percentage represents the ratio of the dry density of the compacted material to the maximum dry density of the material as determined by the procedure set forth in ASTM D 1557.

C. Upon completion of the construction work, certify that all compacted fills and foundations are in place at the correct locations, and have been constructed in accordance with sound construction practice. In addition, certify that the materials used are of the types, quality and quantity required by these Technical Specifications. The Contractor shall be responsible for the stability of all fills and backfills constructed by his forces.

D. Finish soil grade tolerance at completion of grading:
1. Building and paved areas: +0.05
2. Other areas: ±0.10 feet.

E. The project geotechnical engineer shall be notified of the construction schedule at least one week prior to the beginning of major site construction, and notified at least 48 hours (working days) before being required to perform field observation and testing.

1.8 PROJECT CONDITIONS

A. Promptly notify the Owner of surface or subsurface conditions differing from those disclosed in the construction documents. First notify the Owner verbally to permit verification and extent of condition and then in writing. No claim for conditions differing from those anticipated in the Contract Documents will be allowed unless the Contractor has notified the Owner in writing of differing conditions prior to the Contractor starting work on affected items.

B. Protect open excavations, trenches, and the like with fences, covers and railings to maintain safe pedestrian and vehicular traffic passage.

C. Prevent erosion of freshly graded areas during construction and until such time as permanent drainage and erosion control measures have been installed.

D. Temporarily stockpile fill material in an orderly and safe manner and in a location approved by the Owner.

E. Provide dust and noise control in conformance with Division 1 General Requirements for Cleaning and Waste Management.

F. Environmental Requirements: When unfavorable weather conditions necessitate interrupting earthwork operation, areas shall be prepared by compaction of surface and grading to avoid collection of water. Provide adequate temporary drainage to prevent erosion. After interruption, compaction specified in last layer shall be re-established before resuming work.

PART 2 - PRODUCTS

2.1 SOIL MATERIALS

A. General: Provide borrow soil materials when sufficient satisfactory soil materials are not available from on-site excavations.

B. On-Site Structural Fill and Structural Backfill: Excavated Bay Mud shall not be used as engineered fill. Bay Mud may not be suitable for use as landscape soil due to its marine origin and generally high sulfate content. Bay Mud encountered during excavation or grading shall be segregated from the fill such that the drier fill material is not mixed with wet Bay Mud.

On-site soils with an organic content less than 3 percent by weight may be reused as general fill. General fill shall not have lumps, clods or cobble pieces larger than 6 inches in diameter; 85 percent of the fill shall be smaller than 2 ½ inches in diameter. Minor amounts of oversized material (smaller than 12 inches in diameter) may be allowed provided the oversized pieces are not allowed to nest together and the compaction method will allow for loosely placed lifts not exceeding 12 inches.

C. Imported Structural Fill and Structural Backfill: Imported and non-expansive material shall be inorganic with a Plasticity Index (PI) of 15 or less. Imported material shall have sufficient fines. Samples of potential import sources shall be delivered to the geotechnical engineer at least 10 days prior to the desired import start date. Information regarding the import source shall be provided, such as any site geotechnical reports. If the material will be derived from an excavation rather than a stockpile, potholes will likely be required to collect samples from throughout the depth of the planned cut that will be imported. At a minimum, laboratory testing will include PI tests. Material data sheets for select fill materials (Class 2 aggregate base, ¾-inch crushed rock, quarry fines, etc.) listing current laboratory testing data (not older than 6

months from the import date) may be provided for the geotechnical engineer's review without providing a sample. If current data is not available, specification testing will need to be completed prior to approval.

Environmental and soil characterization shall also be considered prior to acceptance. Suitable environmental laboratory data to the planned import quantity shall be provided to the project environmental consultant; additional laboratory testing may be required based on the project environmental consultant's review. The potential import source shall also not be more corrosive than the on-site soils, based on pH, saturated resistivity, and soluble sulfate and chloride testing.

D. Re-Use of On-Site Site Improvements: Asphalt concrete (AC) grindings and aggregate base (AB) may be generated during site demolition. If the AC grindings are mixed with the underlying AB to meet Class 2 AB specifications, they may be reused within the new pavement and flatwork structural sections. AC/AB grindings may not be reused within building footprint areas. Laboratory testing will be required to confirm the grindings meet project specifications.

E. Sandy Loam: Planting soil material for treatment shall consist of high organics soil (no gravel) with a high percolation rate, supplied from previously tested and approved sources, and shall conform to the following specifications and requirements:

1. All material shall be free of trash and debris, expansive clays or any other deleterious materials, and shall be subject to the approval and acceptance of the Authority Having Jurisdiction.
2. The contractor shall designate their proposed import sources in advance and shall provide source samples of material to the jurisdiction having authority.
3. Material shall be free of seeds.
4. The treatment planting soil shall have documentation from the supplier showing conformance to the following gradation guidelines:

Screen Information	Percentage
Maximum particle size	2 millimeters (0.078 inch)
Percent passing No. 10 screen (2mm)	100 (coarse sand or finer)
Percent passing No. 200 screen (0.074mm)	10 to 15%

The overall dry weight percentages shall be 85-90% sand, less than 5% clay, and less than 5% silt. The range of clay and silt and organics should be 10-15% of total volume.

a. The treatment planting soil shall have 4 to 6% by dry weight organic compost mixed in. Organic compost percentage may be lowered by the jurisdiction of authority for varying plant species in the treatment measure. Native in-situ loamy sand soils can be used, with 4 to 6% of organic compost mixed in. This mixed soil must be certified to meet the imported planting soil requirements. Organic compost shall meet the specifications stated in Section II — Organic Compost Amendment. The soil shall have a salt concentration less than 500 mg/L. The pH shall be between 5.5 and 7, unless directed otherwise by the jurisdiction of authority.
b. One test shall be conducted by the supplier per each 500 cubic yards supplied. Testing shall be conducted for the above gradation requirements, salt contents and pH range.
c. Contractor shall demonstrate the in-situ percolation of each treatment measure for design storm flows through the installed soil to the satisfaction of the Authority Having Jurisdiction. The material shall have an onsite tested percolation rate of 5 to 10 inch per hour. In-field percolation test shall consist of a 1-foot diameter pipe, 2.5 feet long pipe, driven 1.5 feet deep into

treatment soils. Pipe shall be filled with 1 foot of water after the treatment measure has been wetted. The pipe should empty 1 foot of water above the wetted soil layer in no less than 1 hour and 12 minutes, and no longer than 2 hours and 24 minutes. Contractor shall provide records of percolation tests to city inspector.

d. Soil shall be placed in lifts of 8-10 inches.

e. Standard compaction to a minimum of 85 percent shall be used when placing the mixed material. The method to achieve 85% compaction shall be approved by the local jurisdiction before the soil is placed in the treatment measure.

PART 3 - EXECUTION

3.1 GENERAL

A. Conform to Section 19, Earthwork, Caltrans Standard Specifications as modified by the Contract Documents.

B. Placement and compaction of material by flooding, ponding, or jetting will not be permitted.

C. The use of explosives will not be permitted.

3.2 CONTROL OF WATER AND DEWATERING

A. Construction extending into the fill materials, or into the native Bay Mud, may require excavation dewatering due to perched water or ground water. Because of the relatively low permeability of the Bay Mud, seepage from the native Bay Mud may be minimal; however, existing fill areas could potentially be saturated and excavations extending through them could be subject to seepage. The dewatering system shall be designed and implemented by the contractor.

B. Depending on the ground water quality, on-site retention, off-site disposal, or treatment prior to discharge, either into storm or sanitary sewer, may be required.

C. Prevent surface water and ground water from entering excavations, from ponding on prepared subgrades, and from flooding the site and surrounding area. Provide dewatering equipment necessary to drain and keep excavations and site free from water.

D. Dewater during backfilling operation so that groundwater is maintained a least one foot below level of compaction effort.

E. Obtain the Owner’s approval for proposed control of water and dewatering methods.

F. Protect subgrades from softening, undermining, washout and damage by rain or water accumulation.

G. Reroute surface water runoff away from excavated areas. Do not allow water to accumulate in excavations.

H. Maintain dewatering system in place until dewatering is no longer required.

3.3 WET WEATHER CONDITIONS

A. Do not prepare subgrade, place or compact soil materials if above optimum moisture content.

3.4 BRACING AND SHORING

A. Conform to California and Federal OSHA requirements.

B. Place and maintain such bracing and shoring as may be required to support the sides of the excavations for the proper protection of workmen; to facilitate the work; to prevent damage to the facility being constructed; and to prevent damage to adjacent structures or facilities. Remove all bracing and shoring upon completion of the work.

C. Be solely responsible for all bracing and shoring and, if requested by the Owner, submit details and calculations to the Owner. The Owner may forward the submittal to the Consulting Engineer and/or the California Division of Industrial Safety for their review. The Contractor's submittal shall include the basic design, assumed soils conditions and estimation of forces to be resisted, together with plans and specifications of the materials and methods to be used, and shall be prepared by a civil engineer or structural engineer registered in California. No excavations related to the proposed facility shall precede a response to the submittal by the Owner.

D. Be solely responsible for installing and extracting the sheathing in a manner which will not disturb the position or operation of the facility being constructed or adjacent utilities and facilities.

3.5 EXCAVATION

A. Excavate earth and rock to lines and grades shown on drawings and to the neat dimensions indicated on the Plans, required herein or as required to satisfactorily compact backfill.

B. Remove and dispose of large rocks, pieces of concrete and other obstructions encountered during excavation.

C. Where forming is required, excavate only as much material as necessary to permit placing and removing forms.

D. Provide supports, shoring and sheet piles required to support the sides of excavations or for protection of adjacent existing improvements.

3.6 REMOVAL OF EXISTING FILLS AND UNSUITABLE MATERIAL

A. Over-excavate areas of existing fills and other unsuitable material encountered during mass grading.

B. Compensation for increased removal widths and depths that are not required will not be considered, except when such increase is necessary for protection of life and property as determined by and approved by the Owner.

3.7 GRADING

A. Uniformly grade the Project to the elevations shown on plans.

B. Finish ditches, gutters and swales to the sections, lines and grades indicated and to permit proper surface drainage.

C. Round tops and bottoms of slopes as indicated or to blend with existing contours.

3.8 SUBGRADE PREPARATION

A. After site clearing and demolition is complete, and prior to backfilling any excavations resulting from fill removal or demolition, the excavation subgrade and subgrade within areas to receive additional site fills, slabs-on-grade and/or pavements shall be

scarified to a depth of 6 inches, moisture conditioned, and compacted in accordance with the Compaction section.

B. Any below-grade excavation, could be located close to, or in, Bay Mud, depending on the excavation depth and the amount of fill in that area. Stabilization of the bottom of these excavations will likely be required. Stabilization shall be accomplished with 12 to 18 inches of clean crushed rock depending on the final depth and condition of subgrade. The crushed rock shall be underlain by a stabilization fabric (Mirafi 500x or approved equivalent) as separation between the native clays and the crushed rock. The final thickness of crushed rock needed shall be based on the judgment of the contractor and the type of equipment and material loading that is likely to occur. Construction equipment is unlikely to be able to access the bottom of excavations without stabilized access. Destabilized or disturbed areas will require repair using methods approved by the geotechnical engineer. Increased stability could be obtained with the use of fabric or geogrids beneath the stabilization section of crushed rock. Excavations shall be in accordance with recommendations for excavations in Bay Mud.

3.9 PLACEMENT OF STRUCTURAL FILL

A. Place structural fill on prepared subgrade.

B. Spread structural fill material in uniform lifts not more than 8-inches in un-compacted thickness and compact.

C. Place structural fill material to suitable elevations above grade to provide for anticipated settlement and shrinkage.

D. Overbuild fill slopes to obtain required compaction. Remove excess material to lines and grades indicated.

E. Do not drop fill on structures. Do not backfill around, against or upon concrete or masonry structures until structure has attained sufficient strength to withstand loads imposed and the horizontal structural system had been installed.

F. Backfill in uniform lifts not exceeding 8 inches in uncompacted thickness. Each lift should be brought to a uniform moisture content of at lease 1 percent above optimum prior to compacting by either spraying the soil with water of it is too dry or aerating the material if it is too wet.

3.10 FINISH GRADING

A. Blade finish to lines and grades indicated.

3.11 COMPACTION AND TESTING

A. All fills, and subgrade areas where fill, slabs-on-grade, and pavements are planned, shall be placed in loose lifts 8 inches thick or less and compacted in accordance with ASTM D1557 (latest version) requirements as shown in the table below. In general, clayey soils shall be compacted with sheepsfoot equipment and sandy/gravelly soils with vibratory equipment; open-graded materials such as crushed rock shall be placed in lifts no thicker than 18 inches and consolidated in place with vibratory equipment. Each lift of fill and all subgrade shall be firm and unyielding under construction equipment loading in addition to meeting the compaction requirements to be approved. The contractor (with input from the geotechnical engineer) shall evaluate the in-situ moisture conditions, as the use of vibratory equipment on soils with high moistures can cause unstable conditions. Where the soil's PI is 20 or greater, the expansive soil criteria shall be used.

Description	Material Description	Minimum Relative Compaction[1] (percent)	Moisture Content[2] (percent)
General Fill (within upper 5 feet)	On-Site Expansive Soils	87-92	>3
	On-Site Low Expansion Soils	90	>1
General Fill (below a depth of 5 feet)	On-Site Expansive Soils	95	>3
	On-Site Low Expansion Soils	95	>1
Trench Backfill	On-Site Expansive Soils	87-92	>3
Trench Backfill	On-Site Low Expansion Soils	90	>1
Trench Backfill (upper 6 inches of subgrade)	On-Site Low Expansion Soils	95	>1
Crushed Rock Fill	3/4-inch Clean Crushed Rock	Consolidate In-Place	N/A
Non-Expansive Fill	Imported Non-Expansive Fill	90	Optimum
Flatwork Subgrade	On-Site Expansive Soils	87-92	>3
Flatwork Subgrade	On-Site Low Expansion Soils	90	>1
Flatwork Aggregate Base	Class 2 Aggregate Base[3]	90	Optimum
Pavement Subgrade	On-Site Expansive Soils	87-92	>3
Pavement Subgrade	On-Site Low Expansion Soils	95	>1
Pavement Aggregate Base	Class 2 Aggregate Base[3]	95	Optimum
Asphalt Concrete	Asphalt Concrete	95 (Marshall)	NA

1 – Relative compaction based on maximum density determined by ASTM D1557 (latest version)
2 – Moisture content based on optimum moisture content determined by ASTM D1557 (latest version)
3 – Class 2 aggregate base shall conform to Caltrans Standard Specifications, latest edition, except that the relative compaction shall be determined by ASTM D1557 (latest version)

3.12 CONSTRUCTION MOISTURE CONDITIONING

A. Expansive soils can undergo significant volume change when dried then wetted. The contractor shall keep all exposed expansive soil subgrade (and also trench excavation side walls) moist until protected by overlying improvements (or trenches are backfilled). If expansive soils are allowed to dry out significantly, re-moisture conditioning may require several days of re-wetting (flooding is not recommended), or deep scarification, moisture conditioning, and re-compaction.

3.13 DISPOSAL

A. Lawfully dispose of all unsuitable and excess or surplus material off-site at no cost to the Owner.

END OF SECTION 31 22 00

SECTION 31 23 33

TRENCHING AND BACKFILLING

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Excavation, bedding, and backfill for underground storm drain, sanitary sewer, and water piping and associated structures.

1.2 SECTION EXCLUDES

A. Drainage fill material and placement around subdrains.

B. Trenching and backfill for other utilities such as underground HVAC piping, electrical conduit, telephone conduit, gas piping, cable TV conduit, etc.

1.3 RELATED SECTIONS

A. Section 31 22 00 – Grading.

B. Section 33 10 00 – Water Utilities.

C. Section 33 30 00 – Sanitary Sewerage Utilities.

D. Section 33 40 00 – Storm Drainage Utilities.

1.4 RELATED DOCUMENTS

A. ASTM:
   1. C 33, Specification for Concrete Aggregates.
   2. C 150, Specification for Portland Cement.
   3. C 260, Specification for Air-Entraining Admixtures for Concrete.
   4. C 618, Specification for Fly Ash and Raw or Calcined Natural Pozzolan for Use as a Mineral Admixture in Portland Cement Concrete.
   5. D 1557, Test Method for Laboratory Compaction Characteristics of Soil Using Modified Effort.
   6. D 2321, Practice for Underground Installation of Flexible Thermoplastic Sewer Pipe.
   7. D 2487, Classification of Soils for Engineering Purposes.
   8. D 3740, Practice for Evaluation of Agencies Engaged in Testing and/or Inspection of Soil and Rock as Used in Engineering Design and Construction.
   9. E 329, Specification for Minimum Requirements for Agencies Engaged in the Testing and/or Inspection of Materials Used in Construction.
   10. E 548, Guide for General Criteria Used for Evaluating Laboratory Competence.

B. California Code of Regulation Title 24, Part 2, California Building Code:
   1. Chapter 11B – Accessibility to Public Buildings.
   2. Chapter 33 – Site Work, Demolition and Construction.

C. Caltrans Standard Specifications:
   1. Section 19, Earthwork.
   2. Section 26, Aggregate Bases.
   3. Section 68, Subsurface Drains.
   4. Section 88, Engineering Fabrics.

D. CAL/OSHA, Title 8.

1.5 DEFINITIONS

A. AC: Asphalt Concrete.

B. ASTM: American Society for Testing and Materials.

C. Bedding: Material from bottom of trench to bottom of pipe.

D. CDF: Controlled Density Fill.

E. DIP: Ductile Iron Pipe.

F. Initial Backfill: Material from bottom of pipe to 12-inches above top of pipe.

G. PCC: Portland Cement Concrete.

H. RCP: Reinforced Concrete Pipe.

I. Springline of Pipe: Imaginary line on surface of pipe at a vertical distance of ½ the outside diameter measured from the top or bottom of the pipe.

J. Subsequent Backfill: Material from 12-inches above top of pipe to subgrade of surface material or subgrade of surface facility or to finish grade.

K. Trench Excavation: Removal of material encountered above subgrade elevations and within horizontal trench dimensions.
   1. Authorized Trench Over-Excavation: Excavation below trench subgrade elevations or beyond indicated horizontal trench dimensions as shown on plans.
   2. Unauthorized Trench Over-Excavation: Excavation below trench subgrade elevations or beyond indicated horizontal trench dimensions. Unauthorized excavation shall be without additional compensation.

L. Utility Structures:
   1. Storm drainage manholes, catch basins, drop inlets, curb inlets, vaults, etc.
   2. Sanitary sewer manholes, vaults, etc.
   3. Water vaults, etc.

1.6 SUBMITTALS

A. Follow submittal procedures outlined in Section 01 33 00 – Submittal Procedures.

B. Product Data:
   1. Grading and quality characteristics showing compliance with requirements for the Work.
   2. Certify that material meets requirements of the Project.

C. Samples:
   1. If required, provide 40-pound samples of all imported trench bedding and backfill material sealed in airtight containers, tagged with source locations and suppliers of each proposed material.
   2. Provide materials from same source throughout work. Change of source requires approval of the Owner.

1.7 QUALITY ASSURANCE

A. Conform all work to the appropriate portion(s) of the Caltrans Standard Specifications, Section 19.

B. Percentage of compaction specified shall be the minimum acceptable. The percentage represents the ratio of the dry density of the compacted material to the maximum dry density of the material as determined by the procedure set forth in ASTM D 1557.

C. Conform work to the requirements of the California Building Code.
   1. Section 1806A.11 – Pipe and Trenches.

1.8 PROJECT CONDITIONS

A. Promptly notify the Owner of surface or subsurface conditions differing from those disclosed in the construction documents. First notify the Owner verbally to permit verification and extent of condition and then in writing. No claim for conditions differing from those anticipated in the Contract Documents will be allowed unless Contractor has notified the Owner in writing of differing conditions prior to contractor starting work on affected items.

B. Protect open, trenches, and utility structure excavations with fences, covers and railings to maintain safe pedestrian and vehicular traffic passage.

C. Stockpile on-site and imported backfill material temporarily in an orderly and safe manner.

D. Provide dust and noise control in conformance with project specifications. Also see Division 1 General Requirements for Cleaning and Waste Management.

PART 2 - PRODUCTS

2.1 PIPE BEDDING AND SHADING

A. Crushed rock (3/8–inch diameter or greater) or well-graded sand and gravel materials conforming to the pipe manufacturer's requirements.

2.2 WARNING TAPE

A. See Section 33 10 00 – Water Utilities.

2.3 SUBSEQUENT BACKFILL

A. Conform to on-site or imported structural backfill in Section 31 22 00 – Grading.

2.4 CONTROLLED DENSITY FILL (CDF) (IN TRENCHES)

A. Provide non-structural CDF, from bottom of trench to finish subgrade of subbase or base material, that can be excavated by hand and produce unconfined compressive 28-day strengths from 50-psi to a maximum of 150-psi. Provide aggregate no larger than 3/8-inch top size. The 3/8-inch aggregate shall not comprise more than 30% of the total aggregate content.

B. Cement: Conform to the standards as set forth in ASTM C-150, Type II Cement.

C. Fly Ash: Conform to the standards as set forth in ASTM C-618, for Class F pozzolan. Do not inhibit the entrainment of air with the fly ash.

D. Air Entraining Agent: Conform to the standards as set forth in ASTM C-260.

E. Aggregates need not meet the standards as set forth in ASTM C-33. Any aggregate, producing performances characteristics described herein will be accepted for consideration. The amount of material passing a #200 sieve shall not exceed 12% and no plastic fines shall be present.

F. Provide CDF that is a mixture of cement, Class F pozzolan, aggregate, air entraining agent and water. CDF shall be batched by a ready mixed concrete plant and delivered to the job site by means of transit mixing trucks.

G. The Contractor shall determine the actual mix proportions of the controlled density fill to meet job site conditions, minimum and maximum strengths, and unit weight. Entrained air content shall be a minimum of 4.0%. The actual entrained air content shall be established for each job with the materials and aggregates to be used to meet the placing and unit weight requirements. Entrained air content may be as high as 20% for fluidity requirements.

2.5 CONCRETE STRUCTURE BEDDING AND BACKFILL

A. Precast Structures: Same materials to the same heights as specified for pipe bedding and backfill.

B. Poured-in-Place Structures:
   1. Bedding: In general, bedding is not required, pour bases against undisturbed native earth in cut areas and against engineered fill compacted to 90% relative compaction in embankment areas.
   2. Side Backfill: On-site or imported structural fill meeting the requirements given in Section 31 22 00 – Grading.

2.6 FILTER FABRIC

A. Filter Fabric:
   1. Filter Fabric: Section 88-1.03 of Caltrans Standard Specifications.
   2. Mirafi 140N (Mirafi Inc., Charlotte, NC) (Tel. 800-438-1855) or equal.

2.7 LIGHTWEIGHT BACKFILL MATERIAL (CELLULAR CONCRETE)

A. Cellular concrete is designated as Class I through Class VI as shown in the following table:

Cellular Concrete Class	Cast Density (PCF)	Minimum Compressive Strength at 28 days[1] (PSI)
I	24 – 29	10
II	30 – 35	80
III	36 – 41	80
IV	42 – 49	120
V	50 – 79	160
VI	80 – 90	300

1 – Relative compaction based on maximum density determined by ASTM D1557 (latest version)

B. General
   1. All materials must be delivered, stored and handled per recommendations of cellular concrete manufacturer.

C. Admixtures
   1. Admixtures for accelerating the set time may be used under the manufacturer's recommendations. A foaming agent must be used and tested in accordance with ASTM C 796.

D. Water
   1. Mixing water must be potable and free of deleterious amounts of acids, alkali, salts, oils, and organic materials in accordance with Section 90-1.02D.

E. Portland Cement
   1. Portland cement must comply with ASTM C 150, Types II/ V. Pozzolans and other cementitious materials may be used when approved by the manufacturer of

the foaming agent. Fly ash and natural pozzolans must comply with ASTM C 618. Ground granulated blast furnace slag must comply with ASTM C 989, grade 100 or 120.

F. Geocomposite Drain
   1. Geocomposite drain must comply with the specifications for geocomposite wall drain in section 88-1.02C.

PART 3 - EXECUTION

3.1 TRENCHING AND EXCAVATION

A. Existing PCC or AC Areas: Cut PCC or AC to full depth at a minimum distance of 12-inches beyond the edge of the trench.

B. Excavate by hand or machine. For gravity systems begin excavation at the outlet end and proceed upstream. Excavate sides of the trench parallel and equal distant from the centerline of the pipe. Hand trim excavation. Remove loose matter.

C. Excavation Depth for Bedding: Minimum of 4-inches below bottom, except that bedding is not required for nominal pipe diameters of 2-inches or less.

D. Excavation Width at Springline of Pipe:
   1. Up to a nominal pipe diameter of 24-inches: Minimum of twice the outside pipe diameter.
   2. Nominal pipe diameter of 30-inches through 36-inches: Minimum of the outside pipe diameter plus 2-feet.
   3. Nominal pipe diameter of 42-inches through 60-inches: Minimum of the outside pipe diameter plus 3-feet.

E. Over-Excavations: Backfill trenches that have been excavated below bedding design subgrade, with approved bedding material.

F. Comply with the Owner's limitations on the amount of trench that is opened or partially opened at any one time. Do not leave trenches open overnight without the approval of the Owner.

G. Where forming is required, excavate only as much material as necessary to permit placing and removal of forms.

H. Grade bottom of trench to provide uniform thickness of bedding material and to provide uniform bearing and support for pipe along entire length. Remove stones to avoid point bearing.

I. To reduce the potential for water migration into building and pavement areas through the granular shading materials a plug of low-permeability clay soil, sand-cement slurry, or lean concrete shall be placed within trenches just outside where the trenches pass into building and pavement areas.

3.2 CONTROL OF WATER AND DEWATERING

A. Conform to dewatering recommendations in Section 31 22 00 – Grading.

B. Be solely responsible for dewatering trenches and excavations and subsequent control of ground and surface water. Provide and maintain such pumps or other equipment as may be necessary to control ground water.

C. Dewater during backfilling operation so that groundwater is maintained a least one foot below level of compaction effort.

D. Reroute surface water runoff away from open trenches and excavations. Do not allow water to accumulate in trenches and excavations.

E. Maintain dewatering system in place until dewatering is no longer required.

3.3 BRACING AND SHORING

A. Conform to California and Federal OSHA requirements.

B. Place and maintain such bracing and shoring as may be required to support the sides of the excavations for the proper protection of workmen; to facilitate the work; to prevent damage to the pipes and appurtenances being constructed; and to prevent damage to adjacent structures or facilities. Remove all bracing and shoring upon completion of the work.

C. Be solely responsible for all bracing and shoring and, if requested by the Owner, submit details and calculations to the Owner. The Owner may forward the submittal to the Consulting Engineer and/or the California Division of Industrial Safety for their review. The Contractor's submittal shall include the basic design, assumed soils conditions and estimation of forces to be resisted, together with plans and specifications of the materials and methods to be used, and shall be prepared by a civil engineer or structural engineer registered in California. No excavations in trench section or around structures shall precede a response to the submittal by the Owner.

D. Be solely responsible for installing and extracting the sheathing in a manner which will not disturb the line, grade, or backfill compaction or operation of the utility being installed or adjacent utilities and facilities.

E. Bay Mud underground utility construction means and methods are left up to the contractor; however, excavations extending into Bay Mud will require shoring. Bay Mud is very weak, and may fail due to surcharge from equipment, or even under it’s own weight. Utilities extending into Bay Mud should balance the weight of backfill materials with the weight of materials being removed as recommended by the geotechnical engineer.

3.4 PIPE BEDDING

A. Open-graded shading materials shall be consolidated in place with vibratory equipment and well-graded materials shall be compacted to at least 90 percent relative compaction with vibratory equipment prior to placing subsequent backfill materials.

3.5 BACKFILLING

A. Bring initial backfill up simultaneously on both sides of the pipe, so as to prevent any displacement of the pipe from its true alignment. Carefully place and compact initial backfill material to an elevation of 12-inches above the top of the pipe in layers not exceeding 8-inches in loose thickness. Compact bedding material at greater than 1% optimum water content to 90% relative compaction unless specified otherwise on the. Compact by pneumatic tampers or other mechanical means. Jetting or ponding of initial backfill material will not be permitted.

B. Bring subsequent backfill to subgrade or finish grade as indicated. Carefully place and compact subsequent backfill material to the proper elevation in layers not exceeding 8-inches in loose thickness. Compact bedding material consisting of on-site low expansion soils at greater than 1% optimum water content to 95% relative compaction, unless specified otherwise on the Plans. Compact by pneumatic tampers

or other mechanical means. Jetting or ponding of subsequent backfill material will not be permitted.

C. Do not use compaction equipment or methods that produce horizontal or vertical earth pressures that may cause excessive pipe displacement or damage the pipe.

3.6 LIGHTWEIGHT BACKFILL MATERIAL (CELLULAR CONCRETE) CONSTRUCTION

A. Specialized Batching, Mixing, and Placing Equipment
   1. Batching, mixing and placing equipment must be capable of producing material that meets the requirements of this Section. Cement and water may be premixed and delivered to the site. Foam must be added and mixed at the site using aforementioned equipment.

B. Personnel Requirements
   1. The cellular concrete installer must be certified and approved in writing by the foam agent manufacturer. The installer's foreman must have a minimum of 2 years experience in this work and must have worked on at least three successful cellular concrete projects.
   2. The installer must use adequate numbers of skilled workers who are thoroughly trained and experienced in the necessary crafts and who are familiar with the specified requirements and the methods needed for proper performance of the work.
   3. The Contractor's Representative must be experienced in the placement of cellular concrete and must be on site full-time during placement.

C. Quality Control and Quality Assurance Testing
   1. Cast Density
      a. During placement of the initial batch, the installer must check the density and adjust the mix as required to obtain the manufacturer's specified cast density at point of placement.
      b. At the point of placement, the density must comply with the specified cast density. A single cast density test must represent the lesser of 100 cy or 2 hours production.
   2. Compressive Strength
      a. The compressive strength must be tested under ASTM C 495 except as follows:
         1) Furnish a sufficient quantity of molded and cured cylinders specimens. Unless otherwise approved, the specimens must be 3 x 6 inch cylinders. During molding, place the concrete in 2 equal layers and raise and drop the cylinders 1 inch, 3 times on a hard surface or lightly tap the side or bottom of the cylinder to close any accidental entrained air. No rodding is allowed.
         2) At a minimum, prepare a set of 3 test cylinders for each 400 CY of cellular concrete placed or a minimum of 2 sets of 4 cylinders each per day (whichever is greater). Specimens must be covered and protected immediately after casting to prevent damage and loss of moisture. Specimens should be cured in the molds for up to 7 days and then removed from the mold and moist cured. Stop moist curing specimens from 24 to 72 hours before the 28 day compressive strength test and allow to air dry. Specimens must not be oven dried.
   3. Acceptance Testing
      a. At a minimum, provide 3 test cylinders for each 400 CY of cellular concrete placed or a minimum of 2 sets of 4 cylinders each per day (whichever is

greater) to Engineer. Specimens must be covered and protected immediately after casting to prevent damage and loss of moisture.

4. Site Preparation
   a. Subgrade to receive embankment material must be free of all loose and extraneous material. Subgrade must be uniformly moist, and any excess water standing on the surface must be removed before placing embankment material.
5. Placement
   a. Cellular concrete must be a homogeneous mixture and all materials must be approved prior to use.
   b. Cellular concrete must be job site mixed with foaming agent and placed with equipment specialized for cellular concrete lightweight material. Cement and water may be premixed and delivered to the job site and foaming agent added on site. Once mixed, the cellular concrete must be conveyed promptly to the location of placement without excessive handling.
   c. Cellular concrete lift thicknesses must not exceed 3 feet. After curing for 12 hours, any crumbling area on the surface must be removed and scarified before the next layer is placed. Surface stepping to achieve grade and super elevation under the pavement must not be less than 5 inches nor more than 6 inches in thickness. If more than 1 lift is required, scarify the layer to receive the next lift with a broom or rake.
   d. Install geocomposite drain between cellular concrete lightweight embankment material and existing structural elements such as abutments and wingwalls as necessary to prevent the cellular concrete from bonding with the existing concrete.
   e. A minimum 12 hour curing period between lifts is required. If ambient temperatures are anticipated to be below 40 degrees F within 24 hours after cellular concrete placement, mixing water must either be heated as approved by foaming agent manufacturer or placement must be prohibited. Cellular concrete must not be placed on frozen ground. Cellular concrete must not be placed in wet ground condition. Dewatering is necessary where groundwater is present.
   f. Any material that does not meet the minimum specified strength within 28 days must be removed and replaced by the Contractor at no additional cost.
   g. Paving machines, heavy construction equipment must not be permitted on cellular concrete until it has attained the specified 28 days compressive strength.
6. Acceptance
   a. The contractor must rectify any cellular concrete material rejected by the Engineer that does not meet the minimum required material properties or is not installed in accordance with this specification. Corrective measures are subject to the approval of the Engineer. Accepted corrected measures will be performed by the contractor at no additional cost or extension of the contract time. This includes removal and replacement of rejected cellular concrete material not meeting the minimum material requirements or installed in accordance with this specification.

3.7 CLEANUP

A. Upon completion of utility earthwork all lines, manholes catch basins, inlets, water meter boxes and other structures shall be thoroughly cleaned of dirt, rubbish, debris and obstructions of any kind to the satisfaction of the Owner.

B. See Section 01 74 00 – Refer to Division 1 General Requirements for Cleaning and Waste Management for further cleanup requirements.

END OF SECTION 31 23 33

SECTION 32 00 01
SITE RESTORATION AND REHABILITATION

PART 1 GENERAL

1.1 REFERENCES

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

1. A615: Deformed and Plain Billet-Steel Bars for Concrete Reinforcement.
2. C150: Portland Cement.

B. Current Caltrans Standard Specifications

1. Section 26 – Aggregate Bases
2. Section 39 – Asphalt Concrete
3. Section 51 – Concrete Structures
4. Section 73 – Concrete Curbs and Sidewalks
5. Section 90 – Portland Cement Concrete

1.2 GENERAL RESTORATION REQUIREMENTS

A. Asphalt Concrete Surfacing:

1. Except in areas of pavement reconstruction, all streets, paths, or other paved areas in which the surface is removed, broken, or damaged, or in which the ground has caved in or settled due to the installation of the improvements, shall be repaired and resurfaced and brought to the original grade by the Contractor.

2. Pavement replacement shall be in kind subject to the following minimum pavement sections:

   a. Streets and all other areas subject to vehicular traffic: 3 inches asphalt concrete over 8 inches aggregate base material, except where shown on the Plans or as directed by the Project Manager.

   b. Asphalt paths and walks: 2 inches asphalt concrete over 4 inches Class 2 aggregate base.

3. In areas of pavement reconstruction, trench backfill will be as shown on the Plans except that the asphalt concrete will be deleted. Backfill will be brought to the level of existing grade with Class 2 aggregate base.

B. Concrete Surfacing:

1. Unless otherwise noted, all walkways, paths, driveways, curbs and other improvements damaged or removed as a result of construction shall be reconstructed by the Contractor to the same dimensions and with the same materials used in the original work subject to the following minimum requirements:

a. Concrete sidewalks: 4-inches of 6-sack concrete over 4-inches of Class 2 aggregate base.

b. Concrete driveways: 6-inches of 6-sack concrete with No. 4 rebar at 12-inches on center over 4-inches of Class 2 aggregate base

c. Concrete pads (not building structure): 8-inches of 6-sack concrete with No. 4 rebar at 12-inches on center over 4-inches of Class 2 aggregate base.

2. All work shall match the appearance of the existing improvements as nearly as practicable. Lampblack or other pigments shall be added to the concrete to obtain the necessary results.

C. Landscaped Areas:

1. All landscaped areas shall be left with a neatly graded surface, free of depressions, conforming to the adjacent existing ground. No mounds of earth shall be left along trenches.

2. Plants destroyed during construction shall be replaced with new plants of the same size and species as the original plants unless noted otherwise. Any damage to the existing irrigation system by the Contractor shall be repaired at no cost to the Owner.

3. Existing sod areas may be rolled, properly stored, and re-laid. Existing sod which cannot be saved, shall be replaced with new sod. Re-seeding is not acceptable.

4. Replanted and/or replacement plants and sod shall be maintained by the Contractor at his expense, for 45 days after acceptance by the Owner.

D. Removal of Striping, Pavement Markers and Pavement Markings

1. All stripes and pavement markings not in conformance with the proposed striping plan shall be removed by grinding or sandblasting. Black paint will not be allowed unless specifically indicated on the drawings.

2. After removal of paint and thermoplastic traffic striping or pavement markings, an asphalt seal coat of Reed & Graham OverKote Asphalt Pavement Coating or approved equal shall be applied 10 feet beyond the limit of the thermoplastic material removal and to the entire width of the street.

E. Replacement of Striping, Pavement Markers and Pavement Markings:

1. Work shall match existing markings in materials, color, and dimension.

2. Except where otherwise noted, striping, pavement markers and pavement markings shall be applied to restored areas regardless of the condition of the existing striping, markers and markings.

PART 2 PRODUCTS

2.1 PAVING MATERIALS

A. Aggregate base shall conform to Class 2 aggregate base, ¾-inch maximum size, as specified in Section 26 of the Caltrans Standard Specifications.

B. Asphalt Concrete:

1. Paving asphalt to be mixed with aggregate shall be steam-refined asphalt, AR-4000, conforming to Section 92 of the Caltrans Standard Specifications.

2. Mineral aggregate shall be Type B mineral aggregate as specified in Section 39 of the Caltrans Standard Specifications.

3. Maximum aggregate size shall be ½-inch for the surface coarse and ¾-inch for the base coarse.

4. Liquid asphalt for prime coat shall be Grade SC-70 in conformance with Section 93 of the Caltrans Standard Specifications.

C. Portland Cement Concrete:

1. Concrete shall be Class A concrete conforming to Section 90 of the Caltrans Standard Specifications.

2. Cement shall be Type II cement conforming to Section 90 of the Caltrans Standard Specifications.

3. Aggregate shall be ¾-inch maximum size conforming to Section 90 of the Caltrans Standard Specifications.

4. Water shall be clear and free from injurious amounts of oil, acid, alkali, organic matter or other deleterious substances.

5. Reinforcing bars shall conform to the requirements of ASTM Designation A615 Grade 40 and Section 52 of the Caltrans Standard Specifications.

6. Filled joints, unless noted otherwise on the Plans, shall be 1/4 inch thick, the full depth of the concrete section and conforming to Section 51 of the Caltrans Standard Specifications.

7. Joint filler shall conform to Section 51 of the Caltrans Standard Specifications for pre-molded expansion joint filler and expanded polystyrene joint filler.

8. Lamp black shall be added to concrete for curbs, gutters, and sidewalks as required to conform to existing work. For new concrete which is not required to match adjacent concrete, ½ pound lamp black shall be mixed per cubic yard of concrete.

9. No admixtures will be allowed without prior approval of the Project Manager.

2.2 TRAFFIC PAINT, THERMOPLASTIC AND PAVEMENT MARKERS

A. Traffic paint and glass beads shall conform to the requirements of Section 84-3 of the Caltrans Standard Specifications.

B. Thermoplastic Material shall conform to the requirements of Caltrans Standard Specifications Section 84-2.

C. Glass Beads to be applied to surface of the paint and thermoplastic shall conform to the requirements of State Specification 8010-11E-22 (Type II).

D. Pavement Markers and Adhesives

1. Reflective and non-reflective pavement markers shall be ceramic and conform to the requirements of Section 85 of the Caltrans Standard Specifications.

2. Adhesive for pavement markers shall be Rapid Set Type epoxy conforming to Section 95-2.04 of the Caltrans Standard Specifications or hot melt bituminous adhesive conforming to Section 85-1.055 of the Caltrans Standard Specifications.

PART 3 EXECUTION

3.1 PREPARATION

A. Before resurfacing material is placed, pavement edges and conform limits shall be ground and trimmed back far enough to provide clean, solid faces and shall be free of any loose material. Trenches shall be sawcut 6 inches back from edge of trench.
B. The top 6 inches of subgrade under all areas to be paved shall be scarified and compacted to 95% maximum dry density.

C. Aggregate base shall be placed, spread, and compacted to 95% maximum dry density in conformance with Section 26 of the Caltrans Standard Specifications.

3.2 ASPHALT CONCRETE PAVING

A. Asphalt concrete shall be proportioned, mixed, placed, spread and compacted in layers in conformance with Section 39 of the Caltrans Standard Specifications. No layer of asphalt concrete shall be less than l inch in compacted thickness nor shall any layer exceed the maximum thickness allowed per Section 39.

B. Before placing asphalt concrete, an asphalt emulsion tack coat (paint binder) shall be applied to all vertical surfaces of existing pavement, curbs, gutters, construction joints

and all existing pavement to be surfaced, in conformance with Section 39 of the Caltrans Standard Specifications.

3.3 CONCRETE CONSTRUCTION

A. All concrete shall be mixed and placed in accordance with Caltrans Standard Specifications, Section 90.

B. Construction of concrete substructures shall conform to applicable provisions of Section 51 of the Caltrans Standard Specifications. Unless noted otherwise herein, all exposed surfaces of structures shall have Class 1 surface finish.

C. Construction of concrete curbs and sidewalks shall conform to Caltrans Standard Specifications, Section 73.

D. Curing shall conform to Section 90-7 of the Caltrans Standard Specifications. No pigments shall be used in curing compounds unless otherwise approved.

E. All work shall be subject to the inspection of the Project Manager. No concrete shall be placed until the Project Manager has approved the forms and reinforcement.

F. Concrete shall not be dropped freely where reinforcing bars will cause segregation, nor shall it be dropped freely more than 6 feet. Spouts, elephant trunks, tremies, or other approved means shall be used to prevent segregation.

3.4 SURFACE STRUCTURES

A. The Contractor shall be responsible for referencing surface structures prior to beginning work. Access to existing valves, manholes and vaults shall be provided at all times. The location of existing valves, manholes and vaults shall be staked and referenced during construction.

B. All surface structures within the limits of proposed paving shall have traffic rated (ASSHTO H-20 loading) frames and covers as specified.

C. Grade Adjustments:

1. Frames, grates and covers of all existing surface structures (manholes, vaults, valve boxes, drain inlets, monument boxes, etc.) shall be adjusted to finish grade within 48 hours of surface paving. Grade rings shall be supplied and installed by the Contractor as needed to meet finish grade. No more than three (3) grade rings may be used.

2. Frames of new or adjusted surface structures shall be supported by concrete with minimum dimensions as follows: 6 inches wide by 6 inches deep for structures less than 18 inches in diameter and 6 inches wide by 9 inches deep for structures 18 inches or greater in diameter.

3. The highest rung of ladders in new or adjusted surface structures shall be no more than 12 inches from the top of the structure, and all rungs shall be spaced evenly (12 inches maximum). Ladder rungs shall conform to State Industrial Safety requirements.

4. Structures Within Paved Areas:

a. A structure located in an area paved with asphalt concrete shall not be constructed to final grade until the adjacent pavement or surfacing has been completed.

b. After asphalt concrete paving is complete, the asphalt shall be cut out 6 inches wider than the frames of all surface structures. Each frame shall then be raised to finished grade (allowable tolerance ± 1/8-inch) and supported by concrete as noted above. The concrete shall be left 1½-inches lower than finished grade. This depressed area shall be paved to finished grade with hot-mix asphalt concrete, ½-inch maximum aggregate size within 48 hours. Cold-applied asphalt patching material will not be allowed.

5. When reconstruction or adjustment of a concrete drainage facility requires partial removal of concrete, sufficient concrete shall be removed to permit new reinforcing steel to be spliced to existing reinforcing steel as specified in Caltrans Standard Specifications Section 52-1.08, "Splicing". Existing reinforcement that is to be incorporated in new work shall be protected from damage and shall be thoroughly cleaned of all adhering material before being embedded in new concrete. Concrete removal shall be performed without damage to any portion that is to remain in place. All damage to the existing concrete which is to remain in place, shall be repaired to a condition equal to that existing prior to the beginning of removal operations. The cost of repairing existing concrete damaged by the Contractor's operations shall be at its expense.

6. All manholes that are to be lowered shall be removed to an approximate depth of 3.5 feet below finish grade and shall then be reconstructed with the proper taper to finish grade.

7. When existing manholes or inlets are to be abandoned, all pipes entering the manhole or inlet shall be securely closed by tight fitting plug or wall of Class A or Class B concrete not less than 0.5 foot thick. The bases of manholes or inlets shall be broken in a manner to prevent entrapment of water. The manhole or inlet shall be demolished to an elevation 3 feet below finish grade and backfilled.

3.5 TRAFFIC PAINT AND GLASS BEADS

A. All new surfaces shall have the traffic paint applied in two applications in accordance with Section 84-3 of the Caltrans Standard Specifications. The first or priming coat shall be in light applications without glass beads to seal the pavement. The first coat shall be dry before application of the second coat.

B. Restriping where indicated on the drawings, shall coincide with the original painting and shall be applied in one application in accordance with Section 84-3 of the Caltrans Standard Specifications.

C. All surfaces to be painted shall be clean and dry prior to painting. Ample time shall be allowed between placement of the asphalt pavement and the initial painting application. There shall be a minimum drying time between paint applications of approximately 20 minutes.

D. Glass beads shall be placed on all traffic stripes (except black stripes) and pavement markings except for the first or priming coat on new asphalt surfaces. All glass beads shall be applied directly to the wet traffic paint with a method that provides uniform distribution

E. Striping shall not be applied at temperatures below 40° F or if pavement surfaces are wet.

F. The alignment of all striping shall be accurately laid out. Lines which do not conform to the alignment as set forth in the Plans, or which have a wavy appearance, shall be removed and replaced by the Contractor at its expense.

3.6 THERMOPLASTIC MATERIAL AND GLASS BEADS

Thermoplastic material and glass beads shall be applied in accordance with Caltrans Standard Specifications Section 84-2.04. Minimum application thickness shall be 0.1-inch for traffic stripes and 0.15-inch for pavement markings.

3.7 PAVEMENT MARKERS

A. All surfaces shall be clean and dry prior to application of the markers.

B. Installation of pavement markers shall conform to the requirements of Section 85-1.06 of the Caltrans Standard Specifications.

END OF SECTION 32 00 01

SECTION 32 05 23

CONCRETE FOR EXTERIOR IMPROVEMENT

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Materials for portland cement concrete.

B. Aggregate and aggregate grading for portland cement concrete.

C. Water for portland cement concrete.

D. Admixtures for portland cement concrete.

E. Proportioning for portland cement concrete.

F. Mixing and transporting portland cement concrete.

G. Formwork for cast in place portland cement concrete.

H. Embedded materials for portland cement concrete.

I. Steel reinforcement for portland cement concrete.

J. Placing and finishing portland cement concrete.

K. Curing portland cement concrete.

L. Protecting portland cement concrete.

1.2 RELATED SECTIONS

A. Section 31 22 00, Grading.

B. Section 32 17 23, Pavement Markings.

C. Section 33 05 16, Utility Structures.

1.3 RELATED DOCUMENTS

A. ASTM Standards
   1. A 82, Cold Drawn Steel Wire for Concrete Reinforcement.
   2. A 185, Steel Welded Wire Fabric, Plain for Concrete Reinforcement.
   3. A 615, Deformed and Plain Billet Steel Bars, for Concrete Reinforcement.
   4. C 94, Specification for Ready-mixed Concrete.
   5. C 114, Method for Chemical Analysis of Hydraulic Cement.
   6. C 150. Portland Cement.
   7. C 618, Fly Ash and Raw or Calcined Natural Pozzolan for use as Natural Admixture in Portland Cement.
   8. C 1751, Preformed Expansion Joint Fillers for Concrete. Paving and Structural Construction (Non-extruded and Resilient Bituminous Types).

B. Caltrans Standard Specifications:
   1. Section 51: Concrete Structures.
   2. Section 73: Concrete Curbs and Sidewalks.
   3. Section 90: Portland Cement Concrete.

C. California Building Code:
   1. Chapter 11B – Accessibility To Public Buildings.

2. Chapter 19A – Concrete.
3. Chapter 33 – Site Work, Demolition and Construction.
4. Section 1133B – General Accessibility for Entrances, Exits and Paths of Travel.

1.4 DEFINITIONS

A. ASTM: American Society for Testing and Materials.

1.5 SUBMITTALS

A. Follow submittal procedures outlined in Section 01 33 00 – Submittal Procedures.

B. Design Mixes: Have all concrete mixes designed by a testing laboratory and approved by the Consulting Engineer. Conform all mixes to the applicable building code requirement, regardless of other minimum requirements listed herein or on the drawings. Submit mix designs for review before use. Show proportions and specific gravities of cement, fine and coarse aggregate, and water and gradation of combined aggregates.

C. Reinforcing Steel Shop-Drawings

1.6 QUALITY ASSURANCE

A. Concrete shall be subject to quality assurance in accordance with Section 90 of the Standard Specifications.
   1. Slump tests: Have available, at job site, equipment required to perform slump tests. Make one slump test for each cylinder sample, from same concrete batch. Allowable maximum slump shall be 4 inches for walls and 3 inches for slabs on grade and other work.

B. Certifications:
   1. Provide Owner's Representative at the time of delivery with certificates of compliance signed by both Contractor and Supplier containing the following statements:
   2. Materials contained comply with the requirements of the Contract Documents in all respects.
   3. Proportions and mixing comply with the design mix approved by the Consulting Engineer. Design mix shall have been field tested in accordance with the herein requirements of the Caltrans Standard Specifications and produces the required compressive strength under like conditions.
   4. Statement of type and amount of any admixtures.
   5. Provide Owner's Representative, at time of delivery, with certified delivery ticket stating volume of concrete delivered and time of mixing, or time of load-out in case of transit mixers.

C. Conform to the applicable provisions of Section 51, 73 and 90 of the Caltrans Standard Specification and these Technical Specifications.
   1. Conform construction of portland cement concrete surface improvements (including curbs, gutters, medians, valley gutters, walks) to the requirements of Section 73 of the Caltrans Standard Specifications unless otherwise required in these Technical Specifications or shown on the Plans.
   2. Construct "V" ditches in accordance with Section 72-4 of the Standard Specifications; except that finishing shall be in accordance with Standard Specification Section 73 instead of 53, or as otherwise required in these Technical Specifications or shown on the Plans.
   3. Conform other construction of portland cement concrete items to the requirements of Section 51 of the Caltrans Standard Specifications unless

otherwise required in these Technical Specifications or shown on the Plans.

D. Conform to the requirements of the California Building Code section 1929A.2 for testing of reinforcing bars.

1.7 DESIGNATION

A. General: Whenever the 28-day compressive strength is designated herein or on the plans is greater than 3,600 psi, the concrete shall considered to be designated by compressive strength. The 28-day compressive strength shown herein or on the plans which are 3,600 psi or less are shown for design information only and are not considered a requirement for acceptance of the concrete. Whenever the concrete is designated by class or as minor concrete herein or on the plans, the concrete shall contain the cement per cubic meter shown in section 90-1.01 of the Caltrans Standard Specifications.

B. Unless specified otherwise herein or on the Plans, Portland Cement Concrete for this Project shall be Class "2" as specified in Section 90-1.01 of the Caltrans Standard Specifications.

PART 2 - PRODUCTS

2.1 PORTLAND CEMENT

A. General: Type V or type II (modified) cement conforming to the requirements of ASTM C 150, with the following modifications:
   1. Cement shall not contain more than 0.60% by weight of alkalies, calculated as the percentage of Na_2O plus 0.658 times the percentage of K_2O when determined by either 4 intensity flame photometry or by the atomic absorption method. The instrument and procedure used shall be qualified as to precision and accuracy in accordance with the requirements of ASTM C 114.
   2. The autoclave expansion shall not exceed 0.50%.
   3. Mortar containing the Portland Cement to be used and the sand, when tested in accordance with Test Method No. Calif. 527, shall not expand in water more than 0.010% and shall have an air content less than .048%.
   4. Allowable tri-calcium Aluminate (C_3A) by weight shall not exceed 5%. Allowable tetracalcium alumino ferrite plus twice the tricalcium aluminate (C_4AF+2C_3A) by weight shall not exceed 25%. The sulfate expansion test (ASTM C 452) may be used in lieu of the above chemical requirements, provided the sulfate expansion does not exceed 0.040% at 14 days (max.).
   5. Contractor may substitute pozzolan for Portland Cement in amounts up to 15% of the required mix unless high early strength concrete is specified. Pozzolan shall consist of Class F Fly Ash meeting the requirements of ASTM C 618.

B. Cement for Surface Improvements: Provide a coloring equivalent to ¼ pound of lampblack per cubic yard. Add to the concrete at the central mixing plant.

C. Liquiblack, as supplied by Concrete Corporation of Redwood City, California, may be used in lieu of lampblack. One pint of liquiblack shall be considered equal to one pound of lampblack.

2.2 AGGREGATE AND AGGREGATE GRADING

A. General: Conform to the requirements of Section 90-2.02, 2.02A and 2.02B of the Caltrans Standard Specifications.

B. Aggregate Size and Gradation: Conform to the requirements of section 90-3 of the Caltrans Standard Specifications for 25-mm (1-inch) maximum combined aggregate.

2.3 WATER

A. General: Conform to the requirements of section 90-2.03 of the Caltrans Standard Specifications, for mixing and curing portland cement concrete and for washing aggregates.

2.4 CLASSIFICATION OF PORTLAND CEMENT CONCRETE

A. Concrete for the following items shall be designated by the following classes per Section 90-1.01 of the Caltrans Standard Specifications:
   1. Vehicular Pavement: Class 2.
   2. Curbs, Gutters, and Sidewalks: Minor Concrete.
   3. Cast in place Concrete Pipe: The concrete shall consist of a minimum of 564 pounds of Portland cement per cubic yard of concrete.
   4. Thrust Blocks: The concrete shall have a minimum compressive strength of 3,000 psi.
   5. Sign and Fence Footings: The concrete shall consist of a minimum of 376 pounds of Portland cement per cubic yard of concrete.
   6. Water, Storm, and Sanitary Structures: The concrete shall consist of a minimum of 564 pounds of Portland cement per cubic yard of concrete.

2.5 EXPANSION JOINT MATERIAL

A. Material for expansion joints in portland cement concrete improvements shall be premolded expansion joint fillers conforming to the requirements of ASTM Designation D 1751. Expansion joint material shall be shaped to fit the cross section of the concrete prior to being placed. Suppliers certificates showing conformance with this specification shall be delivered with each shipment of materials delivered to the job site. Unless noted otherwise herein or on the Plans expansion joint thickness shall be as follows:
   1. Curbs, Curb Ramps, Island Paving, Sidewalks, Driveways and Gutter Depressions: ¼-inch.
   2. Concrete Slope Protection, Gutter Lining, Ditch Lining and Channel Lining: ½-inch.
   3. Structures: As indicated.

2.6 REINFORCEMENT AND DOWELS

A. Bar reinforcement for concrete improvements shall be deformed steel bars of the size or sizes called for on the plans conforming to the requirements of ASTM Designation A 615 for Grade 60 bars. Size and shape for bar reinforcement shall conform to the details shown or called for on the Plans. Substitution of wire mesh reinforcement for reinforcing bars will not be allowed.

B. Slip dowels, where noted or called for on the plans or detail drawings shall be smooth billet-steel bars as designated and conforming to the requirements of ASTM Designation A 615 for Grade 60 bars. Ends of bars inserted in new work shall be covered with a cardboard tube sealed with cork; no grease or oil shall be used.

C. Mesh for reinforcement for concrete improvements shall be cold drawn steel wire mesh of the size and spacing called for on the plans conforming to the requirements of ASTM Designation A 82 for the material and ASTM Designation A 185 for the mesh. Size and extent of mesh reinforcement shall conform to the details shown or called for on the plans.

D. Tie wire for reinforcement shall be eighteen (18) gauge or heavier, black, annealed conforming to the requirements of ASTM Designation A 82.

E. Suppliers certificates showing conformance with this specification shall be delivered with each shipment of materials delivered to the job site.

2.7 ACCESSORY MATERIALS

A. Conform water stops and other items required to be embedded in of Portland Cement Concrete structures to the applicable requirements of Section 51 of the Caltrans Standard Specifications unless otherwise specifically noted or called for on the Plans or detail drawings.

B. Curing Compounds:
   1. Regular Portland Cement Concrete: "Non-Pigmented Curing Compound - chlorinated Rubber Base-Clear" conforming to the requirements contained in Section 90-7.01B, of the Caltrans Standard Specifications.
   2. Color Conditioned Decorative Portland Cement Concrete: LITHOCHROME colorwax as manufactured by the L. M. Scofield Company or approved equal.

2.8 FORMS

A. Conform to the requirements of Section 51-1.05 of the Caltrans Standard Specifications.

2.9 PRECAST CONCRETE STRUCTURES

A. Conform to the following Sections of Caltrans Standard Specifications:
   1. 51-1.02, Minor Structures.
   2. 70-1.02C, Flared End Sections.
   3. 70-1.02H, Precast Concrete Structures.

2.10 PORTLAND CEMENT CONCRETE VEHICULAR PAVEMENT

A. General: See Section 32 12 33 – Paving and Surfacing.

PART 3 - EXECUTION

3.1 STRUCTURAL EXCAVATION

A. Structural excavation may be either by hand, or by machine and shall be neat to the line and dimension shown or called for on the plans. Excavation shall be sufficient width to provide adequate space for working therein, and comply with CAL-OSHA requirements.

B. Where an excavation has been constructed below the design grade, refill the excavation to the bottom of the excavation grade with approved material and compact in place to 95% of the maximum dry density.

C. Remove surplus excavation material remaining upon completion of the work from the job site, or condition it to optimum moisture content and compact it as fill or backfill on the site.

3.2 BRACING AND SHORING

A. Conform to California and Federal OSHA requirements.

B. Place and maintain such bracing and shoring as may be required to support the sides of the excavations for the proper protection of workmen; to facilitate the work; to

prevent damage to the facility being constructed; and to prevent damage to adjacent structures or facilities. Remove all bracing and shoring upon completion of the work.

C. Be solely responsible for all bracing and shoring and, if requested by the Owner's Representative, submit details and calculations to the Owner's Representative. The Owner's Representative may forward the submittal to the Consulting Engineer and/or the California Division of Industrial Safety for their review. The Contractor's submittal shall include the basic design, assumed soils conditions and estimation of forces to be resisted, together with plans and specifications of the materials and methods to be used, and shall be prepared by a civil engineer or structural engineer registered in California. No excavations related to the proposed facility shall precede a response to the submittal by the Owner's Representative.

D. Be solely responsible for installing and extracting the sheathing in a manner which will not disturb the position or operation of the facility being constructed or adjacent utilities and facilities.

3.3 PLACING CONCRETE FORMS

A. Form concrete improvements with a smooth and true upper edge. Side of the form with a smooth finish shall be placed next to concrete. Construct forms rigid enough to withstand the pressure of the fresh concrete to be placed without any distortion.

B. Thoroughly clean all forms prior to placement and coat forms with an approved form oil in sufficient quantity to prevent adherence of concrete prior to placing concrete.

C. Carefully set forms to the alignment and grade established and conform to the required dimensions. Rigidly hold forms in place by stakes set at satisfactory intervals. Provide sufficient clamps, spreaders and braces to insure the rigidity of the forms.

D. Provide forms for back and face of curbs, lip of gutters and edge of walks, valley gutters or other surface slabs that are equal to the full depth of the concrete as shown, noted or called for on the Plans. On curves and curb returns provide composite forms made from benders or thin planks of sufficient ply to ensure rigidity of the form.

3.4 PLACING STEEL REINFORCEMENT

A. Bars shall be free of mortar, oil, dirt, excessive mill scale and scabby rust and other coatings of any character that would destroy or reduce the bond. All bending shall be done cold, to the shapes shown on the plans. The length of lapped splices shall be as follows:
   1. Reinforcing bars No. 8, or smaller, shall be lapped at least 45 bar diameters of the smaller bar joined, and reinforced bars Nos. 9, 10, and 11 shall be lapped at least 60 bar diameters of the smaller bars joined, except when otherwise shown on the plans.
   2. Splice locations shall be made as indicated on the plans.

B. Accurately place reinforcement as shown on the plans and hold firmly and securely in position by wiring at intersections and splices, and by providing precast mortar blocks or ferrous metal chairs, spacers, metal hangers, supporting wires, and other approved devices of sufficient strength to resist crushing under applied loads. Provide supports and ties of such strength and density to permit walking on reinforcing without undue displacement.

C. Place reinforcing to provide the following minimum concrete cover:
   1. Surfaces exposed to water: 4-inches.
   2. Surfaces poured against earth: 3-inches.

3. Formed surfaces exposed to earth or weather: 2-inches.
4. Slabs, walls, not exposed to weather or earth: 1-inch.

D. Minimum spacing, center of parallel bars shall be two and one half (2-1/2) times the diameter of the larger sized bar. Accurately tie reinforcing securely in place prior to pouring concrete. Placing of dowels or other reinforcing in the wet concrete is not permitted.

3.5 MIXING AND TRANSPORTING PORTLAND CEMENT CONCRETE

A. Transit mix concrete in accordance with the requirements of ASTM Designation C 94. Transit mix for not less than ten (10) minutes total, not less than three (3) minutes of which shall be on the site just prior to pouring. Mix continuous with no interruptions from the time the truck is filled until the time it is emptied. Place concrete within one hour of the time water is first added unless authorized otherwise by the Owner's Representative.

B. Do not hand mix concrete for use in concrete structures.

3.6 PLACING PORTLAND CEMENT CONCRETE

A. Thoroughly wet subgrade when concrete is placed directly on soil. Remove all standing water prior to placing concrete.

B. Do not place concrete until the subgrade and the forms have been approved.

C. Convey concrete from mixer to final location as rapidly as possible by methods that prevent separation of the ingredients. Deposit concrete as nearly as possible in final position to avoid re-handling.

D. Place and solidify concrete in forms without segregation by means of mechanical vibration or by other means as approved by the Owner's Representative. Continue vibration until the material is sufficiently consolidated and absent of all voids without causing segregation of material. The use of vibrators for extensive shifting of fresh concrete will not be permitted.

E. Concrete in certain locations may be pumped into place upon prior approval by the Owner's Representative. When this procedure requires redesign of the mix, such redesign shall be submitted for approval in the same manner as herein specified for approval of design mixes.

3.7 PLACING ACCESSORY MATERIALS

A. Place water stops and other items required to be embedded in of portland cement concrete structures at locations shown or required in accordance with Section 51 of the Caltrans Standard Specifications unless otherwise specifically noted or called for on the Plans.

B. Curing Compounds:
1. Regular Portland Cement Concrete: Apply "Non-Pigmented Curing Compound - chlorinated Rubber Base-Clear" in accordance with Section 90-7.01B, 7.01D and 7.03 of the Caltrans Standard Specifications.
2. Color Conditioned Decorative Portland Cement Concrete: Apply LITHOCHROME colorwax in accordance with the manufactures instructions.

3.8 EXPANSION JOINTS

A. Construct expansion joints incorporating premolded joint fillers at twenty (20) foot intervals in all concrete curbs, gutters, sidewalks, median/island paving, valley gutters,

driveway approaches and at the ends of all returns. At each expansion joint install one-half inch by twelve inch (1/2" x 12") smooth slip dowels in the positions shown or noted on the detail drawings.

B. Orient slip dowels at right angles to the expansion joint and hold firmly in place during the construction process by means of appropriate chairs.

3.9 WEAKENED PLANE JOINTS

A. Construct weakened plane joints in concrete curbs, gutters, sidewalks, median/island paving and valley gutters between expansion joints at ten (10) foot intervals throughout, or as otherwise indicated. Depth of joint score depth to be one-fourth (25%) the thickness of the concrete. At each weakened plane joint install one-half inch by twelve inch (1/2" x 12") smooth slip dowels in the positions shown or noted on the detail drawings. Orient slip dowels at right angles to the weakened plane joint and hold firmly in place during the construction process by means of appropriate chairs.

1. Grooved Joints: Form weakened plane joints after initial floating by grooving and finishing each edge of joint to a radius of 1/8-inch. Repeat grooving of weakened plane joints after applying surface finishes. Eliminate groover tool marks on concrete surfaces.

3.10 FINISHING CONCRETE

A. Finish curb and gutter in conformance with the applicable requirements of Section 73-1.04 and 73-1.05A of the Caltrans Standard Specifications as modified herein.

B. Where monolithic curb, gutter and sidewalk is specified, separate concrete pours will not be allowed.

C. Provide a medium broom finish to all horizontal surfaces unless otherwise shown.

3.11 FORM REMOVAL

A. Remove forms without damage to the concrete. Remove all shores and braces below the ground surface, before backfilling.

B. Do not backfill against concrete until the concrete has developed sufficient strength to prevent damage.

C. Leave forms for cast-in-place walls in place at least 72 hours after pouring.

D. Leave edge forms in place at least 24 hours after pouring.

3.12 CONSTRUCTION

A. Form, place and finish concrete walkways, island paving, valley gutters and driveway approaches in conformance with the applicable requirements of Section 73-1.04 and 73-1.06 of the Caltrans Standard Specifications as modified herein.

B. Construct new concrete curb, curb and gutter and valley gutters against existing asphalt concrete by removing a minimum of 12-inches of the asphalt concrete to allow placement of curb or gutter forms. Patch pavement with a 6-inch deep lift of asphalt concrete after gutter form is removed.

3.13 CONNECTING TO EXISTING CONCRETE IMPROVMENTS

A. New curb, gutter, or sidewalk is to connect to existing improvements to remain by saw cutting to existing sound concrete at the nearest score line, expansion joint or control joint. Drill and insert ½-inch diameter by 12-inch long dowels at 24-inches on center into existing improvements. Install pre-molded expansion joint filler at the matching

joint.

B. A cold joint to the existing curb is not acceptable.

3.14 FIELD QUALITY CONTROL

A. Finish subgrade for concrete improvements shall be subject to approval prior to placement of forms.

B. No concrete shall be placed prior to approval of forms.

C. Concrete improvements constructed shall not contain "bird baths" or pond water and shall be smooth and ridge free.

D. Conform the finish grade at top of curb, flow line of gutter, and the finish cross section of concrete improvements to the design grades and cross sections.

E. Variation of concrete improvements from design grade and cross section as shown or called for on the plans shall not exceed the tolerances established in Sections 73-1.05 and/or 73-1.06 of the Caltrans Standard Specifications.

3.15 RESTORATION OF EXISTING IMPROVEMENTS

A. Replace in kind all pavement or other improvements removed or damaged due to the installation of concrete improvements.

B. Remove, landscaping or plantings damaged or disturbed due to the installation of concrete improvements. Replace in kind.

END OF SECTION 32 05 23

SECTION 32 11 00
BASE COURSES

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Aggregate base.

1.2 RELATED SECTIONS

A. Section 31 22 00 – Grading.

B. Section 32 12 33 – Paving and Surfacing.

1.3 RELATED DOCUMENTS

A. ASTM:
   1. D 3740, Practice for Evaluation of Agencies Engaged in Testing and/or Inspection of Soil and Rock as Used in Engineering Design and Construction.
   2. E 329, Specification for Minimum Requirements for Agencies Engaged in the Testing and/or Inspection of Materials Used in Construction.
   3. E 548, Guide for General Criteria Used for Evaluating Laboratory Competence.

B. Caltrans Standard Specifications:
   1. Section 26, Aggregate Bases.

1.4 DEFINITIONS

A. Geotechnical Testing Agency: An independent testing agency qualified according to ASTM E 329 to conduct soil materials and rock definition testing, as documented according to ASTM D 3740 and ASTM E 548.

B. Rock: Rock material in beds, ledges, unstratified masses, and conglomerate deposits and boulders of rock material ¾-cubic yards or more in volume that when tested, according to ASTM D 1586, exceeds a standard penetration resistance of 100 blows/2-inches.

C. Structures: Buildings, footings, foundations, retaining walls, slabs, tanks, curbs, mechanical and electrical appurtenances, or other man made stationary features constructed above or below grade.

D. Subgrade: Surface or elevation remaining after completing excavation, or top surface of a fill or backfill immediately below subbase, base or topsoil materials.

1.5 SUBMITTALS

A. Follow submittal procedures outlined in Sec tion 01 33 00 – Submittal Procedures.

B. Submit material certificates signed by the material producer and the Contractor, certifying that that each material item complies with, or exceeds the specified requirements.

1.6 QUALITY ASSURANCE

A. Percentage of compaction specified shall be the minimum acceptable. The percentage represents the ratio of the dry density of the compacted material to the

maximum dry density of the material as determined by the procedure set forth in ASTM D 1557.

B. Finish grade tolerance at completion of base installation: +0.05’

1.7 PROJECT CONDITIONS

A. Protect open excavations, trenches, and the like with fences, covers and railings to maintain safe pedestrian and vehicular traffic passage.

B. Temporarily stockpile material in an orderly and safe manner and in a location approved by the Owner.

C. Provide dust and noise control in conformance with Division 1 General Requirements.

PART 2 - PRODUCTS

2.1 AGGREGATE BASE

A. Aggregate base shall conform to Caltrans Recycled Class 2 (R value 78 min) aggregate base, 3/4" maximum size, as specified in Section 26 of the C.D.T. Standard Specifications.

PART 3 - EXECUTION

3.1 GENERAL

A. Placement and compaction of material by flooding, ponding, or jetting will not be permitted.

3.2 WET WEATHER CONDITIONS

A. Do not place or compact subgrade if moisture content differs from requirements in Section 31 22 00 - Grading.

3.3 AGGREGATE BASE

A. Watering, Spreading and Compacting: Section 26-1.035, 26-1.04 and 26-1.05 of Caltrans Standard Specifications.

3.4 DISPOSAL

A. Lawfully dispose of all unsuitable and excess or surplus material off-site at no cost to the Owner.

END OF SECTION 32 11 00

SECTION 32 12 33

PAVING AND SURFACING

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 (but is not necessarily limited to):
   1. Asphalt Concrete Paving.
   2. Vehicular Concrete Paving.
   3. Liquid Asphalt and Asphalt Emulsion.
   4. Aggregate Base.
   5. Concrete Aprons, Curbs and Gutters.

B. Section Excludes:
   1. Concrete Site Walls.
   2. Concrete Mow Strips.
   3. Concrete Finishes.
   4. Concrete Sidewalks.

C. Related work furnished under other sections but conforming to the provisions of this section:
   1. Subgrade preparation.
   2. Aggregate Base installation.

D. Related Sections:
   1. Section 32 1723 – Pavement Markings.

1.3 REFERENCES

A. American Society for Testing and Materials (ASTM):
   1. A615: Deformed and Plain Billet-Steel Bars for Concrete Reinforcement.
   2. C150: Portland Cement.
   3. D1557: Moisture Unit Weight Relations of Soils and Aggregate Mixtures Using a 10 lb (4.5 kg) Rammer and 18 in. (457 mm) Drop.
   4. D1682: Breaking Loads and Elongation of Textile Fabrics.

B. California Code of Regulations (CCR): Title 24, Chapter 2-71, Site development Requirements for Handicapped Accessibility.

C. California Department of Transportation (C.D.T.):
   1. Standard Specifications:
      a. Section 26 Aggregate Bases.
      b. Section 37 Bituminous Seals.
      c. Section 39 Asphalt Concrete.
      d. Section 51 Concrete Structures.
      e. Section 52 Reinforcement.
      f. Section 73 Concrete Curbs and Sidewalks.
      g. Section 90 Portland Cement Concrete.
      h. Section 92 Asphalts.
      i. Section 93 Liquid Asphalts.

j. Section 94 Asphaltic Emulsions.
2. Traffic Manual.
3. Highway Design.

D. Institute of Transportation Engineers: Transportation and Traffic Engineering Handbook.

1.4 SUBMITTALS

A. Product Data: For each type of manufactured material and product indicated.
1. Submit manufacturer's tech-data sheets and certificates of compliance to applicable ASTM requirements.

B. Material Test Reports: From a qualified testing agency provided by the Owner indicating and interpreting test results for compliance of the following with requirements indicated, based on comprehensive testing of current materials:
1. Aggregates: Include service record data indicating absence of deleterious expansion of concrete due to alkali-aggregate reactivity.

C. Material Certificates: Signed by manufacturers certifying that each of the following materials complies with requirements:
1. Cementitious materials.
2. Steel reinforcement and reinforcement accessories.
3. Admixtures.
4. Curing compounds.
5. Applied finish materials.
6. Joint fillers.

D. Field quality-control test reports.

E. Asphalt Concrete Paving:
1. Provide two copies of material certificates signed by the material producer and the Contractor, certifying that each material item complies with or exceeds specified requirements.
2. The Contractor shall furnish a certified weight or load slip for each load of material used in the construction of the asphalt concrete pavement.

F. Liquid Asphalt: The Contractor shall furnish product data and manufacturer specifications.

G. Pavement Reinforcement Fabric: The Contractor shall furnish product data and manufacturer specifications.

H. Tack Coat: The Contractor shall furnish product data and manufacturer specifications.

I. Pavement Reinforcement Mesh: The Contractor shall furnish product data and manufacturer specifications.

J. Structural Geotextile Fabric: The Contractor shall furnish product data and manufacturer specifications.

1.5 PROJECT CONDITIONS

A. Liquid Asphalt and Asphalt Emulsion:
1. Seal coat, and paint binder shall be applied only when the ambient temperature is above 50° Fahrenheit and when temperature has not been below 35° Fahrenheit for 12 hours immediately prior to application.
2. Seal coat, and paint binder shall not be applied when base or surfaces are wet or contain excess moisture.

B. Asphalt Concrete Paving: Asphalt concrete surfaces shall be constructed only when ambient temperature is above 50° Fahrenheit and when base is dry.

1.6 GENERAL DESIGN CRITERIA

A. Services Areas: Approach ramps, driveways, and paved work areas in excess of 4 percent slope shall be provided with a rough texture for non-skid surface.

B. Walks and Paths: Concrete exterior slabs (walks, terraces, etc.) shall have a pitch of at least 2 percent.

C. Pavement Markings: All traffic control striping and pavement markings shall conform to the standards illustrated in the C.D.T. Standard Plans Book issued July 1992, General Road Work Section.

PART 2 - PRODUCTS

2.1 PAVING MATERIALS

A. Aggregate Base: Aggregate base shall conform to Caltrans Class 2 (R value 78 min) aggregate base, 3/4" maximum size, as specified in Section 26 of the C.D.T. Standard Specifications.

B. Asphalt Concrete Paving:
1. Paving asphalt to be mixed with aggregate shall be steam-refined asphalt, AR-4000, conforming to Section 92 of the C.D.T. Standard Specifications.
2. Mineral aggregate shall be Type B mineral aggregate as specified in Section 39 of the C.D.T. Standard Specifications.
3. Maximum aggregate size shall be as follows:

A.C. Thickness	Max. Ag.
¾" - 1½	1/2"
2 & 2½"	1/2"
3" & 4"	3/4"

4. Liquid asphalt for prime coat shall be Grade SC-70 in conformance with Section 93 of the C.D.T. Standard Specifications.
5. Asphaltic emulsion for paint binder, and seal coat shall be emulsified asphalt, Type SS-1h, conforming to Section 94 of the C.D.T. Standard Specifications.

C. Pavement Reinforcement Fabric: Pavement reinforcement fabric shall meet Caltrans Section 88-1.02, BP Petromat or approved equivalent.

D. Crack Sealant:
1. Crack sealant shall be rubberized hot-pour type and shall meet ASTM D 3405, Husky 1611 or approved equivalent.
2. Blotting Agent shall be one of: Screened sand, cement, or fly ash.

E. Tack coat: Tack coat shall meet Caltrans Section 39-4.02.

F. Pavement reinforcement mesh: Pavement reinforcement mesh for use in Type 2 Overlay shall be Glasgrid Model 8501 or approved equivalent.

G. Structural geotextile fabric: Structural geotextile fabric shall be Mirafi 500X or approved equivalent.

2.2 FORMS

A. Form Materials: Plywood, metal, metal-framed plywood, or other approved panel-type materials to provide full-depth, continuous, straight, smooth exposed surfaces.

1. Use flexible or curved forms for curves with a radius 100 feet or less.

B. 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.

2.3 STEEL REINFORCEMENT

A. Reinforcing Bars: ASTM A 615/A 615M, Grade 60; deformed.

B. Joint Dowel Bars: Plain steel bars, ASTM A 615/A 615M, Grade 60. Cut bars true to length with ends square and free of burrs, similar to “Speed Dowel” assembly manufactured by Greenstreak, Inc. St. Louis, MI (800) 325-9504.

C. Hook Bolts: ASTM A 307, Grade A, internally and externally threaded. Design hook-bolt joint assembly to hold coupling against pavement form and in position during concreting operations, and to permit removal without damage to concrete or hook bolt.

D. Bar Supports: Bolsters, chairs, spacers, and other devices for spacing, supporting, and fastening reinforcing bars and dowels in place. Manufacture bar supports according to CRSI's "Manual of Standard Practice" from steel wire, plastic, or precast concrete of greater compressive strength than concrete, and as follows:
   1. Equip wire bar supports with sand plates or horizontal runners where base material will not support chair legs.

2.4 CONCRETE MATERIALS

A. Concrete material shall comply with ASTM C94, Ready-Mixed Concrete, and the State of California Standard Specifications, Section 90, except as herein specified.

B. Fine and Coarse Aggregates: ASTM C33, 3/4-inch maximum size; clean, crushed permanent limestone aggregate free of materials which may cause staining.

C. Water: Clean, free from injurious amounts of oil, alkali, organic matter, or other deleterious material, and not detrimental to concrete per ASTM C 94/C 94M.

D. Cementitious Material: Use the following cementitious materials, of the same type, brand, and source throughout the Project:
   1. Portland Cement: ASTM C 150, Type II, or IV, gray [white].
      a. Ground Granulated Blast-Furnace Slag: ASTM C 989, Grade 100 or 120. E.Air-Entraining Admixture: ASTM C 260.

E. Chemical Admixtures: Provide admixtures certified by manufacturer to be compatible with other admixtures and to contain not more than 0.1 percent water-soluble chloride ions by mass of cementitious material.
   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.

2.5 CURING MATERIALS

A. Moisture-Retaining Cover: ASTM C 171, polyethylene film or white burlap-polyethylene sheet.

B. Water: Potable.

C. Evaporation Retarder: Waterborne, monomolecular film forming; manufactured for application to fresh concrete.
   1. Products:
      a. Burke by Edeco; BurkeFilm.
      b. ChemMasters; Spray-Film.
      c. Dayton Superior Corporation; Sure Film.
      d. Euclid Chemical Company (The); Eucobar.
      e. Kaufman Products, Inc.; Vapor Aid.
      f. Lambert Corporation; Lambco Skin.
      g. L&M Construction Chemicals, Inc.; E-Con.
      h. Meadows, W. R., Inc.; Sealtight Evapre.
      i. Nox-Crete Products Group, Kinsman Corporation; Monofilm.
      j. Sika Corporation, Inc.; SikaFilm.

D. Curing and Sealing Materials:
   1. Curing and sealing-exterior: Colorcure concrete cureseal manufactured by L.M. Scofield Company. Color-matched, water-based curing and sealing compound that complies with ASTM C-309. Application per tech-data A634.03
   2. Concrete surface repellent-vertical and/or flatwork: Repello surface treatment, invisible chemical treatment barrier system.

2.6 HARDENERS & SEALERS

A. Curing and finishing-exterior: Sinak HLQ-125 as manufactured by Sinak Corporation. Clear, non-yellowing water-based curing compound that complies with ASTM C-309.

2.7 AGGREGATE BASE

A. 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 (37.5-mm) sieve and 0 to 5 percent passing a No. 8 (2.36-mm) sieve.

B. Fine-Graded Granular Material: Clean mixture of crushed stone, crushed gravel, and manufactured or natural sand; ASTM D 448, Size 10, with 100 percent passing a 3/8-inch (9.5-mm) sieve, 10 to 30 percent passing a No. 100 (0.15-mm) sieve, and at least 5 percent passing No. 200 (0.075-mm) sieve; complying with deleterious substance limits of ASTM C 33 for fine aggregates.

C. Sand: Clean bank sand, free of clay content, dirt or organic matter and complying with ASTM C33. (Bay Sand Not allowed)

2.8 RELATED MATERIALS

A. Expansion- and Isolation-Joint-Filler Strips: ASTM D 1751, asphalt-saturated cellulosic fiber.

2.9 CONCRETE MIX, DESIGN, AND TESTING

A. Comply with requirements of applicable Division 3 sections for concrete mix design, sampling and testing, and quality control and as herein specified.

B. Design mix to produce normal-weight concrete consisting of portland cement, aggregate, water-reducing or high-range water-reducing admixture (superplasticizer), air-entraining admixture, and water to produce the following properties:
   1. Compressive Strength:
      a. Typical: 3000 psi, minimum at 28 days, unless otherwise indicated.
      b. Curbs & Gutters: 3500 psi, minimum at 28 days.

2. Slump Limit: 8 inches minimum for concrete containing high-range water-reducing admixture (superplasticizer, limited to flatwork only); 4 inches for other concrete.
3. Water/Cement Ratio: 0.5

C. Ready-Mixed Concrete: Measure, batch, and mix concrete materials and concrete according to ASTM C 94/C 94M and ASTM C 1116. Furnish batch certificates for each batch discharged and used in the Work.
1. When air temperature is between 85 deg F 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.

D. Project-Site Mixing: Measure, batch, and mix concrete materials and concrete according to ASTM C 94/C 94M. Mix concrete materials in appropriate drum-type batch machine mixer.
1. For concrete mixes of 1 cu. yd. or smaller, continue mixing at least 1-1/2 minutes, but not more than 5 minutes after ingredients are in mixer, before any part of batch is released.
2. For concrete mixes larger than 1 cu. yd., increase mixing time by 15 seconds for each additional 1 cu. yd.
3. Provide batch ticket for each batch discharged and used in the Work, indicating Project identification name and number, date, mixture type, mixing time, quantity, and amount of water added.

PART 3 - EXECUTION

3.1 PREPARATION

A. Subgrade and Aggregate Base:
1. Prepare subgrade, including chemical subgrade treatment, in accordance with Section 31 22 00, Grading.
2. Aggregate base shall be compacted to 95 percent ASTM D1557. Sections 26-1.04B and 26-1.05 of the C.D.T. Standard Specifications shall apply.
3. Soil sterilant shall be applied to prepared subgrade or after installation of rock or aggregate base uniformly at the rate recommended by the manufacturer.

B. Crack Sealing:
1. Before sealing, cracks shall be cleared of dirt, dust, and all other deleterious materials to a depth of 1/4-inch to 1/2-inch.
2. Cracks 1/8-inch in width and greater shall be sealed.
3. Application of crack sealer shall be in accordance with the manufacturer's recommendations unless otherwise directed.

3.2 ASPHALT CONCRETE PAVING

A. General:
1. Asphalt concrete shall be proportioned, mixed, placed, spread, and compacted in conformance with Section 39 of the C.D.T. Standard Specifications.
2. Before placing asphalt concrete on untreated base, a liquid asphalt prime coat shall be applied to the base course in conformance with Section 39 of the C.D.T. Standard Specifications. Prime coat shall be applied at the rate of 0.25 gallons per square yard.
3. Before placing asphalt concrete, an asphalt emulsion tack coat shall be applied to all vertical surfaces of existing pavement, curbs, gutters, construction joints, and all existing pavement to be surfaced, in conformance with Section 39 of the C.D.T. Standard Specifications.

4. Spreading and compacting asphalt concrete shall be performed in accordance with Section 39 of the C.D.T. Standard Specifications.
5. Seal coat shall be applied to all finished surfaces of asphalt concrete pavement at a rate of 0.05 gallons per square yard, in accordance with Section 37 of the C.D.T. Standard Specifications.
6. After seal coat has been applied, ample time shall be allowed for drying before traffic is allowed on the pavement or paint striping is applied.

3.3 CONCRETE CONSTRUCTION

A. EXAMINATION
1. Examine exposed subgrades and subbase surfaces for compliance with requirements for dimensional, grading, and elevation tolerances.
2. Proof-roll prepared subbase surface below concrete pavements with heavy pneumatic-tired equipment to identify soft pockets and areas of excess yielding.
   a. Completely proof-roll subbase in one direction and repeat in perpendicular direction. Limit vehicle speed to 3 mph.
   b. Subbase with soft spots and areas of pumping or rutting exceeding depth of 1/2 inch require correction according to requirements in Section 31 22 00, Grading.
3. Proceed with concrete pavement operations only after nonconforming conditions have been corrected and subgrade is ready to receive pavement.

B. PREPARATION
1. Remove loose material from compacted subbase surface immediately before placing concrete.

C. EDGE FORMS AND SCREED CONSTRUCTION
1. Set, brace, and secure edge forms, bulkheads, and intermediate screed guides for pavement to required lines, grades, and elevations. Install forms to allow continuous progress of work and so forms can remain in place at least 24 hours after concrete placement.
2. Clean forms after each use and coat with form-release agent to ensure separation from concrete without damage.
3. Slope step treads at 1/4-inch per foot to drain

D. AGGREGATE BASE
1. Granular Course: Cover subgrade with granular fill, moisten, and compact with mechanical equipment to elevation tolerances of plus 0 inch (0 mm) or minus 3/4 inch (19 mm).
   a. Place and compact a 1/2-inch- (13-mm-) thick layer of fine-graded granular material over granular fill.
2. Sand: Sand to conform to grading requirements of ASTM C33. Screen sand to thickness as shown on plans. Do not use sand to fill depressions in the base; fill with base material and compact.

E. STEEL REINFORCEMENT
1. General: Comply with CRSI's "Manual of Standard Practice" for fabricating, placing, and supporting reinforcement.
2. Clean reinforcement of loose rust and mill scale, earth, ice, or other bond-reducing materials.
3. Arrange, space, and securely tie bars and bar supports to hold reinforcement in position during concrete placement. Maintain minimum cover to reinforcement.

F. JOINTS
1. General: Form construction, isolation, and contraction joints and tool edgings true to line with faces perpendicular to surface plane of concrete. Construct transverse joints at right angles to centerline, unless otherwise indicated.
   a. When joining existing pavement, place transverse joints to align with previously placed joints, unless otherwise indicated.
2. Construction Joints: Set construction joints at side and end terminations of pavement and at locations where pavement operations are stopped for more than one-half hour unless pavement terminates at isolation joints.
   a. Continue steel reinforcement across construction joints, unless otherwise indicated. Do not continue reinforcement through sides of pavement strips, unless otherwise indicated.
   b. Provide tie bars at sides of pavement strips where indicated.
   c. Butt Joints: Use bonding agent at joint locations where fresh concrete is placed against hardened or partially hardened concrete surfaces.
   d. Keyed Joints: Provide preformed keyway-section forms or bulkhead forms with keys, unless otherwise indicated. Embed keys at least 1-1/2 inches into concrete.
   e. Doweled Joints: Install dowel bars and support assemblies at joints where indicated. Lubricate or asphalt-coat one-half of dowel length to prevent concrete bonding to one side of joint.
3. Isolation (Expansion)Joints: Form isolation joints of preformed joint-filler strips abutting concrete curbs, catch basins, manholes, inlets, structures, walks, other fixed objects, and where indicated.
   a. Locate expansion joints at intervals of 20 feet, unless otherwise indicated on plans and drawings.
   b. Extend joint fillers full width and depth of joint.
   c. Terminate joint filler not less than 1/2 inch or more than 1 inch below finished surface if joint sealant is indicated.
   d. Place top of joint filler flush with finished concrete surface if joint sealant is not indicated.
   e. Furnish joint fillers in one-piece lengths. Where more than one length is required, lace or clip joint-filler sections together.
   f. Protect top edge of joint filler during concrete placement with metal, plastic, or other temporary preformed cap. Remove protective cap after concrete has been placed on both sides of joint.
4. Contraction (Control) Joints: Form weakened-plane contraction joints, sectioning concrete into areas as indicated. Construct contraction joints for a depth equal to at least one-fourth of the concrete thickness, as follows to match jointing of existing adjacent concrete pavement:
   a. Grooved Joints: Form contraction joints after initial floating by grooving and finishing each edge of joint with grooving tool to a 1/8-inch radius. Repeat grooving of contraction joints after applying surface finishes. Eliminate groover 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 joints into concrete when cutting action will not tear, abrade, or otherwise damage surface and before developing random contraction cracks.
   c. Do not continue steel across joint.
5. Edging: Tool edges of pavement, gutters, curbs, and joints in concrete after initial floating with an edging tool to a 3/4-inch radius. Repeat tooling of edges after applying surface finishes. Eliminate tool marks on concrete surfaces.

G. CONCRETE PLACEMENT

1. Inspection: Before placing concrete, inspect and complete formwork installation, steel reinforcement, and items to be embedded or cast in. Notify other trades to permit installation of their work.
2. Remove snow, ice, or frost from subbase surface and reinforcement before placing concrete. Do not place concrete on frozen surfaces.
3. Moisten subbase to provide a uniform dampened condition at time concrete is placed. Do not place concrete around manholes or other structures until they are at required finish elevation and alignment.
4. Comply with ACI 301 requirements for measuring, mixing, transporting, and placing concrete.
5. Do not add water to concrete during delivery or at Project site.
6. Do not add water to fresh concrete after testing.
7. Deposit and spread concrete in a continuous operation between transverse joints. Do not push or drag concrete into place or use vibrators to move concrete into place.
8. Consolidate concrete according to ACI 301 by mechanical vibrating equipment supplemented by hand spading, rodding, or tamping.
    a. Consolidate concrete along face of forms and adjacent to transverse joints with an internal vibrator. Keep vibrator away from joint assemblies, reinforcement, or side forms. Use only square-faced shovels for hand spreading and consolidation. Consolidate with care to prevent dislocating reinforcement, dowels, and joint devices.
9. Screed pavement surfaces with a straightedge and strike off.
10. Commence initial floating using bull floats or darbies to impart an open textured and uniform surface plane before excess moisture or bleed water appears on the surface. Do not further disturb concrete surfaces before beginning finishing operations or spreading surface treatments.
11. Cold-Weather Placement: Comply with ACI 306.1 and as follows. Protect concrete work from physical damage or reduced strength that could be caused by frost, freezing actions, or low temperatures.
    a. When air temperature has fallen to or is expected to fall below 40 deg F, uniformly heat water and aggregates before mixing to obtain a concrete mixture temperature of not less than 50 deg F and not more than 80 deg F at point of placement.
    b. Do not use frozen materials or materials containing ice or snow.
    c. Do not use calcium chloride, salt, or other materials containing antifreeze agents or chemical accelerators unless otherwise specified and approved in mix designs.
12. Hot-Weather Placement: Comply with ACI 301 and as follows when hot-weather conditions exist:
    a. Cool ingredients before mixing to maintain concrete temperature below 90 deg F at time of placement. Chilled mixing water or chopped ice may be used to control temperature, provided water equivalent of ice is calculated to total amount of mixing water. Using liquid nitrogen to cool concrete is Contractor's option.
    b. Cover steel reinforcement with water-soaked burlap so steel temperature will not exceed ambient air temperature immediately before embedding in concrete.
    c. Fog-spray forms, steel reinforcement, and subgrade just before placing concrete. Keep subgrade moisture uniform without standing water, soft spots, or dry areas.

H. FLOAT FINISHING
1. General: Do not add water to concrete surfaces during finishing operations.

2. Float Finish: Apply float finish to monolithic slab surfaces to receive finishes as specified; slab surfaces shall be covered with membrane or elastic waterproofing, membrane or elastic roofing, or as otherwise indicated.
    a. After screeding, consolidating, and leveling concrete slabs, do not work surface until ready for floating. Begin floating when surface water has disappeared, or when concrete has stiffened sufficiently to permit operation of power-driven floats, or both. Consolidate surface with power-driven floats or by hand-floating if area is small or inaccessible to power units. Check and level surface plane to a tolerance not exceeding 5/16-inch in 10 feet when tested with a 10 feet straightedge or to tolerance of F(F) not less than 20 (floor flatness) and F(L) not less than 15 (floor levelness) measured according to ASTM E1155. Cut down high spots and fill low spots. Uniformly slope surface to drains. Immediately after leveling, refloat surface to a uniform, smooth, granular texture.
3. Broom Finish: Perform broom finishing immediately after float finishing.
    a. Medium-to-Fine-Textured Broom Finish: Draw a soft bristle broom across float-finished concrete surface perpendicular to line of traffic to provide a uniform, fine-line texture.
    b. Medium-to-Coarse-Textured Broom Finish: Provide a coarse finish by striating float-finished concrete surface 1/16 to 1/8 inch deep with a stiff-bristled broom, perpendicular to line of traffic.
4. Final Tooling: Tool edges of paving, gutters, curbs, and joints formed in fresh concrete with a jointing tool to the following radius. Repeat tooling of edges and joints after applying surface finishes. Eliminate tool marks on concrete surfaces.
    a. 3/8-inch wide radius at surface, tapered, with top edges rounded to 1/8-inch radius.

I. CONCRETE PROTECTION AND CURING
1. General: Protect freshly placed concrete from premature drying and excessive cold or hot temperatures.
2. Comply with ACI 306.1 for cold-weather protection.
3. Evaporation Retarder: Apply evaporation retarder to 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.
4. Begin curing after finishing concrete but not before free water has disappeared from concrete surface.
5. Curing Methods: Cure concrete by moisture curing, moisture-retaining-cover curing, curing compound, or a combination of these as follows:
    a. Moist Curing: Keep surfaces continuously moist for not less than seven days with the following materials:
        1) Water.
        2) Continuous water-fog spray.
        3) Absorptive cover, water saturated and kept continuously wet. Cover concrete surfaces and edges with 12-inch lap over adjacent absorptive covers.
    b. 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. Immediately repair any holes or tears during curing period using cover material and waterproof tape.

c. 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.

J. PAVEMENT TOLERANCES
1. Comply with tolerances of ACI 117 and as follows:
a. Elevation: 1/4 inch.
b. Thickness: Plus 3/8 inch, minus 1/4 inch.
c. Surface: Gap below 10-foot- long, unleveled straightedge not to exceed 1/4 inch.
d. Lateral Alignment and Spacing of Tie Bars and Dowels: 1 inch.
e. Vertical Alignment of Tie Bars and Dowels: 1/4 inch.
f. Alignment of Tie-Bar End Relative to Line Perpendicular to Pavement Edge: 1/2 inch.
g. Alignment of Dowel-Bar End Relative to Line Perpendicular to Pavement Edge: Length of dowel 1/4 inch per 12 inches.
h. Joint Spacing: 3 inches, unless otherwise indicated.
i. Contraction Joint Depth: Plus 1/4 inch, no minus.
j. Joint Width: Plus 1/8 inch, no minus.

3.4 FIELD QUALITY CONTROL

A. Asphalt Concrete Paving:
1. The specified thickness of the finished pavement shall be the minimum acceptable.
2. Conforms shall form a smooth, pond-free transition between existing and new pavement.
3. Depressions in paving between high spots are not to exceed 1/8-inch when measured below a 10 feet long straight edged placed anywhere on surface in any direction.
4. The finished asphalt pavement shall have positive drainage without ponding.

B. Remove and replace concrete pavement where test results indicate that it does not comply with specified requirements.

C. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.

D. Design Team Review – contractor to contract Design Team requesting review of the following stages of paving construction:
1. Pre-Installation Meeting
2. Formwork string layout
3. Formwork layout
4. Formwork placement prior to concrete pour
5. First Concrete pour
6. Layout of paving joints to be sawcut
7. First day of paving joint sawcutting
8. First day of paving sealing.

3.5 REPAIRS AND PROTECTION

A. Remove and replace concrete pavement that is broken, cracked, damaged, or defective or that does not comply with requirements in this Section.

B. Drill test cores, where directed by Engineer of Record, when necessary to determine magnitude of cracks or defective areas. Fill drilled core holes in satisfactory pavement areas with portland cement concrete bonded to pavement with epoxy adhesive.

C. Protect concrete from damage. Exclude traffic from pavement for at least 14 days after placement. When construction traffic is permitted, maintain pavement as clean as possible by removing surface stains and spillage of materials as they occur.

D. Maintain concrete pavement free of stains, discoloration, dirt, and other foreign material. Sweep concrete pavement not more than two days before date scheduled for Substantial Completion inspections.

3.6 CLEANUP

A. General:
   1. Surplus material remaining upon completion of paving operations shall become the property of the Contractor, to be removed from the work site and disposed of in a lawful manner.
   2. Surfaces shall be left in a clean, neat, and workmanlike condition, and all construction waste, rubbish, and debris shall be removed from the work site and disposed of in a lawful manner.
   3. Remove all concrete over pours, and waste from the site.
   4. Provide a final power wash of all concrete surfaces.

END OF SECTION 32 12 33

SECTION 32 13 00

RIGID PAVING

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Furnishing, placing, spreading, compacting and shaping portland cement concrete pavement with undoweled transverse weakened plane joints, for vehicular traffic.

B. Form construction and use in placing portland cement concrete pavement.

C. Joints for portland cement concrete pavement.

D. Finishing portland cement concrete pavement.

E. Curing and protecting portland cement concrete pavement.

1.2 RELATED SECTIONS

A. Section 32 05 23 – Cement and Concrete for Exterior Improvements.

1.3 RELATED DOCUMENTS

A. AASHTO Standard Specifications
   1. T 53: Softening Point of Bitumen (Ring-and-Ball Apparatus).

B. ASTM Standards
   1. A 615: Deformed and Plain Billet-Steel Bars for Concrete Reinforcement.
   2. A 775: Epoxy Coated Reinforcing Steel Bars.
   3. A 934: Epoxy-Coated Prefabricated Steel Reinforcing Bars.
   4. C 881: Epoxy-Resin-Base Bonding Systems for Concrete.
   5. D 2628: Preformed Polychloroprene Elastomeric Joint Seals for Concrete Pavements.
   6. D 2835: Lubricant for Installation of Preformed Compression Seals in Concrete Pavements.
   7. D 3405: Joint Sealants , Hot Poured , for Concrete and Asphalt Pavements.
   8. D 3963: Fabrication and Jobsite Handling of Epoxy-Coated Reinforcing Steel.

C. Caltrans Standard Specifications:
   1. Section 40, Portland Cement Concrete Pavement.
   2. Section 52, Reinforcement.
   3. Section 90, Portland Cement Concrete.
   4. Section 95, Epoxy.

D. Caltrans Standard Plans:
   1. Plan A35A: Portland Cement Concrete Pavement (Undoweled Transverse Joints).
   2. Plan A35C: Portland Cement Concrete Pavement Joint and End Anchor Details.

1.4 DEFINITIONS

A. AASHTO: American Association of State Highway and Transportation Officials.

B. ASTM: American Society for Testing and Materials.

1.5 QUALITY ASSURANCE

A. Manufacturer Qualifications: Manufacturer of ready-mixed concrete products complying with ASTM C 94 requirements for production facilities and equipment.
   1. Manufacturer must be certified according to the National Ready Mix Concrete Plant Certification Program.

B. Installer Qualification: An experienced installer who has completed pavement work similar in material, design and extent to that indicated for this Project and whose work has resulted in construction with a record of successful in-service performance.

C. Source Limitations: Obtain each type or class of cementitious material of the same brand from the same manufacturer's plant and each aggregate from one source.

1.6 SUBMITTALS

A. Follow submittal procedures outlined in Section 01 33 00 – Submittal Procedures.

B. Design Mixes: For each concrete pavement mix. Include alternate mix designs when characteristics of materials, project conditions, weather, test results or other circumstances warrant adjustments.

C. Material Certificates: Signed by manufacturers certifying that each of the following materials complies with requirements.
   1. Cementitious materials and aggregates.
   2. Steel reinforcement and reinforcement accessories.
   3. Admixtures.
   4. Curing compound.
   5. Applied finish material.
   6. Bonding agent of adhesive.
   7. Joint filler.
   8. Joint Sealant.
   9. Tie Bars.
   10. Epoxy.
   11. Backer Rods.

PART 2 - PRODUCTS

2.1 PORTLAND CEMENT CONCRETE

A. General: Conform to Caltrans Standard Specifications, Section 90. Use Class 2 Concrete

B. Replace 25% minimum Portland cement with fly ash

C. Aggregate shall contain 30% minimum recycled content

2.2 TIE BARS

A. Deformed reinforcing steel bars conforming to the requirements of ASTM Designation A 615/A (615M), Grade 40 or 60 (Grade 300 or 420). Reinforcing bars for pedestrian paving shall be 75% minimum recycled content.

B. Epoxy-coat in conformance with the provisions in Section 52-1.02B of Caltrans Standard Specifications, except that references made to ASTM Designation D 3963/D 3963M shall be deemed to mean ASTM Designation A 934/A 934M or A 775/775M.

C. Do not bend tie bars.

2.3 EPOXY

A. Bond tie bars to existing concrete with epoxy resin conforming to Section 95-2.03, "Epoxy Resin Adhesive for Bonding New Concrete to Old Concrete," of the Caltrans Standard Specifications.

2.4 SILICONE JOINT SEALANT

A. Furnish low modulus silicone joint sealant in a one-part silicone formulation. Do not use acid cure sealants. Compound to be compatible with the surface to which it is applied and conform to the following requirements:

Specification	Test Method	Requirement
Tensile stress, 150% elongation, 7-day cure at 25°± 1°C and 45% to 55% R.H.[e]	ASTM D 412 (Die C)	310 kPa max.
Flow at 25° ± 1°C	ASTM C 639[a]	Shall not flow from channel
Extrusion Rate at 25° ± 1°C	ASTM C 603[b]	75-250 g/min.
Specific Gravity	ASTM D 792 Method A	1.01 to 1.51
Durometer Hardness, at -18°C, Shore A, cured 7 days at 25° ± 1°C	ASTM C 661	10 to 25
Ozone and Ultraviolet Resistance, after 5000 hours	ASTM C 793	No chalking, cracking or bond loss
Tack free at 25° ± 1°C and 45% to 55% R.H.[e]	ASTM C 679	Less than 75 minutes
Elongation, 7 day cure at 25° ± 1°C and 45% to 55% R.H.[e]	ASTM D 412 (Die C)	500 percent min.
Set to Touch, at 25° ± 1°C and 45% to 55% R.H.[e]	ASTM D 1640	Less than 75 minutes
Shelf Life, from date of shipment	—	6 months min.
Bond, to concrete mortar-concrete briquets, air cured 7 days at 25° ± 1°C	AASHTO T 132[c]	345 kPa min.
Movement Capability and Adhesion, 100% extension at -18°C after, air cured 7 days at 25° ± 1°C, and followed by 7 days in water at 25° ± 1°C	ASTM C 719[d]	No adhesive or cohesive failure after 5 cycles

Notes:
ASTM Designation: C 639 Modified (15 percent slope channel A).
ASTM Designation: C 603, through 3-mm opening at 345 kPa.
Mold briquets in conformance with the requirements in AASHTO Designation: T 132, sawed in half and bonded with a 1.5 mm maximum thickness of sealant and tested in conformance with the requirements in AASHTO Designation: T 132. Briquets shall be dried to constant mass at 100 ± 5° C.
Movement Capability and Adhesion: Prepare 305 mm x 25 mm x 75 mm concrete blocks in conformance with the requirements in ASTM Designation: C 719. A sawed face shall be used for bond surface. Seal 50 mm of block leaving 12.5 mm on each end of specimen unsealed. The depth of sealant shall be 9.5 mm and the width 12.5 mm.
e. R.H. equals relative humidity.

B. Formulate the silicon joint sealant to cure rapidly enough to prevent flow after application on grades of up to 15 percent.

C. Furnish to the Owner a Certificate of Compliance. Accompany certificate with a certified test report of the results of the required tests performed on the sealant material within the previous 12 months prior to proposed use. Provide the certificate and accompanying test report for each lot of silicone joint sealant prior to use on the project.

2.5 ASPHALT RUBBER JOINT SEALANT

A. Conform to the requirements of ASTM Designation: D 3405 as modified herein or to the following:
   1. Provide a mixture of paving asphalt and ground rubber. Ground rubber to be vulcanized or a combination of vulcanized and de-vulcanized materials ground so that 100 percent will pass a 2.36-mm sieve and contain not less than 22 percent ground rubber, by mass. Modifiers may be used to facilitate blending.
   2. The Ring and Ball softening point shall be 57°C minimum, when tested in conformance with the requirements in AASHTO Designation: T 53.
   3. Provide asphalt rubber sealant material capable of being melted and applied to cracks and joints at temperatures below 204°C.

B. The penetration requirement of Section 4.2 of ASTM Designation: D 3405 do not apply. The required penetration at 25°C, 150g, 5s, shall not exceed 120.

C. The resilience requirement of Section 4.5 of ASTM Designation: D 3405 do not apply. The required resilience, when tested at 25°C, shall have a minimum of 50 percent recovery.

D. Accompany each lot of asphalt rubber joint sealant shipped to the job site, whether as specified herein or conforming to the requirements of ASTM Designation D 3405, as modified herein, by a Certificate of Compliance, storage and heating instructions and precautionary instructions for use.

E. Heat and place in conformance with the manufacturer's written instructions and the details shown on the plans. Provide manufacturer's instructions to the Owner. Do not place when the pavement surface temperature is below 10°C.

2.6 PREFORMED COMPRESSION JOINT SEALANT

A. Material: ASTM Designation: D 2628.
   1. Number of cells: 5 or 6.
   2. Lubricant Adhesive: ASTM Designation D 2835.
   3. Install compression seals along with lubricant adhesive according to the manufacturer's recommendations. Submit manufacture's recommendations to the Owner’s Representative`.

B. Accompany each lot of compression seal and lubricant adhesive by a Certificate of Compliance, storage instructions and precautionary instructions for use. Also submit the manufacturer's data sheet with installation instructions and recommended model or type of preformed compression seal for the joint size and depth as shown on the plans. Show evidence that the selected seal is being compressed at level between 20 and 50 percent at all times for the joint width and depth shown on the plans.

2.7 BACKER RODS

A. Provide backer rods that have a diameter prior to placement at least 25 percent greater than the width of the saw cut after sawing and are expanded, crosslinked, closed-cell polyethylene foam that is compatible with the joint sealant so that no bond, adverse reaction occurs between the rod and sealant. In no case use a hot pour sealant that will melt the backer rod. Submit a manufacturer's data sheet verifying that the backer rod is compatible with the sealant to be used.

PART 3 - EXECUTION

3.1 WATER SUPPLY

A. Conform to Section 40-1.02 of Caltrans Standard Specifications.

3.2 SUBGRADE

A. Conform to Section 40-1.04 of Caltrans Standard Specifications.

3.3 SOIL STERILANT

A. Furnish and apply to areas indicated in accordance with Section 31 31 19 – Vegetation Control.

3.4 PLACING

A. Conform to Section 40-1.06 of Caltrans Standard Specifications.

3.5 SPREADING COMPACTING AND SHAPING

A. Conform to Section 40-1.07 of Caltrans Standard Specifications.
   1. Stationary Side Form Construction: Section 40-1.07A of Caltrans Standard Specifications.
   2. Slip Form Construction: Section 40-1.07B of Caltrans Standard Specifications.

3.6 INSTALLING TIE BARS

A. Install at longitudinal contact joints, longitudinal weakened plane joints, and transverse contact joints as shown on the plans. In no case, shall any consecutive width of new portland cement concrete pavement tied together with tie bars exceed 15 meters. In no case shall tie bars be used at a joint where portland cement concrete and asphalt concrete pavements abut.

B. Tie bars shall be installed at longitudinal joints by one of the 3 following methods:
   1. Drilling and bonding in conformance with the details shown on the plans. Provide a two-component, epoxy-resin, conforming to the requirements of ASTM Designation: C 881, Type V. Grade 3 (Non-Sagging), Class shall be as follows:

Temperature of Concrete	Required Class of Epoxy Resin
Lower than 40° F (4.5 °C)	A
40˚ F (4.5˚ C) through 60˚ F (15.5˚ C)	B
Above 60˚ F (15.5˚ C)	C

   2. Provide, at least 7 days prior to start of work, a Certificate of compliance and a copy of the manufacturer's recommended installation procedure. The drilled holes shall be cleaned in accordance with the epoxy manufacturer's instructions and shall be dry at the time of placing the epoxy and tie bars. Immediately after inserting the tie bars into the epoxy, the tie bars shall be supported as necessary to prevent movement during the curing and shall remain undisturbed until the epoxy has cured a minimum time as specified by the manufacturer. Tie bars that are improperly bonded, as determined by the Owner, will be rejected. If rejected, adjacent new holes shall be drilled, as directed by the Owner, and new tie bars shall be placed and securely bonded to the concrete. All work necessary to correct improperly bonded tie bars shall be performed at the Contractor's expense.

3. Insert the tie bars into the plastic slip-formed concrete before finishing the concrete. Inserted tie bars shall have full contact between the bar and the concrete. When tie bars are inserted through the pavement surface, the concrete over the tie bars shall be reworked and refinished to such an extent that there is no evidence on the surface of the completed pavement that there has been any insertion performed. Any loose tie bars shall be replaced by drilling and grouting into place with epoxy as described in method 1 above at the Contractor's expense.
4. By using threaded dowel splice couplers fabricated from deformed bar reinforcement material, free of external welding or machining. Threaded dowel splice couplers shall be accompanied by a Certificate of Compliance and installation instructions. Installation of threaded dowel splice couplers shall conform to the requirements of the manufacturer's recommendations.

3.7 JOINTS

A. Conform to Section 40-1.08 of Caltrans Standard Specifications, Except that tie bars shall be as specified under Part 2, Products.
   1. Transverse Contact Joints: Section 40-1.08A of Caltrans Standard Specifications.
      a. Construct a transverse contact (construction) joint at the end of each day's work, or where concrete placement is interrupted for more than 30 minutes, to coincide with the next weakened plane joint location.
      b. If sufficient concrete has not been mixed to form a slab to match the next weakened plane joint, when an interruption occurs, the excess concrete shall be removed and disposed of back to the last preceding joint. The cost of removing and disposing of any excess concrete shall be at the Contractor's expense. Any excess material shall become the property of the Contractor and shall be properly disposed of.
      c. A metal or wooden bulkhead (header) shall be used to form the joint. The bulkhead shall be designed to accommodate the installation of tie bars.
   2. Weakened Plane Joints: Section 40-1.08B, except that the insert method of forming joints in pavement shall not be used.

3.8 FINISHING

A. Conform to Sections 40-1.09 and 40-1.10 of Caltrans Standard Specifications.

3.9 CURING

A. Conform to Section 40-1.11 of Caltrans Standard Specifications.

3.10 SEALING JOINTS

A. Liquid Joint Sealant Installation.
   1. The joint sealant detail for transverse and longitudinal joints, as shown on the plans, shall apply only to weakened plane joints. Construct weakened plane joints by the sawing method. Should grinding or grooving be required over or adjacent to any joint after sealant has been placed, completely remove the joint material and disposed of, and replace at the Contractor's expense. Recess sealant below the final finished surface as shown on the plans.
   2. At the Contractor's option, transverse weakened plane joints shall be either Type DSC or Type SSC as shown on the plans. Longitudinal weakened plane joints shall be Type SSC only as shown on the plans.
   3. Seven days after the concrete pavement placement and not more than 4 hours before placing backer rods and joint sealant materials, clean the joint walls by the

dry sand blast method and other means as necessary to completely remove from the joint all objectionable material such as soil, asphalt, curing compound, paint and rust. After cleaning the joint, remove all traces of sand, dust and loose material from and near the joint for a distance along the pavement surfaces of at least 50 mm on each side of the joint by the use of a vacuum device. Remove surface moisture at the joints by means of compressed air or moderate hot compressed air or other means approved means. Do not use drying procedures that leave a residue or film on the joint wall. Sandblasting equipment shall have a maximum nozzle diameter size of 6 ± 1 mm and a minimum pressure of 0.62-MPa.

4. Install backer rod as shown on the plans. Provide an expanded, closed-cell polyethylene foam backer rod that is compatible with the joint sealant so that no bond or adverse reaction occurs between the rod and sealant. Install backer rod when the temperature of the portland cement concrete pavement is above the dew point of the air and when the air temperature is 4°C or above. Install backer rod when the joints to be sealed have been properly patched, cleaned and dried. Do not use a method of placing backer rod that leave a residue or film on the joint walls.
5. Immediately after placement of the backer rod, place the joint sealant in the clean, dry, prepared joints as shown on the plans. Apply the joint sealant by a mechanical device with a nozzle shaped to fit inside the joint to introduce the sealant from inside the joint. Apply adequate pressure to the sealant to ensure that the sealant material is extruded evenly and that full continuous contact is made with the joint walls. After application of the sealant recess the surface of the sealant as shown on the plans.
6. Any failure of the joint material in either adhesion or cohesion of the material will be cause for rejection of the joint. Conform the finished surface of joint sealant to the dimensions and allowable tolerances shown on the plans. Rejected joint materials or joint material whose finished surface does not conform to the dimensions shown on the plans shall be repaired or replaced, at the Contractor's expense, with joint material that conforms to the requirements.
7. After each joint is sealed, remove all surplus joint sealer on the pavement surface. Traffic shall not be permitted over the sealed joints until the sealant is tack free and set sufficiently to prevent embedment of roadway debris into the sealant.

B. Preformed Compression Joint Seal Installation

1. The compression seal alternative joint detail for transverse and longitudinal joints, as shown on the plans, shall apply only to weakened plane joints. Construct weakened plane joints by the sawing method. Should grinding or grooving be required over or adjacent to any joint after the compression seal has been placed, completely remove the joint materials and disposed of, and replace at the Contractor's expense. Compression seal shall be recessed below the final finished surface as shown on the plans.
2. At the Contractor's option, transverse weakened plane joints shall be either Type DSC or Type SSC as shown on the plans. Longitudinal weakened plane joints shall be Type SSC only as shown on the plans.
3. Seven days after the concrete pavement placement and not more than 4 hours before placing preformed compression joint seals, clean the joint walls by the dry sand blast method and other means as necessary to completely remove from the joint all objectionable material such as soil, asphalt, curing compound, paint and rust. After cleaning the joint, remove all traces of sand, dust and loose material from and near the joint for a distance along the pavement surfaces of at least 50 mm on each side of the joint by the use of a vacuum device. Remove surface

moisture at the joints by means of compressed air or moderate hot compressed air or other means. Do not use drying procedures that leave a residue or film on the joint wall. Sandblasting equipment shall have a maximum nozzle diameter size of 6 ± 1 mm and a minimum pressure of 0.62-MPa.

3.11 PROTECTING CONCRETE PAVEMENT

A. Conform to Section 40-1.12 of Caltrans Standard Specifications.

END OF SECTION 32 13 00

SECTION 32 17 23

PAVEMENT MARKINGS

PART 1 - GENERAL

1.1 WORK INCLUDED

A. General: The Contract General Conditions and Division 1, General Requirements, including, but not limited to, Summary of Work, Submittals and Cleaning, shall form a part of these Specifications with the same force and effect as though repeated herein. Work shall be done according to the Contract Documents and to the satisfaction of the Owner. That which is called for in one of the Contract Documents is binding as though called for in all.

B. Scope: The Work included under this Section consists of furnishing and/or paying for all fees and permits, all labor, tools, equipment, transportation and services required to complete all on and off site parking and traffic controls as required by the contract drawings and specifications, including, but not necessarily limited to the following:

1. Directional pavement markings.

2. Painted stall striping, including handicapped stencils.

3. Painted crosshatch on walkways.

2. Handicap signs as per code, installed.

5. Street name signs.

6. No parking signs.

7. Miscellaneous signs as required.

8. Wheel Stops

1.2 RELATED DOCUMENTS

A. None

1.3 REFERENCES

A. Caltrans Standard Specifications

1. Section 85 - Pavement Markers

2. Traffic Manual

PART 2 - PRODUCTS

2.1 MATERIALS

A. At locations shown on the plans, traffic stripes and pavement markings shall be painted with paint meeting the applicable State Standard Specifications for traffic line paint, and as required by the City of Livermore Standards.

B. Wheel Stops: Precast concrete.

PART 3 - EXECUTION

3.1 APPLICATION

A. Preparation of Surface: All dirt, oil, grease and other foreign matter shall be removed from the areas of the pavement to be painted with traffic paint.

1. Traffic paint shall not be applied to pavements which are excessively dirty, damp or cold. Traffic paint shall not be applied when temperature is less than 60º F, or when the pavement is wet or damp.

B. Paint Application: Traffic paint shall be applied with approved atomizing spray type striping machine. Where required, the paint striping machine shall be equipped with separate thermostatically controlled heating devices for paint and bead pots.

1. The machine shall be capable of applying paint whereby the lines and markings have clear-cut edges, true and smooth alignments and uniform thickness.

2. All completed lines and markings shall be clean and sharp as to dimensions. Ragged ends of segments, fogginess along the sides or objectionable dribbling of paint along the unpainted portions of the stripes will be not be permitted.

3. The Subcontractor shall exercise all reasonable precautions to protect the paint, as applied, during drying time and shall remove all objectionable tracking.

4. The finished paint shall have an opaque, well painted appearance with no black or other discoloration showing through.

C. Rate of Application: Traffic paint shall be applied at the following rates:

Parking Stripe Rate of Application /Square Feet Per Gallon

First Coat 150 square feet per gallon

D. Traffic Paint Removal

1. Traffic stripes and other pavement markings shall be removed by sand blasting only. Under no circumstances are traffic lines to be obliterated with black traffic paint.

2. When temporary traffic lines are to be painted for construction detours or for some other reason, the old lines, which do not apply, shall be entirely obliterated by sand blasting.

END OF SECTION

SECTION 328400 - PLANTING IRRIGATION

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. Backfill
2. Pipes and fittings
3. Pipe sleeves
4. Valves
5. Remote control valves
6. Miscellaneous piping specialties
7. Sprinklers and bubblers
8. Quick couplers
9. Drip irrigation
10. Controllers and enclosure
11. Electrical conduit, wiring, and water proof wire connectors
12. Boxes for valves and wiring
13. Marking and identification products
14. Maintenance period
15. Irrigation audit

1.3 DESCRIPTION OF WORK

A. Furnish all labor, materials, supplies, equipment, tools, and transportation, and perform all operations in connection with and reasonably incidental to the complete installation of the irrigation system, and guarantee/ warranty.

B. Connect electrical power supply and data lines to irrigation controller.

C. Testing of the irrigation system to assure proper operation. Programming of controller and set-up and testing of sensors.

D. All necessary parts that are required to complete, modify, repair, and restore either existing and/ or new irrigation system shall be furnished and installed. All new and existing systems shall meet industry standards and be in operating order at the completion of maintenance period.

E. Maintain and repair irrigation system as needed during maintenance period.

F. Related Sections:

1. Division 03 - Section "Cast-in-Place Concrete"
2. Division 31 - Section "Earth Moving"
3. Division 32 - Section "Portland Cement Concrete Paving"
4. Division 32 - Section "Planting"

1.4 SUBMITTALS

A. Materials list:

1. Contractor shall submit to Landscape Architect complete list of all irrigation system materials and processes proposed to be furnished and installed as part of contract. List shall be provided and approved by Landscape Architect before ordering irrigation system materials.
2. Submittals shall have the following information:
    a. The catalog cut sheets shall identify product from the most recent manufacturer's catalog or from manufacturer's web-site.
    b. The catalog cut sheets shall clearly indicate the manufacturer's name and item model number. The model number, specified options and specified size shall be clearly indicated on catalog cut sheets.
    c. Submittal format requirements:
        1) Title Sheet with job name, contractor's name, contractor address and telephone number, submittal date, and submittal number.
        2) Submittals shall be provided as one complete package for the project
        3) Submittal package shall be stapled or bound in such a way as to allow for disassembly for review processing. Submittal maybe sent as a single .pdf file and electronically transmitted.
        4) Submittal package shall have all pages numbered in the lower right hand corner.
    d. The Landscape Architect will allow no substitution without prior written acceptance.

e. The Landscape Architect will not review the submittal package unless provided in the format described above.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Store plastic piping protected from direct sunlight. Support to prevent sagging and bending. Keep pipes free from dirt and debris.

1.6 PROJECT CONDITIONS

A. Interruption of Existing Water Service: Do not interrupt water service to facilities occupied by Owner or others unless permitted under the following conditions and then, only after arranging to provide temporary water service according to requirements indicated:

1. Notify Owner no fewer than 7 days in advance of proposed interruption of water service.
2. Do not proceed with interruption of water service without Owner's written permission.

1.7 TESTS AND INSPECTIONS

A. The Contractor is responsible for notifying the Landscape Architect for site visits to review work as follows. Provide Landscape Architect 48 hours minimum notice to schedule these visits.

1. Pre-construction conference with general contractor, grading contractor, landscape contractor, and landscape architect.
2. Staking
   a. Set stakes to identify locations of proposed point of connection, backflow preventer, master valve and flow sensor assembly, controller, quick coupler, remote control valves, isolation valves, and mainline pipe.
3. Mainline Pressure/ Leak Test: After installation of mainline pipe, valves, and remote control valves.
   a. Perform test after welded plastic pipe joints have cured at least 24 hours, or longer if manufacturer of solvent cement requires.
   b. Leak Test procedures:
      1) Charge system slowly to avoid water hammer.
      2) Bleed system to remove air from pipes.
      3) Maintain pressure in mainline pipe for 24 hour duration
      4) Pressurize system to 125% of design pressure for one hour using hydraulic pump or other safe method.
      5) Visually inspect all parts of irrigation system while the system is pressurized.
      6) Repair any leaks found in mainline irrigation system.

4. Operational Test: After electrical circuitry has been energized, operate controllers and automatic control valves to confirm proper system operation.
    a. If operation test presents problems contractor shall contact a factory-authorized service representative to inspect, test, and adjust components, assemblies, and equipment installations, including connections.
5. Coverage Test: After completion of irrigation system a coverage test shall be performed to determine uniform and complete coverage of landscape area.
    a. 24 hours before test, run irrigation system at least once in all landscape planters.
    b. Landscape Architect shall review and approve all planters before plant material, bark mulch, gravel, or decomposed granite is installed.
6. Test and adjust controller and irrigation equipment. Replace damaged and malfunctioning irrigation components and equipment.
7. Irrigation Audit: Irrigation system is designed in accordance with the Model Water Efficient Landscape Ordinance (MWELO). Landscape and irrigation installation shall meet or exceed the MWELO, and shall pass an irrigation water audit.

1.8 PROJECT WARRANTY

A. Contractor to furnish and install all work free of defects in materials and workmanship for period of 1-year from start of Maintenance Period per Div. 32- Section "Planting". Contractor to warranty all work furnished in accordance to the drawings and specifications. Ordinary wear and tear, neglect from maintenance, abuse, and vandalism are exempt from the contractor warranty. Repair and replacement of defective work and material will be done by the contractor at no cost to the owner. Repairs and replacement shall be conducted within 48 hours of notification to contractor.

2. PRODUCTS

2.1 QUALITY ASSURANCE

A. Materials used in the system shall be new and free of flaws and defects of any type.

2.2 BACKFILL MATERIAL

A. Backfill shall be either screened on-site material or imported.

B. Backfill material shall be free of organic materials, large clods of earth or rocks larger than one (1) inch diameter, trash, construction debris, asphalt, or concrete.

C. Imported material shall be a clean loam soil.

2.3 PIPE AND FITTINGS

A. Comply with requirements in the drawing for applications of pipe and fitting materials, and for joining methods for specific services, service locations, and pipe sizes.

B. Use a dielectric union wherever a copper-based metal (copper, brass, bronze) is joined to an iron-based metal (iron, galvanized steel, stainless steel).

C. Assemblies calling for threaded pipe connections shall utilize PVC Schedule 80 nipples and PVC Schedule 80 threaded fittings.

D. Joint sealant: Use only Teflon-type tape pipe joint sealant on plastic threads. Use non-hardening, nontoxic pipe joint sealant formulated for use on water-carrying pipes on metal threaded connections.

E. PVC Pipe: ASTM D 1785, PVC 1120 compound, Class 315, schedule 40, schedule 80, with integral belled end. Pipe color: Purple.

1. PVC Socket Fittings: ASTM D 2466, Schedule 80.
2. PVC Threaded Fittings: ASTM D 2464, Schedule 80.
3. Use Schedule 40 and SCH 80, Type 1, PVC solvent weld fittings conforming to ASTM Standards D2466 and D1784. Use primer approved by the pipe manufacturer. Solvent cement to conform to ASTM Standard D2564.

F. PVC Threaded Nipples: PVC Schedule 80 nipples shall be extruded. PVC Schedule 80 nipples shall be made from NSF approved PVC compound conforming to ASTM D1784, Cell Classification 12454B.

G. Mainline detection tape:

1. Manufacturer: TChristy. Model# TA.DT.2.PRW. 5 mil (.005") thick tape w/aluminum foil core and polyethylene backing, 2" width, and shall say "Caution Reclaimed Water Line Buried Below".

2.4 IRRIGATION PIPE SLEEVE

A. Corrugated HDPE with dual wall construction for irrigation sleeves eight (8) inches and larger.

B. PVC schedule 40 for irrigation sleeves six (6) inches and smaller.

2.5 REMOTE CONTROL VALVES

A. Manufacturers: Refer to drawings for manufacturer, model, and size of remote control valves.

B. Remote control valve to be in normally closed position.

C. Remote control drip zone shall have forty (40) psi pressure regulator and a filter cartridge with a minimum of 120 mesh. Size valve, pressure regulator and filter for drip zone flow rate.

2.6 QUICK COUPLERS

A. Manufacturers: Refer to drawings for manufacturer, model, and size of quick coupler.

B. Coupler cap color: Purple.

C. Description: Factory-fabricated, bronze or brass, two-piece assembly. Include coupler water-seal valve; removable upper body with spring-loaded or weighted, locking rubber-covered cap; hose swivel with ASME B1.20.7, 3/4-11.5NH threads for garden hose on outlet; and operating key.

2.7 SPRINKLERS AND BUBBLERS

A. General Requirements: Designed for uniform coverage over entire spray area indicated at available water pressure.

B. Plastic, Pop-up Spray Sprinklers:

1. Refer to drawings for manufacturer, model, and size of pop-up spray sprinklers and bubblers.

2.8 DRIP IRRIGATION SYSTEM

A. Manufacturers: Refer to drawings for manufacturer, model, and size of drip irrigation system and associated components.

B. Drip Tubes with Inline Emitters:

1. Tubing: Flexible Polyethylene tubing.
2. Emitter spacing: 12", 18", or 24" on center as specified on drawings.
3. Emitters: Check valve and pressure compensation.

C. Fittings: Drip tubing fittings shall be per manufacturer's specifications.

D. Tubing color: Purple. Drip emitter cap color: Purple.

E. Filter Units: Plastic housing, with corrosion-resistant internal parts; of size and capacity required for devices downstream from unit.

F. Air Relief Valves: Plastic housing, with corrosion-resistant internal parts.

G. Vacuum Relief Valves: Plastic housing, with corrosion-resistant internal parts.

2.9 IDENTIFICATION PRODUCTS

A. Remote control valve tags:

1. Manufacturer: TChristy. Model# ID.MAX.P1.RC005. Plastic tag attached by nylon tie to valve, hot stamped lettering, tag color: Purple. Tag to identify valve based on drawings controller letter and valve numbering.

B. Backflow History Tag

1. Manufacturer: TChristy. Model# ID.BFHT.1. Plastic tag attached directly and permanently to backflow.

2.10 AUTOMATIC IRRIGATION CONTROLLERS

A. Manufacturer: Refer to drawings for manufacturer and model of automatic irrigation controller.

B. ET Sensor Manufacturer: Refer to drawings for manufacturer and model of ET sensor.

C. Remote control. Refer to drawings for manufacturer and model of hand held remote control.

D. Enclosure Manufacturer: Strong Box Model# SB-18SSW.

1. Stainless steel locking wall mount enclosure, 18" wide x 36" high x 12" deep.
2. Securely wall mount controller with anchor bolts.
3. Waterproof enclosure, with locking cover and matching keys; refer to drawings and manufacturer's grounding requirements.

E. Two Wire Cable

1. Controller to decoder wire use 14 gauge solid copper insulated wire, twisted together, loose tube-high density polyethylene jacket. Paige Electric Co., model P7354D.
2. Decoder to Solenoid wire use 14 gauge solid copper insulated wire, parallel wire held by webbing, in various color. Paige Electric Co., model ICD.
3. Where spliced wires are required, splices shall be housed in a grey plastic electric pull box.
4. Waterproof wire connector manufacturer: 3M Direct Bury Splice Kit. Model# DBR/Y-6.

2.11 CONDUIT

A. All conduit and fittings to be PVC schedule 40, color: grey.

B. Pull tape manufacturer: Fibertek, Inc. Model# WP1250.

1. Electrical pull tape to be 1/2" woven polyester tape with a minimum of 1250 pounds tensile strength and less than 0.10 coefficient of friction.
2. All pull tape to be continuous with out slicing or knots.
3. Provide couplers or bushings on cut pipe end to prevent damage to wires.

2.12 GROUNDING

A. Earth grounding for irrigation equipment shall meet or exceed article 250 of National Electrical Code (NEC) and be UL listed.

B. Grounding rod shall be minimum copper clad 5/8" diameter by 10 feet long.

C. OR Grounding plate

D. Bare Copper Wire shall be minimum 6 gauge soft-annealed uncoated wire.

E. Grounding rod connection to be exothermic weld or clamp.

1. Grounding rod clamp shall be brass and must securely attach grounding rod and wire.

F. Grounding to have a resistance of 25 ohms or less.

G. Back fill shall be highly conductive material. Where needed use electrical grounding backfill products like Powerfill by Loresco.

2.13 BOXES VALVES AND ELECTRICAL PULL

A. Electrical Pull Box:

1. Manufacturer: Carson. Body model# 910-10 and lid model# 910-4B. Bolt down kit, T-cover lid, body and lid color: grey.
2. Or equal

B. Remote Control Valve:

1. Manufacturer: Carson. Body model# 1220-12 and lid model# 1220-4B. Bolt down kit, T-cover lid, body and lid color: Purple.

C. Quick coupler:

1. Manufacturer: Rainbird. Body model# VB-STD. Bolt down kit, T-cover lid, body color: black and lid color: Purple.

D. Isolation Valve:

1. Manufacturer: Rainbird. Body model# VB-10RND. Bolt down kit, T-cover lid, body color: black and lid color: Purple.

E. Flush Valve:

1. Manufacturer: Rainbird. Body model# VB-10RND. Bolt down kit, T-cover lid, body color: black and lid color: Purple.

F. Air/ Vacuum Relief Valve:

1. Manufacturer: Rainbird. Body model# VB-7RND. T-cover lid, body color: black and lid color: Purple.

G. Subterranean Drip Emitter Box:

1. Manufacturer: Rainbird. Body model# SEB 7XB. T-cover lid, body color black and lid color: Purple.

H. Drain rock shall be 3/4" washed crushed rock.

I. Hardware cloth shall be galvanized 16 gauge 1/4" mesh.

J. Use valve box extension where needed to install boxes at proper height.

3. EXECUTION

3.1 GENERAL

A. Irrigation system shall meet all federal, state, and local codes, regulations and ordinances.

B. Verify all underground utilities by contacting Common Ground Alliance (C.G.A.) at 811 a minimum of 2 working days before any excavation work begins on site.

C. If contractor finds utilities on site that are not shown on plans, contractor shall contact Landscape Architect. Found utilities that cross irrigation lines shall be shown on Record Drawings.

D. Verify water pressure and available flow prior to construction. Notify Landscape Architect if water pressure or flow will prevent the irrigation system from functioning properly.

3.2 EARTHWORK

A. Excavating, trenching, and backfilling are specified in Division 31 - Section "Earth Moving."

B. Install warning tape directly above pressure piping, 12" below finished grades and above irrigation pipe.

3.3 PREPARATION

A. Set stakes to identify locations of proposed point of connection, backflow preventer, master valve and flow sensor assembly, controller, quick coupler, remote control valves, isolation valves, and mainline pipe. Contact Landscape Architect within 48 hours for approval before excavation.

3.4 WATER, ELECTRICAL, & COMMUNICATION CONNECTIONS

A. Water Supply

1. Contact the Owner a minimum of five (5) working days before beginning any work that will disrupt existing irrigation system.

B. Electrical Supply

1. Contractor is responsible for coordination of electrical supply connection to controller enclosure.
2. Electrical work shall be preformed by licensed electrical contractor. Material and workmanship for electrical service shall meet all federal, state, and local codes, regulations and ordinances.

C. Communication

1. Contractor is responsible for coordination of data line connection to controller enclosure.

3.5 PIPING INSTALLATION

A. Install piping free of sags and bends. Lay piping on solid sub-base, uniformly sloped without humps or depressions.

B. Install groups of pipes parallel to each other and with a minimum of 4" of separation. Pipes shall not lie on top of another pipe.

C. Install fittings for changes in direction and branch connections.

D. Install PVC piping in dry weather when temperature is above 40 deg F. Allow joints to cure at least 24 hours at temperatures above 40 deg F before testing.

E. Install piping in sleeves under parking lots, roadways, and sidewalks.

F. Remove all rough edges and burrs from PVC pipe by reaming cut ends. All irrigation pipe cuts shall be square. Remove all debris from pipe before installing.

G. PVC pipe shall not lie on top of another pipe. All pipe should have 4" separation between pipes.

H. Cap all pipe ends during construction to prevent debris from entering pipe.

I.Snake pipe in trench one (1) foot per every one hundred (100) feet for thermal expansion.

J. Mainline changes in depth and direction shall be done with 45 degree fittings.

3.6 JOINT CONSTRUCTION

A. Ream ends of pipes and tubes and remove burrs.

B. Threaded Joints: Thread pipe with tapered pipe threads according to ASME B1.20.1. Join pipe fittings and valves as follows:

1. Apply appropriate PTFE/ Teflon tape or thread compound to external pipe threads. Provide three wraps around male thread.
2. Tighten joints to hand tight, plus one turn with a strap wrench
3. Damaged Threads: Do not use pipe or pipe fittings with threads that are corroded or damaged. Do not use pipe sections that have cracked or open welds.

C. PVC Piping Solvent-Cemented Joints: Clean and dry joining surfaces. Join pipe and fittings according to the following:

1. Comply with ASTM F 402 for safe-handling practice of cleaners, primers, and solvent cements.
2. PVC P Piping: Join schedule number, ASTM D 1785, PVC pipe and PVC socket fittings according to ASTM D 2672
3. Allow 30 minute cure time for handling and 24 hours of cure time before allowing water in the pipe..

3.7 CONDUIT

A. Remove all rough edges or burrs from conduit pipe by reaming cut ends. All conduit cuts shall be square.

B. Install coupler or bushing on cut pipe ends.

C. All 2-wire cable shall be in PVC conduit.

3.8 SLEEVES

A. Install sleeve in all locations where irrigation pipe and controller wire cross beneath pavement or other hardscape elements.

B. Irrigation controller wire shall not share sleeve with 120 volt and higher voltage wire.

C. Contractor shall coordinate the installation of sleeves with other trades.

D. Sleeves shall have minimum of 25% void space. Contractor is responsible for sizing sleeve based on field conditions. Size sleeve based on conduit and irrigation pipe size.

3.9 BACKFILLING

A. Backfill shall be of approved screen material.

B. With the exception of center loading, irrigation trenches shall not be backfilled until completion and passing of tests.

C. Trench should be cleaned of debris before backfilling.

D. Backfill shall be compacted in 6" lifts using vibrating plate. Compaction of backfill shall be equal to adjacent undisturbed soil.

E. Contractor shall correct any settling with more backfill and compaction.

3.10 REMOTE CONTROL VALVES

A. Flush mainline before installing remote control valves

B. Install valves in landscape planter. Do not install valves in roadways or paved areas.

C. Group remote control valves and other valves whenever possible.

D. Install per drawings and manufacturer's specifications.

E. Install valve in valve box to provide proper operation and maintenance of valve.

F. First downstream fitting past valve shall be located min. 18" from valve.

3.11 SPRINKLER INSTALLATION

A. Install sprinklers after hydrostatic testing is completed.

B. Flush lateral pipe before installing sprinklers.

C. Set sprinklers perpendicular to finish grade.

D. Install sprinklers at manufacturer's recommended heights.

E. Locate part-circle sprinklers to maintain a minimum distance of 4 inches from walls and 2 inches from other boundaries unless otherwise indicated.

F. Adjust the radius and throw of each sprinkler for best performance. Minimum of 70% low quarter distribution uniformity (DULQ) of spray irrigation. Post-installation irrigation audit may be conducted to confirm (DULQ) of spray irrigation.

G. Install per drawings and manufacturer's specifications.

3.12 DRIP IRRIGATION

A. Flush lateral before installing drip tubing.

B. Install drip tubing on uniformly prepared bed. Drip tubing emitters should be offset to create a triangular spacing.

C. Install fitting for all 90 degree changes of direction in line.

D. Use 6" wire staples every three (3) feet to secure drip tubing.

E. Install air relief and vacuum relief valves in valve boxes, at highest point of landscape planter.

F. Install automatic flush and ball valves at drip exhaust header. Refer to drawings for location of flush valves.

G. The pressure at the end of the drip tubing should have a maximum of 20% drop in pressure from the beginning of the drip line.

H. Install per drawings and manufacturer's specifications.

3.13 AUTOMATIC IRRIGATION CONTROLLER

A. Equipment Pedestal Mounting: Install on 6" thick concrete pad. Refer to drawings for location.

1. Place and secure anchorage devices. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
2. Install anchor bolts for proper attachment to supported equipment.

3. Orient enclosure to provide access to controller.

B. Equipment Wall Mounting: Install wall mounted controller on building wall shown on plans and coordinated with building owner representative.

1. Place and secure anchorage devices. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.

2. Install anchor bolts for proper attachment to supported equipment.

3. Orient enclosure to provide access to controller.

C. Provide connection to electrical power supply and data line as required by controller.

D. All remote control valves, master valves, and flow sensors to be connected to controller.

E. Install all ET sensor, weather stations, and rain/ freeze sensor equipment. Contractor to program and fine tune controller to operate with sensor equipment during maintenance period. Fine tuning of schedule and ET sensor should be completed at the end of maintenance period.

F. Irrigation schedule shall not exceed water budget established for project. Water budget and irrigation schedule shown on plans.

G. Install per drawings and manufacturer's specifications.

3.14 FIELD QUALITY CONTROL

A. Contractor to make adjustments to irrigation components to provide optimum performance of system. Adjust irrigation components to prevent excessive watering onto paved surfaces, windows, and building walls.

B. Adjust sprinklers and devices, except those intended to be mounted aboveground, so they will be flush with, or not more than 1/2" above, finish grade or compacted mulch.

C. Any irrigation product will be considered defective if it does not pass tests and inspections.

D. Improperly installed equipment shall be reinstalled or replaced to meet Construction Documents.

3.15 CLEANING

A. Flush dirt and debris from piping before installing sprinklers and other devices.

B. Upon completion of work, remove all site machinery, tools, construction material, and any rubbish.

3.16 MAINTENANCE

A. Provide maintenance as per Division 32 - Section "Planting"

3.17 RECORD DRAWINGS

A. Prior to Pre-Maintenance Review, obtain from the Owner's Authorized Representative a reproducible copy of the Drawings. Using computer aided drafting, duplicate information contained on the Record Drawings maintained on site.

B. Label each sheet "Record Drawing".

C. Record pipe and wiring network alterations. Record work which is installed differently than shown on the construction drawings. Record accurate reference dimensions, measured from at least two permanent reference points, of each irrigation system valve, each backflow prevention device, each controller or control unit, each sleeve end, and other irrigation components enclosed within a valve box.

3.18 ITEMS FURNISHED TO OWNER

A. The following items to be furnished to the Owner by the contractor at the completion of the project:

1. Two (2) keys to the control and enclosure
2. Two (2) quick coupler keys and hose swivels
3. One (1) isolation valve opening key
4. One (1) hand held remote control for controller, if specified.
5. One (1) of each specialized tool used to adjust irrigation equipment
6. All manuals for irrigation equipment
7. One (1) copy of irrigation schedule
8. One (1) copy of the approved irrigation submittal.

3.19 CONTROLLER CHARTS

A. Prior to completion of the maintenance period, prepare a reduced copy of the as-built plans, with valve numbering/zones clearly highlighted at the reduced scale. The reduced plan shall be sized to fit flat within the controller, laminated in plastic, and placed in the controller.

3.20 IRRIGATION WATER AUDIT:

A. An irrigation audit is required, per AB 1881. Irrigation audit shall be conducted by a certified landscape irrigation auditor.

B. IRRIGATION DESIGN
As designed, the irrigation system is compliant with AB1881. The installation and tuning of the irrigation system shall also meet the requirements for a compliant irrigation audit.

C. AUDIT ATTENDEES
At a minimum the following people shall be in attendance at the time of the Irrigation Audit: A certified landscape irrigation auditor, an Owner's representative, a landscape contractor who is knowledgeable of the irrigation design and installation, and who has access to the irrigation controller, and tune or repair the irrigation system if necessary during the audit.

D. AUDIT PROCEDURE
Audit may only be performed after the completion of irrigation and landscape irrigation. No other irrigation water may be in use at time of irrigation audit. A project with spray irrigation cannot be audited when winds exceed 5 mph.

1. Inspection- Prior to start of audit, inspect and confirm installation meets design intent of irrigation drawings. Inspect irrigation controller installation and programmed schedule, and ET sensor.

2. Measurement- Measure static and dynamic pressure at irrigation point of connection.

3. Sample areas- Audit shall include a representative sample of each type of irrigation (spray, drip) on each type of hydrozone. Linking of irrigation stations is allowed.

4. Spray irrigation- Auditing of spray irrigation valves shall measure:
   a. Pressure at first and last spray head
   b. Flow rate of station
   c. Distribution uniformity

5. Drip irrigation- Auditing of drip irrigation valves shall measure:
   a. Pressure in drip line at supply and exhaust
   b. Flow rate of station.

END OF SECTION 328400

SECTION 329000

PLANTING

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. Provide all labor, material, equipment and services necessary to provide all landscape planting, complete in place, as shown and specified.

B. Section Includes:
1. Planting and landscape areas.

C. Subgrade Elevations
1. Excavation filling and grading required to establish elevations is shown on drawings. Coordinate all work with grading contractor in order to arrive at rough grades that will allow tolerance for topsoil in planting areas, soil amendments and ornamental mulch as required in other sections of this specification. Contractor to assume tolerance of rough grades established at +/- .1 feet (1 tenth of a foot).

D. Related Sections:
1. Division 01 Section "Tree and Plant Protection" for protection of existing trees and plant materials.
2. Division 31 Section "Site Clearing" for topsoil stripping and stockpiling.
3. Division 31 Section "Earth Moving" for excavation, filling and backfilling, and rough grading.
4. Division 32 Section "Planting Irrigation" for irrigation.
5. Division 33 Section "Subdrainage" for subsurface drainage.

1.3 SUBMITTALS

A. Informational submittals shall include but not be limited to the following:
1. Pesticides and herbicides: Include product label and manufacturer's application instructions specific to this Project.

2. Fertilizer: Chemical and percentage composition, and manufacturers or vendor's certified analysis.
3. Plant materials: Include botanical and common name, quantities, sizes, quality, and sources for all plant materials.
4. Submit other data substantiating that materials comply with specified requirements. Such certificates may be tags, labels, and/or manufacturers literature. All submittals shall be reviewed and accepted by Landscape Architect before contractor begins work.
5. Planting schedule: Submit proposed planting schedule at least two weeks prior to planting any materials, indicating dates for each type of landscape work during normal seasons for such work in areas of the site. Correlate with specified maintenance periods to provide maintenance from date of substantial completion. If dates need to be revised after acceptance of planting schedule, document reasons for delays and submit for acceptance.

B. Material submittals shall include but not be limited to the following:
1. Mulch: 1-pint in sealed labeled plastic bag.

1.4 SITE VISITS

A. The Contractor is responsible for notifying the Landscape Architect for site visits to review work as follows. Provide Landscape Architect 48 hours minimum notice to schedule these visits, unless otherwise indicated.
1. Pre-construction conference with general contractor, grading contractor, landscape contractor, and landscape architect, at project site. 7 days minimum notice. The purpose of this conference will include:
a. Review of Contractor's questions regarding project.
b. Review of administrative and inspection procedures that will occur during construction.
c. Review of Contractor's work schedule for project.
d. Tour, inspect, and discuss site conditions (if necessary).
2. Review of planting stock at nursery, or upon arrival on site.
3. Review of all landscape areas in preparation for planting.
a. All landscape areas have been cleaned of all construction debris, including gravel, concrete, concrete washout, cement plaster, paint, asphalt, etc.
b. Irrigation coverage.
4. Review of plant material locations.
a. The Landscape Architect may adjust locations of any plant materials prior to installation.
5. Punch list at substantial completion (prior to installation of bark mulch). 7 days minimum notice.
6. Final completion. Final review of entire project, including grading, irrigation, planting and completion of all punch list items (to begin Maintenance Period). 7 days minimum notice.
7. Final acceptance of project (at end of Maintenance Period). 7 days minimum notice.

a. Final application shall have been made to all landscape areas with slow-release maintenance fertilizer.

1.5 QUALITY ASSURANCE

A. Subcontract: Subcontract landscape work to a single firm specializing in commercial landscape installation.

B. Source Quality Control:
1. General: Comply with regulations applicable to shipping of landscape materials.
2. Analysis and Standards: All materials shall be of standard, approved and first-grade quality and shall be in prime condition when installed and accepted. Any commercially processed or packaged material shall be delivered to the site in the original unopened container bearing the manufacturer's guaranteed analysis. The Contractor shall supply the Landscape Architect with analytical data from an approved laboratory source illustrating compliance of bearing the manufacturer's guaranteed analysis of all supplied materials.

C. Trees, Shrubs and Plants: Provide trees, shrubs and plants of quantity, size, genus, species and variety shown and scheduled for landscape work and complying with recommendations and requirements of ANSI Z60.1-1980 "American Standard for Nursery Stock". Provide healthy, vigorous stock, grown in recognized nurseries in accordance with good horticultural practice and free of disease, insects, insect eggs, larvae and defects such as knots, sun-scald, injuries, abrasions, overlapping surface roots, or disfigurement. Central leaders of all trees shall be intact, undamaged, with evenly spaced lateral branches.

D. The contractor is responsible for ordering and reserving plant materials immediately upon bid award to ensure plant materials meet size and quality requirements as specified herein. Plant material of substandard size will be rejected.

E. Label at least one tree and one shrub of each variety in each grouping with a securely attached waterproof tag bearing legible designation of botanical and common name. Where formal arrangements and consecutive order of trees is shown, select stock for uniform height/spread, and label with number to assure symmetry in planting.

F. Stock review: The Landscape Architect will review all plant materials either at place of growth or at site before planting for compliance with requirements for genus, species, variety, size and quality. Landscape Architect retains right to further review trees and shrubs for size and condition of balls and root systems, insects, injuries and latent defects, and to reject unsatisfactory or defective material at any time during progress of the work. Remove rejected vegetation immediately from project site. Contractor shall request review of such stock by Landscape Architect by delivering notice in writing 48 hours in advance.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Packaged Materials: Deliver packaged materials in original, unopened containers showing weight, certified analysis, name and address of manufacturer, and indication of conformance with state and federal laws, as applicable. Protect materials from deterioration during delivery, and while stored on site.

B. Bulk Materials:
   1. Do not dump or store bulk materials near structures, utilities, walkways and pavements, or on existing turf areas or plants.
   2. Provide erosion-control measures to prevent erosion or displacement of bulk materials, discharge of soil-bearing water runoff, and airborne dust reaching adjacent properties, water conveyance systems, or walkways.
   3. Accompany each delivery of bulk fertilizers and soil amendments with appropriate certificates.

C. Trees: Do not prune prior to delivery. Do not bend or bind trees or shrubs in such manner as to damage bark, break branches or destroy natural shape. Provide protective covering during delivery, and provide protection on site from traffic, pedestrians, and deleterious effects of climate while planting operations are in progress. Dropped or damaged stock will not be accepted.

D. Deliver trees and shrubs after preparations for planting have been completed and plant immediately after approval of plant materials locations. If planting is delayed more than 6 hours after delivery, set trees and shrubs in shade, protect from weather and mechanical damage, and keep roots moist by covering with mulch, burlap or other acceptable means of retaining moisture. Do not remove container grown stock from containers.

E. Plant material shall not be stored on the jobsite for more than 48 hours before planting. Contractor shall schedule nursery deliveries in sub-groups as necessary to comply with this requirement. Plant materials that have been damaged in any way will be discarded and if installed, shall be replaced with undamaged materials at the Contractor's expense.

1.7 PROJECT CONDITIONS

A. Proceed with and complete landscape work as rapidly as portions of site become available, working within seasonal limitations for each kind of landscape work required.

B. Contractor shall verify locations of all existing utilities, whether shown on plans or not. The Contractor shall call 811 two (2) working days in advance of performing any excavation work.

C. After determining location of underground utilities, perform work in a manner which will avoid possible damage. Hand excavate, as required. Maintain grade stakes set by others until removal is mutually agreed upon by parties concerned.

D. Excavation: When conditions detrimental to plant growth are encountered, such as rubble fill, adverse drainage conditions, or obstructions, notify Landscape Architect before planting.

E. No landscape materials may be planted before an irrigation operation and coverage test is completed and approved by the Landscape Architect.

F. No landscape materials may be planted before finish grade is inspected and approved by the Landscape Architect.

G. Planting Time: Plant or install materials during normal planting seasons for each type of landscape work required.

H. Weather Limitations: Proceed with planting only when existing and forecasted weather conditions permit planting to be performed when beneficial and optimum results may be obtained. Apply products during favorable weather conditions according to manufacturer's written instructions.

1.8 SPECIAL PROJECT WARRANTY

A. Warranty all plant materials and other materials installed under the Contract for a period of one year (from beginning of maintenance period) against defects including death and unsatisfactory growth, or faulty performance, inferior materials and/or workmanship or improper maintenance resulting from neglect, abuse or damage by others, as determined by the Landscape Architect. Materials shall be replaced at the Contractor's expense.

B. Replacement: Any materials found to be dead, missing, or not in a satisfactory or healthy condition during the maintenance period shall be replaced immediately. The Landscape Architect shall be sole judge as to the condition of material. Material to be replaced within the guarantee period shall be replaced by the Contractor within five (5) days of written notification by the Landscape Architect. All replacement materials and installations shall comply to the Plans and Specifications. Any plant missing due to suspected theft shall be replaced by the Contractor. If the Contractor suspects that theft may be a problem, the Contractor shall provide written documentation to the Landscape Architect that security on this site needs to be intensified. The Contractor may relieve himself of theft responsibility if after the security notice, with no result, a written notice to the Landscape Architect shall be given that plant material will not be replaced for theft or vandalism due to lack of site security being maintained. This procedure may take place only during the Landscape Maintenance Period.

1.9 MAINTENANCE SERVICE

A. General: Provide full maintenance by skilled employees of landscape Installer. Maintain as required in Part 3.

B. Continuously maintain entire project area during the progress of the work and during the ninety (90) calendar day maintenance period until final acceptance of the project by the Landscape Architect.

C. Maintenance period shall not start until Final Completion, when all elements of construction, planting and irrigation for the entire project are in accordance with Plans and Specifications. A prime requirement is that all turf grass and landscape areas shall be planted, and that all turf grass areas shall show an even, healthy stand of grass seedlings and which shall have been mown twice. If such criteria are met to the satisfaction of the Landscape Architect, a written notification shall be issued to the Owner establishing the effective beginning date of maintenance period.

D. Any day of improper maintenance, as determined by the Landscape Architect, shall not be credited as an acceptable maintenance period day. The maintenance period shall be extended on a daily basis if the work is not in accordance to the Plans and Specifications. Project shall not be segmented into maintenance areas or phases, unless authorization of the Landscape Architect is obtained.

E. Maintenance shall continue beyond the ninety (90) day maintenance period, as required, until final acceptance is given by the Landscape Architect.

F. Contractor shall provide protection to the project site during the maintenance period.

PART 2 - PRODUCTS

2.1 GENERAL

A. The following organic amendments and fertilizers are to be used for bid price basis only. Specific amendments and fertilizers specification shall be made after rough grading operations are complete and soil samples are tested by the Contractor and approved by the Landscape Architect. The amounts listed in the Preparation section are considered minimum amounts for the project unless directed otherwise by the Landscape Architect.

2.2 MULCH

A. Mulch shall be walk-on shredded fir bark mulch.

B. Physical properties:

1.

Percent Passing	Sieve Size
90-100	1″ Dia.
80-100	½″ Dia.
20-60	¼″

C. Chemistry:
   1. Acid in reaction, max. pH 5.0
   2. Maximum ash Chemistry: 7% based on dry weight.
   3. Minimum moisture 35% at time of delivery based on fresh weight.

D. As available from:
   1. Redi-Grow Corporation
      8909 Elder Creek Road
      Sacramento, CA 95828
      OR
   2. Cascade Rock, Inc.
      8585 Kiefer Boulevard
      Sacramento, CA 95826-3990
      (916) 383-1300

2.3 HERBICIDES

A. General: Herbicide, registered and approved by EPA, acceptable to authorities having jurisdiction, and of type recommended by manufacturer for each specific problem and as required for project conditions and application. Do not use restricted herbicides unless authorized in writing by authorities having jurisdiction.

B. Pre-Emergent Herbicide (Selective and Non-Selective): Effective for controlling the germination or growth of weeds within planted areas at the soil level directly below the mulch layer.

C. Post-Emergent Herbicide (Selective and Non-Selective): Effective for controlling weed growth that has already germinated.
   1. Roundup (Glyphosate)
   2. Approved Equal

2.4 PLANT MATERIAL

A. General: Furnish nursery-grown plants true to genus, species, variety, cultivar, stem form, shearing, and other features shown Drawings and complying with ANSI Z60.1 and in accordance with California State Department of Agricultural regulations for nursery inspections, rules and ratings; and with healthy root systems. Provide well-shaped, fully branched, healthy, vigorous stock, densely foliated when in leaf and free of disease, pests, eggs, larvae, and defects such as knots, sun scald, injuries, abrasions, and disfigurement.
   1. Trees with damaged, crooked, or multiple leaders; tight vertical branches where bark is squeezed between two branches or between branch and trunk ("included bark"); crossing trunks; cut-off limbs more than 3/4 inch in diameter; or with stem girdling roots will be rejected.

2. Collected Stock: Do not use plants harvested from the wild, from native stands, from an established landscape planting, or not grown in a nursery unless otherwise indicated.
3. Plants of a larger size may be used if acceptable to Landscape Architect, with a proportionate increase in size of roots or balls.

B. Labeling: Label at least one plant of each variety, size, and caliper with a securely attached, waterproof tag bearing legible designation of common name and full scientific name, including genus and species. Include nomenclature for hybrid, variety, or cultivar, if applicable for the plant as shown on Drawings.

C. If formal arrangements or consecutive order of plants is shown on Drawings, select stock for uniform height and spread, and number the labels to assure symmetry in planting.

D. Provide single stem trees except where special forms are shown or listed.

PART 3 - EXECUTION

3.1 PREPARATION

A. Protect structures, utilities, sidewalks, pavements, and other facilities, trees, shrubs, and plantings from damage caused by planting operations.
1. Protect adjacent and adjoining areas from hydroseeding overspray.
2. Protect grade stakes set by others until directed to remove them.

B. Install erosion-control measures to prevent erosion or displacement of soils and discharge of soil-bearing water runoff or airborne dust to adjacent properties and walkways.

C. Before planting, obtain Landscape Architect's acceptance of finish grading; restore planting areas if eroded or otherwise disturbed after finish grading.

D. Obstructions: Notify Architect if unexpected rock or obstructions detrimental to trees or shrubs are encountered in excavations.

E. Drainage: Notify Architect if subsoil conditions evidence unexpected water seepage or retention in tree or shrub planting pits.

F. Fill excavations with water and allow to percolate away before positioning trees and shrubs.

3.2 PLANTING

A. After installation and before Substantial Completion, remove all nursery tags, tie tape, labels, wire, and other debris from plant material, planting areas, and project site.

3.3 MULCHING

A. Mulch all planting areas (except turf) to depth of 3".
   1. Do not place mulch within 3 inches of trunks or stems.

3.4 HERBICIDE APPLICATION

A. Apply herbicide and other chemical products and biological control agents in accordance with authorities having jurisdiction and manufacturer's written recommendations. Coordinate applications with Owner's operations and others in proximity to the Work. Notify Owner before each application is performed.

B. Post-Emergent Herbicides (Selective and Non-Selective): Apply only as necessary to treat already-germinated weeds and in accordance with manufacturer's written recommendations.

3.5 MAINTENANCE

A. Maintain plantings by pruning, cultivating, watering, weeding, fertilizing, mulching, adjusting and repairing tree-stabilization devices, resetting to proper grades or vertical position, and performing other operations as required to establish healthy, viable plantings. Spray or treat as required to keep trees and shrubs free of insects and disease.

B. Thoroughly water to insure vigorous and healthy growth until work is accepted. Water in a manner to prevent erosion due to application of excessive quantities of water.

C. Fill in as necessary soil subsidence that may occur because of settling or other processes. Replace mulch materials damaged or lost in areas of subsidence.

D. Weeding
   1. Keep plant basins and areas between plants free of weeds. Control weeds with pre-emergent herbicides. If weeds develop, use legally approved herbicides. Avoid frequent soil cultivation that destroys shallow roots. Weeding also shall be included in all paved areas including public or private sidewalks.
   2. Apply a final application of pre-emergent herbicide at the end of the Maintenance Period, just prior to final acceptance.

E. Pruning
   1. Trees: Prune trees to select and develop permanent scaffold branches; to eliminate narrow V-shaped branch forks that lack strength; to reduce toppling and wind damage by thinning out crowns; to maintain a natural appearance and to balance crown with roots. All trees shall be maintained and pruned in accordance with the accepted practices of the International Society of Aboriculture (ISA). Prune only as directed by the Landscape Architect.

2. Only skilled workers shall perform pruning work in accordance with standard horticultural pruning practices. Remove from the project all pruned branches and material. Remove and replace any plant material excessively pruned or malformed resulting from improper pruning practices at no additional costs to the owner.

F. Staking: Stakes shall remain in place through the guarantee period and shall be inspected and adjusted to prevent rubbing that causes bark wounds. Remove nursery stakes from all trees just prior to end of Maintenance Period, unless otherwise noted.

G. Apply treatments as required to keep plant materials, planted areas, and soils free of pests and pathogens or disease. Use integrated past management practices whenever possible to minimize the use of pesticides and reduce hazards. Treatments include physical controls such as hosing off foliage, mechanical controls such as traps, and biological control agents.

H. Fertilization: Fertilize all planting areas, just prior to end of maintenance period with slow release maintenance fertilizer at manufacturer's recommended rate.

I. IRRIGATION SYSTEM

1. System Observation: The Contractor shall check all systems for proper operation. Lateral lines shall be flushed out after removing the last sprinkler head or two at each end of the lateral. All heads are to be adjusted as necessary for unimpeded head to head coverage.
2. Controllers: Set and program automatic controllers for seasonal water requirements. Give the Owner's Representative instructions on how to turn off system in case of emergency.
3. Repairs: Repair all damages to irrigation system at the Contractor's expense. Repairs shall be made within twenty-four (24) hours.

3.6 CLEANUP AND PROTECTION

A. Promptly remove soil and debris from paved and vertical surfaces. Clean wheels of vehicles before leaving site to avoid tracking soil onto roads, walks, or other paved areas.

B. Erect temporary fencing, barricades and/or warning signs as required protecting newly planted areas from traffic. Maintain fencing and barricades throughout initial maintenance period and remove after plantings are established. Treat, repair, or replace damaged plantings.

C. Remove non-degradable erosion-control measures after grass establishment period.

D. During planting, keep adjacent paving and construction clean and work area in an orderly condition.

E. Trash: Remove trash weekly in all planted areas, pedestrian walkways and parking areas.

3.7 FINAL ACCEPTANCE

A. Work under this section will be accepted by the Landscape Architect upon satisfactory completion of all work (including maintenance). Upon final acceptance, and written notification, the Owner will assume responsibility for maintenance of the work.

END OF SECTION 329200

SECTION 33 05 16
UTILITY STRUCTURES

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Manhole structures for gravity storm drain and sanitary sewer utilities.

1.2 RELATED SECTIONS

A. Section 31 23 33 – Trenching and Backfilling.

B. Section 33 40 00 – Storm Drainage Utilities.

C. Section 32 05 23 – Cement and Concrete for Exterior Improvements.

1.3 RELATED DOCUMENTS

A. AASHTO:
   1. M 199: Precast Reinforced Concrete Manhole Sections.

B. ASTM:
   1. A 615/A615M: Deformed and Billet-Steel Bars for Concrete Reinforcement.
   2. C 478: Precast Reinforced Concrete Manhole Sections.
   3. C 1244: Test Method for Concrete Sewer Manholes by Negative Air Pressure (Vacuum) Test.

C. Caltrans Standard Specifications.
   1. Section 51, Concrete Structures.
   2. Section 75, Miscellaneous Metal.

D. California Building Code.
   1. Section 1172B – Exterior Routes of Travel.

1.4 DEFINITIONS

A. AASHTO: American Association of State Highway and Transportation Officials.

B. ASTM: American Society for Testing Materials.

1.5 SUBMITTALS

A. Follow submittal procedures outlined in Section 01 33 00 – Submittal Procedures.

B. Product data for the following:
   1. Cleanout plugs or caps.

C. Shop drawings: Include plans, elevations, details and attachments for the following:
   1. Precast concrete manholes, frames and covers.
   2. Precast concrete clean out boxes and box covers.

D. Design Mix Reports and Calculations: For each class of cast-in-place concrete.

E. Field Test Reports: Indicate and interpret test results for compliance with performance.

1.6 DELIVERY, STORAGE AND HANDLING

A. Handle precast concrete manholes according to manufacturer's written instructions.

B. Protect imported bedding and backfill material from contamination by other materials.

PART 2 - PRODUCTS

2.1 CLEANOUTS

A. Piping: Same as utility line if possible.

B. Top Cap: Threaded and of same material as piping if possible.

C. Box Size: As required to provide access and allow easy removal and reinstallation of cap.

D. Box Types:
1. Landscape Areas: Portland cement concrete box and box cover (bolt-down), light duty.
2. Traffic Areas: Portland cement concrete box and box cover or steel or cast iron cover, heavy duty, both box and cover (bolt down) to be rated for AASHTO H20 loading.

E. Box Cover Markings: “S.D.” for storm drain cleanouts, “S.S.” for sanitary sewer cleanouts, unless otherwise specified.

F. Available Manufacturers: Subject to compliance with requirements, box manufacturers offering products that may be incorporated into the Project include, but are not limited to the following:
1. Associated Concrete Products, Inc. (Santa Ana, California) (Tel. 714-557-7470).
2. Brooks Products Inc. (El Monte, California) (Tel. 818-443-3017).
3. Christy Concrete Products, Inc. (Fremont, California) (Tel. 800-486 7070).

2.2 UTILITY BOXES

A. Christy Utility Box Model N40

2.3 MANHOLES

A. General: Size, shape, configuration, depth, etc. of manhole and frame and cover shall be as indicated.

B. Portland Cement Concrete and Reinforcing:
1. Cast-In-Place Portion: Use Class A Concrete per Caltrans Standard Specification Section 90, and ASTM A615 Grade 60 reinforcing steel bars.
2. Precast Portion: ASTM C 478. Rate for AASHTO H20 loading in traffic areas.

C. Frames and Covers: As indicated and in accordance with Caltrans Standard Specification Section 75-1.02.

D. Steps: ASTM C 478 or AASHTO M 199. Manufacture from deformed, ½-inch steel reinforcement rod complying with ASTM A 615 and encased in polypropylene complying with ASTM D4101. Include pattern designed to prevent lateral slippage off step. Acceptable manufacturer is Hanson Concrete Products, (Milpitas, CA) (Tel 408-262-1091) or equal.

E. Force Main Piping Access Openings:
1. General: As indicated.

2.4 JOINT SEALANT FOR STRUCTURES AND MANHOLES

A. Mortar: Caltrans Standard Specification Section 51-1.135.
1. Use to seal around pipes at connections to structures and manholes. Also use to seal joints between precast sections of structures and manholes.

B. Gaskets: Preformed flexible rubber or plastic gasket.

1. Rubber Gaskets: ASTM C443.
2. Plastic Gaskets: Federal Specification SS-S-00210 (GSA-FSS), Type I, Rope Form; or alternate standard which may exist. Acceptable material is “Ram-Nek,” as manufactured by the K. T. Snyder Company (Houston TX), or equal.

PART 3 - EXECUTION

3.1 CLEANOUT INSTALLATION

A. General: Install as indicated.

3.2 MANHOLE INSTALLATION

A. General: Install as indicated.

3.3 TESTING OF MANHOLES ON GRAVITY LINES

A. At the option of the Contractor, either the following hydrostatic or vacuum test shall be performed.

B. Hydrostatic Test:
1. Insert inflatable plugs in all sewer inlets and outlets.
2. Fill the manhole with water to a point six inches below the base of the manhole frame.
3. Maintain the water at this point for one hour to allow time for absorption.
4. Begin one-hour test period. Measure the amount of water added in one-hour period to maintain the water level at six inches below the base of the manhole frame. Do not allow water level to drop more than 25% of the manhole depth.
5. Determine the allowable leakage by the following formula.

   L=0.0002 x D X H 1/2

   L = Allowable leakage, gallons per minute.

   D = Depth of manhole from top to bottom, feet.

   H = Head of water in feet as measured from the surface of the water in the manhole to the sewer line invert or to the prevailing ground water surface outside the manhole. The lesser height governs.
6. If the leakage exceeds the allowable, determine the cause, take remedial action and re-test the manhole. If the leakage is less than the allowable and leaks are observed, repair the leaks.

C. Vacuum Test:
1. General: Test in accordance with ASTM C 1244.
2. Test prior to backfilling around the manhole.
3. Test Preparation: Plug all lift holes and pipes entering or exiting the manhole.
4. Place test head inside the top section of the manhole’s cone section and inflate in accordance with the manufacturers instructions.
5. Draw a vacuum of 10-inches of mercury and shut the pump off.
6. With the valve closed, the time for the vacuum to drop 9-inches shall be measured.
7. The manhole shall pass the test if the time is greater than 60 seconds for a 48-inch diameter manhole, 75 seconds for a 60-inch diameter manhole and 90 seconds for a 72-inch diameter manhole.
8. If the manhole fails the initial test, make necessary repairs with a non-shrink grout

while the vacuum is still being drawn. Retest until a satisfactory test is obtained.

END OF SECTION 33 05 16

SECTION 33 10 00
WATER UTILITIES

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Site water distribution system for domestic and fire protection services up to 5 feet of any on-site building being served.

B. Domestic water and fire protection water transmission or distribution system within a roadway or street right-of-way.

C. Furnishing and installation of cathodic protection on all buried iron-based metallic valves, flexible couplings, flanges, fittings or other appurtenances in non-metallic pipe lines. Furnish 316 stainless steel bolts, nuts, washers or other appurtenances as specified or required.

1.2 RELATED SECTIONS

A. Section 31 23 33 – Trenching and Backfilling.

B. Section 32 05 23 – Cement and Concrete for Exterior Improvements.

1.3 RELATED DOCUMENTS

A. ASTM:
1. A 536: Specification for Ductile Iron Castings.
2. B 88: Specifications for Seamless Copper Water Tube
3. D 2564: Specifications for Solvent Cements for Poly (Vinyl Chloride) (PVC) Plastic Piping Systems.

B. AWWA:
1. C104: Cement Mortar Lining for Ductile-Iron Pipe and Fittings for Water.
2. C105: Polyethylene Encasement for Ductile-Iron Pipe Systems
3. C110: Ductile-Iron and Gray-Iron Fittings, 3 in. through 48 in. (76 mm Through 1,219 mm) for water.
4. C111: Rubber-Gasket Joints for Ductile-Iron Pressure Pipe and Fittings.
5. C115: Flanged Ductile-Iron Pipe with Ductile-Iron or Gray-Iron Threaded Flanges.
6. C150: Thickness Design of Ductile Iron Pipe
7. C151: Ductile-Iron Pipe, Centrifugally Cast, for Water.
8. C509: Resilient-Seated Gate Valves for Water Supply Services
9. C510: Double Check Valve Backflow-Prevention Assembly
10. C511: Reduced-Pressure Principle Backflow-Prevention Assembly
11. C605: Underground Installation of Polyvinyl Chloride (PVC) Pressure Pipe and Fittings
12. C651: Disinfecting Water Mains
13. C800: Underground Service Line Valves and Fittings
14. C900: Polyvinyl Chloride (PVC) Pressure Pipe and Fabricated Fittings, 4 in. Through 12 in. (100mm Through 300mm) for Water Distribution
15. C901: Polyethylene (PE) Pressure Pipe and Fittings, smaller than 4 in. for Water Distribution.
16. M23: PVC Pipe – Design and Installation
17. M41: Ductile Iron Pipe and Fittings

C. Caltrans Standard Specifications:

1. Section 70. Miscellaneous Facilities.
2. Section 72, Slope Protection.

D. California Building Code:
1. Section 1806A.11 – Pipes and Trenches.
2. Section 1133B.7.2 – Gratings.

E. California Plumbing Code.

1.4 DEFINITIONS

A. AASHTO: American Association of State Highway and Transportation Officials.

B. ASTM: American Society for Testing Materials.

C. AWWA: American Water Works Association.

D. DIP: Ductile iron pipe.

E. NPS: Nominal pipe size.

F. PVC: Polyvinyl chloride.

G. FM: Factory Mutual

H. NFPA: National Fire Protection Association

I. NSF: National Sanitation Foundation

J. UL: Underwriters Laboratory

1.5 SUBMITTALS

A. Follow submittal procedures outlined in Section 01 33 00 – Submittal Procedures.

B. Product Data Shop Drawings, Etc.: For the following:
1. Piping materials and fittings.
2. Special pipe couplings.
3. Flexible Pipe Fittings
4. Restrained Pipe Fittings
5. High Deflection Fittings/Ball Joints
6. Expansion Joints
7. Flexible Expansion Joints
8. Gate Valves
9. Butterfly Valves
10. Check Valves
11. Air and Vacuum Relief Valves
12. Blow-Off Valves
13. Pressure Reducing Valves
14. Pressure Sustaining Valves
15. Ball Valves
16. Fire Hydrants
17. Post Indicator Valves
18. Fire Department Connection
19. Backflow Preventers
20. Precast Valves Boxes and Box Covers
21. Anodes
22. Wire Identifiers
23. Exothermic Welds
24. Weld Caps
25. Test Station Housing

26. Variable Resistors
27. Coating Manufacturers Approved Repair Material
28. Anode Schedule – Listing Pipe Station Number with the Type and Size, 30 Pound Minimum, to be installed at each valve or fitting installation

C. Design Mix Reports and Calculations: For each class of cast in place concrete.

D. Field Test Reports: Indicate and interpret test results for compliance with performance.

1.6 QUALITY ASSURANCE

A. Comply with requirements of utility supplying water. Do not operate existing valves or tap existing piping without written permission and/or presence of utility company representative.

B. Comply with the following requirements and standards:
1. NSF 61: “Drinking Water System Components-Health Effects” for materials for potable water.
2. NFPA 24: “Installation of Private Fire Service Mains and Their Appurtenances” for materials, installations, tests, flushing, and valve and hydrant supervision.
3. NFPA 70: “National Electric Code” for electrical connections between wiring and electrically operated devices.

C. Provide listing/approval stamp, label, or other marking on piping and specialties made to a specified standard.

D. Preconstruction Requirements: The Contractor shall be required to attend a preconstruction meeting prior to commencing work on the project. The date and location of the preconstruction meeting shall be established after the award of the contract. The purpose of the preconstruction meeting is for contractor personnel and their representatives to establish protocol for notification of testing and test acceptance. The contract requirements for corrosion control shall also be reviewed at this meeting.

E. Testing of Cathodic Protection: All anodes locations shall be tested prior to backfill by the Contractor. Any deficiencies shall be corrected by the Contractor at no additional cost. The contractor shall not backfill, enclose or otherwise cover up any of the cathodic protection materials prior to inspection and/or testing. Should any of the work be backfilled, enclosed or covered up, the Contractor shall, at his own expense, expose such work for such inspection and/or testing. Final Testing of the system shall be after backfill. Final shall be performed by an independent testing firm under the direction of a licensed corrosion engineer. Upon completion of tests, a detailed report shall be submitted to the Owner describing any deficiencies detected. Criteria for acceptance of the cathodic protection system are defined in the National Association of Corrosion Engineers Publication RP-01-69. Any deficiencies shall be corrected by the Contractor at no additional cost.

F. Testing of Joint Bonds: The joint bond shall be inspected for continuity prior to inspection and/or testing. Any deficiencies found shall be corrected by the Contractor at no extra cost. Should any of the work be backfilled, enclosed or covered up the Contractor shall, at his own expense, expose such work for such inspection and/or testing.

G. Testing of Insulating Flanged Joints: After installation and prior to backfill, the insulating flanges shall be tested for effectiveness. The Contractor shall not backfill or cover flanges prior to inspection. Upon completion of test, any and all deficiencies shall be corrected by the Contractor and retested by the Inspector prior to final acceptance.

1.7 DELIVERY, STORAGE AND HANDLING

A. Preparation for Transport: Prepare Valves, including fire hydrants, according to the following:
   1. Ensure that valves are dry and internally protected against rust and corrosion.
   2. Protect valves against damage to threaded ends and flange faces.
   3. Set Valves in best position for handling. Set Valves closed to prevent rattling.

B. Deliver piping with factory-applied end-caps. Maintain end-caps through shipping, storage and handling to prevent pipe end damage and to prevent entrance of dirt, debris and moisture.

C. Handling: Use slings to handle valves and fire hydrants whose size requires handling by crane or lift. Rig valves to avoid damage to exposed parts. Do not use handwheels or stems as lifting or rigging points.

D. During Storage: Use precautions for valves, including fire hydrants according to the following:
   1. Do not remove end protectors, unless necessary for inspection, then reinstall for storage.
   2. Protection from Weather: Store indoors and maintain temperature higher than ambient dew-point temperature. Store indoors and maintain temperature higher than ambient dew point temperature. Support off the round or pavement in watertight enclosures when outdoor storage is necessary.

E. Do not store plastic structures, pipe and fittings in direct sunlight.

F. Protect pipe, fittings, and seals from dirt and damage.

G. Handle precast concrete pipe and other precast structures according to manufacturer's written instructions.

H. Protect imported bedding and backfill material from contamination by other materials.

1.8 COORDINATION

A. Coordinate connection to existing water mains with water utility supplying water.

B. Coordinate piping materials, sizes, entry locations, and pressure requirements with building domestic water distribution piping and fire protection piping.

PART 2 - PRODUCTS

2.1 SMALL-SIZE SERVICE PIPES

A. High Density Polyethylene Pipe (HDPE) PE3408 Pipe: Sizes 1/8-inch through 3 inch
   1. Pipe shall be Pressure Class 200, DR 9 conforming to AWWA C901. J-M Manufacturing PIPE or approved equivalent.
   2. Pipe and Fittings: AWWA C901
   3. Fittings and Couplings: Fusion Welded, Injection molded.
   4. Installers of polyethylene pipe and fittings shall be in compliance with the regulations of the department of Transportation, Materials Transportation Bureau, contained in the code of Federal Regulations Title 49, part 192, Section 192-285.

B. Copper (CU): Provide Type K soft or hard copper pipe conforming to ASTM B88.

C. Recycled/Reclaimed/Non-Potable water piping shall be purple.

2.2 LARGER-SIZE SERVICE AND DISTRIBUTION PIPES

A. PVC Pipe: Sizes 4-inch through 48-inch
   1. Pipe:
      a. 4-inch through 12-inch: AWWA C900
      b. 14-inch through 48-inch: AWWA C905
   2. Restrained Joints:
      a. Plain End PVC to DI Mechanical Joint: Ebaa Iron (Eastland, TX) (Tel. 800-433-1716) or approved equal.
      b. Restrained Joints for PVC shall be internal to avoid buried metallic surfaces such as Eagle loc 900 or Diamond Lok 21
   3. Steel or Ductile Iron Couplings:
      a. Plain End Pipe to Plain End Pipe: Ductile iron or steel bolted couplings, manufacturer's shop coating with low alloy steel bolts and nuts. Steel Couplings to conform to AWWA C219. Smith-Blair, Inc, (Texarkana, AR) (Tel. 501-773-5127), Dresser (Bradford, PA) (Tel. 814-368-31-31) or approved equal.
   4. PVC Couplings
      a. Unrestrained Plain End to Plain End Pipe: AWWA C900, as manufactured by CertainTeed (Valley Forge, PA) (Tel. 610 341-6820) or approved equal.
      b. Restrained Plain End to Plain End Pipe: AWWA C900, "Certa-Lock" as manufactured by CertainTeed (Valley Forge, PA) (Tel. 610 341-6820) or approved equal.

   5. Recycled/Reclaimed/Non-Potable water piping shall be purple

2.3 GATE VALVES

A. Provide on lines 10-inch and smaller

B. Valves, 3-Inch through 20-Inch: AWWA C509, resilient-seated, non-rising stem, gray or ductile-iron body and bonnet, with bronze or gray or ductile-iron gate, bronze stem and square stem operating nut unless noted otherwise. All bolts, nuts and washers, except operating nut, shall be stainless steel. Stem operating nut to be 2-inches square and open counter-clockwise. Stem extensions shall be installed to bring the stem operating nut to within 2-feet of finish grade where the depth from finish grade to the stem operating nut exceeds 4-feet. Equipment valves in pump stations and other interior or vault installations with hand-wheels. Provide protective epoxy interior and exterior coating according to AWWA C550 and manufacturer's recommendations.

C. Service Line Valves and Fittings, 2-inch and Smaller: AWWA C800.

D. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Project include, but are not limited to, the following:
   1. Mueller Company (Decatur, IL) (Tel. 800-423-1323)
   2. M&H Valve Company (Anniston, AL) (Tel. 205-237-3521)
   3. Crane Company (New York, NY)

E. Valve Box and Cover: 9-inch minimum diameter PCC box with extensions of length required for depth of bury of valve, and cast iron or ductile iron cover with lettering "WATER". Both the box and the cover shall be rated for AASHTO H20 loading.

2.4 REDUCED PRESSURE PRINCIPLE BACKFLOW PREVENTER

A. Provide as indicated and as required by State or local agency.

B. General: AWWA C51, with OS gate valve on inlet and outlet and strainer on inlet. Include test cocks and pressure-differential relief valve with ASME A112.1.2 air gap

fitting located between 2 positive-seating check valves for continuous-pressure application.

C. Body:
   1. 2-Inch and Smaller: Bronze with threaded ends.
   2. 2-1/2-Inch and Larger: Bronze, Cast Iron Steel, or Stainless Steel with flanged ends.

D. Interior Lining: AWWA C550, epoxy coating for cast iron or steel bodies.

E. Interior Components: Corrosion-resistant materials.

F. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Project include, but are not limited to, the following:
   1. Cla-Val Company (Newort Beach, CA) (Tel. 714-548-2201)
   2. Ames Company (Woodland, CA) (Tel. 916-666-2493).
   3. Febco, CMB Industries, In. (Fresno, CA) (Tel. 559-252-0791)

G. Backflow stationary piping and fittings to be painted black. Moving parts shall NOT be painted.

2.5 DOUBLE CHECK DETECTOR ASSEMBLY

A. Backflow preventers on the fire water system shall be subject to approval by the local office of the Fire Marshal.

B. FM approved or UL listed, with OS&Y gate valves on inlet and outlet and strainer on inlet. Include two positive-seating check valves and test cocks, and bypass with displacement-type water meter, valves, and double-check backflow preventer, for continuous pressure application. Provide two shut off valves and four test cocks. DDCA shall be tamper-proof and conform to AWWA C510.

C. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the project include, but are not limited to, the following:
   1. Cla-Val Company (Newport Beach, CA) (Tel. 714-548-2201).
   2. Ames Company (Woodland, CA) (Tel 916-666-2493)
   3. Febco, CMB Industries, Inc. (Fresno, CA) (Tel. 559-252-0791)
   4. Hersey Products, Inc. (Dedham, MA) (Tel. 617-326-9400)

D. Backflow stationary piping to be painted black. Fittings to be painted red. Moving parts shall NOT be painted as it could result in delays.

2.6 WARNING TAPE

A. General: Non-detectable 3-inch warning tape made of solid blue film with continuously printed black-letter message reading “CAUTION-WATER LINE BURIED BELOW.”

2.7 TRACER WIRE

A. General: Minimum #12 AWG stranded copper wire with blue THW, THWN or THHN rated insulation.

2.8 CATHODIC PROTECTION MANUFACTURERS

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering product, which may be incorporated in the work, include by are not limited to the following:
   1. Wire Identifiers:

a. Brady International – “Clip Sleeve Wire Markers”, or approved equal.

2. Exothermic Welds:
   a. Enrico Products Inc. – “Cadwell”
   b. Continental Industries – “Thermoweld”, or approved equal.
3. Weld Caps:
   a. Royston Laboratories Inc. – “Royston Handy Cap”
   b. Phillips Petroleum Co. – “Thermit Weld Cap”, or approved equal.
4. Fusion Bonded Epoxy Coating:
   a. Scotchkote No. 203, 3M Company Micorn 650, Michigan Chrome & Chemical Co., or approved equal.
5. Coating Repair Material:
   a. Coating Manufacturers Approved Repair Material
6. Test Station Housing:
   a. Brooks Products, Inc. – “Traffic Valve Box No. 1RT”
   b. Christy Concrete products, Inc. – “G5 Traffic Box”, or approved equal.
7. Variable Resisters:
   a. Ohmite Manufacturing Co. – “Dividohm Type 210”, or approved equal

2.9 CORROSION PROTECTION

A. Encase underground pipe and appurtenances in 4-mil, high-density cross-laminated (HDCL) polyethylene film or 8-mil linear low-density (LLD) polyethylene film in accordance with AWWA/ANSI C105/A21.5. U.S. Pipe, ACIPCO, or approved equivalent. Wrap shall be water tight. All bolts, restraining rods, etc. shall be coated with bituminous prior to encasement in polyethylene bag

2.10 CATHODIC PROTECTION PRODUCTS

A. Zinc Anodes: Anodes shall be high purity zinc anodes conforming to the compositional requirements of ASTM 8-418-80, Type 2, supplied with at least (15) feet of continuous No. 12 AWG solid copper wire, silver soldered to the steel or iron anode core. The wire insulation shall be Type TW. The zinc anode shall be prepackaged in a cloth bag containing a low-resistivity backfill consisting of 75% hydrant gypsum, 20% bentonite and 5% sodium sulfate.

B. Wires shall consist of solid copper of the gage size as shown on the Plans and as specified in these specifications. Wire sizes shall be based on American Wire Gage (AWG). Number 12 AWG is minimum.

C. Copper wire shall conform to the specifications of ASTM Designations: B3 and B4.

D. Insulation jacket shall be thermoplastic insulation per UL Standard 83 for Type TW, Conforming to ASTM D-2219, or cross linked polyethylene (HMW/PE) conforming to ASTM 0-1248 as shown on the plans and as specified in these specifications.

E. All wire terminating at a test station shall have a wire identifier attached within 4 inches of end of wire at terminal board, prior to backfill. Wire identifiers shall be the snap-on type with resistance to oils, solvents and mild acids. Identifier shall fully encircle the wire with imprinted alphanumeric characters for pipe and anode identification. Sleeve shall be either nylon or delrin and sized to fit the wire without slipping.

F. Exothermic welds shall be provided for cable-to-structure connection and made in strict accordance with the manufacturer’s recommendations. Connections shall be made at locations shown on plans. The shape and charge of the exothermic weld shall be chosen by the Contractor and shall be based on the following parameters: Pipe Material, Pipe Size, Wire Material, Number of Strands to be Welded, Orientation of Weld (I.E. Vertical or horizontal).

G. Packing shall be made where necessary to prevent leakage of molten weld metal.

H. Approved coating repair material shall be applied after exothermic welds have been completed and tested by the Engineer.

I. Test Station Housing where shown or required.

J. Terminal board material shall be 1/8-inch thick phenolic plastic and sized as shown on the plans and as specified in these specifications. Double nutted brass studs shall be installed on the terminal boards as shown on the plans and as specified in these specifications.

K. Shunts shall be calibrated 0.01 ohm manganin wire with a 6-amp capacity.

L. Variable resistors shall be vitreous enameled resistors on which a narrow strip shall be left uncovered to expose a portion of each turn. Contact to any wire in this strip shall be made by an embossed contact on the adjustable lug. The variable resistor shall have a full-rated resistance of 100 ohms and a maximum current rating of 0.34 amps.

M. Bolts, nuts and washers for the iron-based fittings and valves in non-metallic pipe shall be 316 type stainless steel.

PART 3 - EXECUTION

3.1 PIPE INSTALLATION

A. General: Install pipe, fittings, and appurtenances utilizing best practices, manufacturer's instructions, and in accordance with the following:
   1. PVC Pipe: AWWA M23 and AWWA C605

B. Pipe Depth and Trench Configuration: Conform to elevations, profiles, and typical trench section(s) indicated.

C. Excavation, Bedding, Backfill, and Compaction: Section 31 23 33 – Trenching and Backfilling.

D. Handling: Carefully handle during loading, hauling, unloading and placing operations to avoid breakage or damage. Use Strap type slings for lifting and placing; no chains or hooks will be permitted. Comply with manufacturer's recommendations.

E. Laying: Before lowering pipe into the trench, remove all stakes, debris, loose rock and other hard materials from the bottom of the trench. Lay accurately in conformance with lines and grades indicated. Lay pipe on a bed of bedding material specified and prepared by handwork, dug true to grade. Furnish firm bearing for pipe throughout its entire length with bell holes provided at the end of each pipe length of sufficient size to permit making up the particular type of joint being used. Adjust pipe to line and grade by scraping away or filling and tamping material under the body of the pipe for the entire pipe length and not by blocking or wedging. After final positioning, hold pipe in place in trench with backfill material placed equally on both sides of the pipe at as many locations as required to hold the pipe section in place.

F. Curved Alignment: When necessary to conform to the alignment specifically indicated, lay pipe on a curved alignment by means of asymmetrical closure of joints or bending of the pipe barrel. If necessary, use shorter than the standard lengths of pipe to achieve curvature specified. Do not exceed the recommendations of the pipe manufacture for deflections at the joints or pipe bending.

G. Closure: Close open ends of pipes and appurtenance openings at the end of each days work or when work is not in progress.

3.2 CONNECTING TO EXISTING MAINS

A. Pressure Tap Connections: Perform in accordance with the requirements of the owner of the system being tapped. Maintain a positive pressure flow from the main being tapped to the tapping device to flush plastic chips, metal ribbons, etc. into the tapping devise and not into the pipe being tapped.

B. Other Connections: As indicated and in accordance with the requirements of the owner of the line being connect to.

3.3 ANCHORAGE INSTALLATION

A. Mechanically Restrained Joints: Install where indicated for lengths indicated in accordance with manufacturer's instructions.

B. PCC Thrust Blocks: Install where required and as indicated. Bearing area indicated is to be against undisturbed earth. Allow a minimum of 24-hours curing time before introducing water into the pipeline and allow a minimum of 7 days curing time before pressure testing.

3.4 VALVE INSTALLATION

A. Install all valves in accordance with the manufacturer's instructions and the following:
   1. General:
      a. Gate Valves: Appendix A of AWWA C509
   2. Joints:
      a. Valves on DI, PE and PVC Pipe: Mechanical Joint Valves for buried locations. Flanged-end valves for installation in vaults/pits
      b. Valves on Steel Pipe: As indicated for buried locations. Flanged-end valves for installation in vaults/pits.

3.5 SERVICE CONNECTIONS INSTALLATION

A. Install as indicated and in accordance with the requirements of the owner of the system.

3.6 WATER METER INSTALLATION

A. Install as indicated and in accordance with the requirements of the owner of the system.

3.7 REDUCED PRESSURE PRINCIPLE BACKFLOW PREVENTER INSTALLATION

A. Install as indicated and in accordance with the requirements of the owner of the system and the local health department requirements.

3.8 DOUBLE CHECK DETECTOR ASSEMBLY INSTALLATION

A. Install as indicated and in accordance with the requirements of the owner of the system and the fire department.

3.9 TRACER WIRE INSTALLATION

A. Install on trench bottom under the vertical projection of the pipe to protect it in all installations.

B. Form a mechanically and electrically continuous line through the pipeline, extending to the nearest valve or other pipeline appurtenance designated by the owner of the system or the Owner. Extend the wire up the outside of the valve box/riser and cut a

hole that is 8-inches from the top, extend a 12-inch wire lead to the inside of the box. At other pipeline appurtenances, designated by the owner of the system or the Owner, terminate the 12-inch wire lead inside the enclosure.

C. Splice wire with a splicing device consisting of and electro-tin plated seamless copper sleeve conductor. Install as recommended by the manufacturer. Wrap splices and damaged insulation with electrician's tape.

3.10 WARNING TAPE INSTALLATION

A. Install tape approximately 1-foot above and along the centerline of the pipe.

B. Where tape is not continuous, lap tape ends a minimum of 2-feet.

3.11 HYDROSTATIC PRESSURE AND LEAKAGE TEST

A. General:
1. Provide all necessary materials and equipment, including water.
2. Backfill all trenches sufficient to hold pipe firmly in position.
3. Allow time for thrust bocks to cure prior to testing.
4. Flush all pipe prior to testing to remove all foreign material.
5. Perform pressure and leakage test concurrently
6. Test Pressure: See Subsection titled "System Performance Requirements."
7. Apply test pressure by means of a pump connected to the pipe.
8. Base test pressure on the elevation of the lowest point in the line.
9. Fill each closed valve section or bulk-headed section slowly. Expel air from section being tested by means of permanent air vents installed at high points or by means of temporary corporation cocks installed at such points. Remove and plug the temporary corporation cocks at the conclusion of the test.
10. Allow water to stand in the pipe for 24 hours before test pressure is applied
11. Allow the system to stabilize at the test pressure before conducting the leakage test.
12. Do not operate valves in either the opening or closing direction at differential pressures above the valves rated pressure.
13. Maintain test pressure as specified for type of pipe being tested.
14. Pressure Test: Examine any exposed pipe, fittings, valves, hydrants and joints during the test, if no leaks are observed the section of line has passed the pressure test. If leaks are observed, repair any damaged or defective pipe, fittings, valves, or hydrants and repeat the pressure test.
15. Leakage Test: Perform as specified hereafter for the type of pipe being installed

B. PVC Pipe Leakage Test: Perform in accordance with AWWA M23. Selected requirements of AWWA M23 are repeated as follows:
1. Maintain the test pressure, +/- 5 psi, for a minimum of two hours.
2. No piping will be accepted if the leakage is greater than that determined by the following formula:

$$L = (N \times D \times P^{1/2})/7{,}400$$

L = Allowable leakage, gallons per hour.

N = Number of joints in the length of the pipeline tested.

D = Nominal diameter of pipe, inches.

P = Average test pressure during the leakage test, pounds per square inch (gauge).

3.12 DISINFECTION

A. All New Pipelines shall be disinfected in accordance with one of the three methods specified in AWWA C651 and the following:
   1. Disinfect after pressure and leakage test have been performed and accepted
   2. The method used shall be at the Contractor's option, unless specified by the owner of the water system.
   3. Engage the services of a commercial testing laboratory, approved by the owner of the water system, to perform the bacteriological tests specified in Section 5.1 of AWWA C651. Direct the testing laboratory to send the original report of the bacteriological testing to the owner of the water system. Should the laboratory report show that any sample taken was not acceptable, repeat the sterilization process shall until a satisfactory sterilization is accomplished.
   4. Lawfully dispose of the chlorinated water.

3.13 CATHODIC PROTECTION OF PIPE, FITTINGS & VALVES

A. All cathodic protection shall be in conformance with geotechnical recommendations.

B. All direct buried ductile iron fittings installed on non-metallic piping shall be provided with a bituminous coating from the factory and encased in an 8-mil polyethylene bag in the field in accordance with AWWA Specification C-105. All bolts, restraining rods, etc. shall be coated with bituminous prior to encasement in polyethylene bag.

C. All metallic valves shall be coated from the factory (i.e. using powdered epoxy or equivalent type of coating system) and all bolts shall be coated with bitumastic in the field and the entire valve shall be encased in an 8-mil polyethylene bag in accordance with AWWA Specification C-105.

D. A sacrificial type of cathodic protection utilizing zinc anodes shall be installed to protect the valves and fittings. Cathodic protection shall be designed in accordance with NACE Standard SP0169-07 and applicable local standards and included with the contract documents to permit installation along with the pipeline.

E. Install sacrificial anodes or anodes, and test stations at all buried iron-based metallic valves, flexible couplings, flanges, fittings or other appurtenances. Anode size and locations shall be in accordance with the Plans.

3.14 SCHEUDLE OF ANODE SIZES

A. Required anode weight are as shown on the plans. Where multiple fittings are installed at one locations, they shall be bonded together across the joints, and the required anode weight shall be the combined weight required for the individual fittings. Where the fitting is a reduced fitting, the pipe size used in the table will be that of the largest outlet.

B. The minimum unpackaged anode weight is 30 pounds.

3.15 INSTALLATION OF CATHODIC PROTECTION

A. All buried metallic iron based valves and fittings shall have cathodic protection as specified herein.

B. Native soil, free of rocks and clods, shall be placed around the anode in six (6) inch lifts and tamped until well compacted. When compacted soil has been placed to the top of the anode, water shall be poured into the hole to saturate anode packing and

surrounding soil. Backfilling with native soil, compacted in six (6) inch lifts shall then continue to ground surface. Damage to the canvas bag enclosing anode and packing material, anode to wire connection, copper wire, or wire insulation will require replacement of the entire assembly. Plastic or paper bags shall be removed from the anode before lowering into hole. Anodes shall not be suspended by lead wire.

3.16 TEST STATIONS

A. Test station shall be installed at all anode, insulated joint locations and other locations as shown on the plans.
   1. Test stations shall be set level and flush with the top of curb or finish grade in paved areas. Where stations are to be installed in unpaved or landscaped areas, a concrete collar shall be provided to prevent settlement, at no additional expense.
   2. Wire Identifiers shall be placed on the wires prior to backfill.
   3. Wires buried in the ground shall be laid straight, without kinks, and shall have a minimum cover of twenty-four (24) inches. The bottom of the finished trench shall be free from stones, roots, or other materials which might injure the insulation of the conductors.
   4. Cable runs shall be continuous in length and free of joints or splices, unless otherwise specified or shown on the Plans. Care shall be used during installation to avoid punctures, cuts and similar damage to insulation. Any damage to insulation will require replacement of entire cable length.
   5. Wire slack of at least one (1) foot shall be left for each conductor at each test station housing. Slack shall be that amount of wire which, when the cover is removed and the wire extended, protrudes beyond the opening of the box or enclosure. No wire bend shall have a radius of less than eight (8) times the diameter of that wire. Copper terminal rings sized for wire and stud shall be used to make all wire connection to terminal studs.

3.17 EXOTHERMIC WELD CONNECTIONS

A. Exothermic weld connections shall be installed in the manner and at the locations shown on the Plans and specified in these specifications, Coating materials shall be removed from the surface over an area just sufficient to make the connection. The steel surface shall be cleaned to white metal b grinding or filing prior to welding the conductor. Resin impregnated grinding wheels will not be allowed. The conductor shall be welded to the pipe by the exothermic process with a copper sleeve fitted over the conductor and only enough insulation shall be removed from the conductor to allow placing in welding mold. After the weld has cooled, all slag and the metallurgical bond shall be treated for adherence to the substrate. Several hammer blows are sufficient to remove slag and test adherence. All defective welds shall be removed and replaced. All exposed surfaces of copper and steel shall be covered with insulating materials as shown on the drawing. After the adherence of the bond to the substrate has been checked and verified for mechanical integrity, the bonding cable shall be fastened to the pipe 3 inches from the end of each bond. Fastening will be achieved by binding the cable to the pipe with a 5/8-inch wide nylon strip and buckle assembly. No connections to the structures or piping shall be buried until inspected and approved by the inspector. Connections made in violation of this provision shall be rejected.
   1. Coating of Welds: The Contractor shall furnish all materials, clean surfaces and apply protective lining and coating in accordance with the specifications. The coating shall be applied to all exposed metal on pipe and conductor at exothermic weld locations. Coating shall be the coating manufacturer’s approved repair and shall be covered with a plastic weld cap. Before application of the approved repair

material, all surfaces must be dry and free of oil, dirt, loose particles and other foreign matter.

2. All oil and grease, if present, shall be removed from steel surfaces to be painted by the use of cleaning solvent and clean, lint-free wiping material. Cleaning solvent shall be as recommended by the coating manufacturer or, if none is recommended, xylene shall be used. Cleaning cloths and solvents shall be discarded before they become contaminated to the extent that a greasy film would remain on the surface being cleaned.
3. Joint bonds shall be provided on all buried iron based metallic pipe to and across all buried flexible couplings, mechanical joints, flanged joints and any joint not welded or threaded and elsewhere as indicated on the plans to provide electrical continuity. Bond wires shall not be placed across insulated joints. The length of the joint bonding wire shall be a minimum of 18 inches in length and shall be sufficient to provide flexibility of the pipe joint.

3.18 INSULATING FLANGED JOINTS

A. Dielectric insulation flange kits shall be provided in the sizes and quantities as shown on the Plans and as specified in these specifications. Bolt sleeves shall be full-face type with elastomeric o-rings made of neoprene or viton rubber. Insulating washers shall be constructed of fabric reinforced phenolic. The assembly shall have an ANSI pressure rating equal to that of the flanges.

1. Flange insulating kits are to be installed at all new tie-in connections to existing lines, to isolate the new line from the existing line and all other locations as shown on the plans and as specified in these specifications. Flange gaskets, washers and bolt sleeves are to be installed per manufacturer's direction.
2. Insulation flange kits shall provide one side insulation. The cathodically protected side shall not have an insulating washer for the bolt, instead it shall have a serrated steel washer. The side connected to the existing main shall have insulating washers but not serrated steel washers.
3. After installation and prior to backfill, the insulating flanges shall be tested by the inspector for effectiveness. The Contractor shall not backfill or cover flanges prior to inspection. Upon completion of test, any and all deficiencies shall be corrected by the Contractor and retested bythe inspector prior to final acceptance.

END OF SECTION

SECTION 33 30 00

SANITARY SEWERAGE UTILITIES

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Roadway and/or site sanitary gravity sewers and force mains up to 5 feet of any on-site building.

1.2 RELATED SECTIONS

A. Section 31 23 33 – Trenching and Backfilling.

B. Section 32 05 23 – Cement and Concrete for Exterior Improvements.

C. Section 33 05 16 – Utility Structures.

1.3 RELATED DOCUMENTS

A. AASHTO:
   1. M 252: Corrugated Polyethylene Drainage Tubing.
   2. M 294: Corrugated Polyethylene Pipe, 12 to 24-inch Diameter.

B. ASTM:
   1. A 615/A615M: Deformed and Billet-Steel Bars for Concrete Reinforcement.
   2. A 674 Practice for Polyethylene Encasement for Ductile Iron Pipe for Water and Other Liquids.
   3. C 443: Joints for Circular Concrete Sewer and Culvert Pipe, Using Rubber Gaskets.
   4. C 1173: Flexible Transition Couplings for Underground Piping Systems.
   5. D 2321: Underground Installation of Thermoplastic Pipe for Sewers and Other Gravity Flow Applications.
   6. D 2564: Solvent Cements for Poly(Vinyl Chloride) (PVC) Plastic Piping Systems.
   7. D 3034: Type PSM Poly(Vinyl Chloride) (PVC) Sewer Pipe and Fittings.
   8. D 4101: Propylene Injection and Extrusion Materials.
   9. F 477: Elastomeric Seals (Gaskets) for Joining Plastic Pipe.
   10. F 656: Primers for Use in Solvent Cement Joints of Poly(Vinyl Chloride) (PVC) Plastic Pipe and Fittings.
   11. F 679: Poly(Vinyl Chloride) (PVC) Large Diameter Plastic Gravity Sewer Pipe and Fittings.
   12. F-1336: Poly(Vinyl Chloride) (PVC) Gasket Sewer Fittings.

C. AWWA:
   1. C104: Cement Mortar Lining for Ductile-Iron Pipe and Fittings for Water.
   2. C105: Polyethylene Encasement for Ductile-Iron Pipe Systems.
   3. C110: Ductile-Iron and Gray-Iron Fittings, 3 In. Through 48 In. (76 mm Through 1,219 mm) for Water.
   4. C111: Rubber-Gasket Joints for Ductile-Iron Pressure Pipe and Fittings.
   5. C150: Thickness design of Ductile Iron Pipe.
   6. C151: Ductile-Iron Pipe, Centrifugally Cast, for Water.
   7. C153: Ductile-Iron Compact Fittings for Water Service.
   8. M41: Ductile Iron Pipe and Fittings.

D. California Building Code.

E. Section 1806A.11 – Pipes and Trenches.

F. California Plumbing Code.

1.4 DEFINITIONS

A. AASHTO: American Association of State Highway and Transportation Officials.

B. ASTM: American Society for Testing Materials.

C. AWWA: American Water Works Association.

D. HDPE: High-density polyethylene.

E. PE: Polyethylene.

F. DIP: Ductile iron pipe.

G. PVC: Polyvinyl Chloride.

H. NPS: Nominal pipe size.

1.5 SUBMITTALS

A. Follow submittal procedures outlined in Section 01 33 00 – Submittal Procedures.

B. Product data for the following:
   1. Piping materials and fittings.
   2. Special pipe couplings.
   3. Joint sealants.
   4. Sewage air relief valves.

C. Shop drawings: Include plans, elevations, details and attachments for the following:
   1. Force main piping access openings.

D. Design Mix Reports and Calculations: For each class of cast-in-place concrete.

E. Field Test Reports: Indicate and interpret test results for compliance with performance.

1.6 DELIVERY, STORAGE AND HANDLING

A. Do not store plastic pipe and fittings in direct sunlight.

B. Protect pipe, fittings, and seals from dirt and damage.

C. Handle precast concrete pipe and other precast structures according to manufacturer's written instructions.

D. Protect imported bedding and backfill material from contamination by other materials.

PART 2 - PRODUCTS

2.1 PIPING MATERIALS FOR GRAVITY FLOW

A. PVC Pipe:
   1. Pipe:
      a. 4-inch through 15-inch: ASTM D 3034, SDR 26. Bell and spigot joints.
   2. Fittings:
      a. 4-inch through 27-inch: ASTM D 3034, SDR 26
   3. Joint Gasket: Elastomeric seal, ASTM F 477.

2.2 SPECIAL PIPE COUPLINGS

A. Gravity Piping: ASTM C 1173. Rubber or elastomeric sleeve and band assembly

fabricated to match outside diameters of pipes to be joined.

2.3 MANHOLES AND CLEANOUTS

A. See Section 33 05 16 – Utility Structures.

PART 3 - EXECUTION

3.1 GRAVITY PIPE INSTALLATION

A. General: Install pipe, fittings, and appurtenances utilizing best practices, manufacturer's instructions, and in accordance with Section 6 and 7 of ASTM D 2321 for plastic pipe, Caltrans Standard Specification Section 65-1.07 for reinforced concrete pipe and chapter 11.3.3 of AWWA M41 for ductile iron pipe.

B. Pipe Depth and Trench Configuration: Conform to typical trench section(s) indicated.

C. Excavation, Bedding, Backfill, and Compaction: Section 31 23 33 – Trenching and Backfilling.

D. Handling: Carefully handle during loading, hauling, unloading and placing operations to avoid breakage or damage. Use strap type slings for lifting and placing; no chains or hooks will be permitted. Comply with the manufacturer's recommendations.

E. Laying: Before lowering pipe into the trench, remove all stakes, debris, loose rock and other hard materials from the bottom of the trench. Lay accurately in conformance with lines and grades indicated. Start laying the pipeline at the low end and proceed upstream. Lay bell and spigot pipe with the bell end facing upstream. Lay pipe on a bed prepared by handwork, dug true to grade. Furnish firm bearing for pipe throughout it's entire length with bell holes provided at the ends of each pipe length of sufficient size to permit making up the particular type of joint being used. Adjust pipe to line and grade by scraping away or filling and tamping material under the body of the pipe for the entire pipe length and not by blocking or wedging. After final positioning, hold pipe in place in trench with backfill material placed equally on both sides of the pipe at as many locations as required to hold the pipe section in place.

F. Curved Alignment: When necessary to conform to the alignment specifically indicated, lay pipe on a curved alignment by means of asymmetrical closure of joints or bending of the pipe barrel. Use shorter lengths of pipe than the standard length if necessary to achieve curvature specified. Do not exceed the recommendations of the pipe manufacture for deflections at the joints or pipe bending.

G. Closure: Close open ends of pipes and appurtenance at the end of each days work or when work is not in progress.

3.2 SPECIAL PIPE COUPLINGS

A. General: Use where required to join piping and no other appropriate method is specified. Do not use instead of specified joining methods.

B. Installation: Per manufacturer's instructions.

3.3 TESTING OF GRAVITY PIPING MAINS

A. Obstructions: After backfilling and compacting, but before paving or other surface improvements, test sewer for obstructions either by rodding or by the sewer ball method. Provide for intercepting all grit, rocks and other flushed debris to keep debris from entering the existing system.

B. At the option of the Contractor, either the following hydrostatic or air test shall be

performed.

C. Hydrostatic Test:
   1. Test after backfilling to finish grade or pavement structural section subgrade in paved areas.
   2. Test sewer mains between successive manholes by closing the lower end of the sewer main to be tested and the inlet sewer main of the upper manhole with stoppers.
   3. Fill pipe and manholes with water to a point four feet below the ground surface of the upper manhole, but in no case less than four feet above the pipe invert. If ground water is present, the water surface at the upper manhole shall be at least four feet above the level of the ground water.
   4. Fill piping at least one hour prior to testing.
   5. Test piping at least two hours by maintaining the head specified above with measured additions of water. The sum of these additions of water, in the two-hour test period, shall be the leakage amount.
   6. The maximum allowable head of water above any portion of sewer being tested shall be 15-feet. Where the difference in elevation between successive manholes exceeds 15-feet, a test tee shall be installed between manholes, and the testing shall be carried on between the tee and the manhole.
   7. The allowable leakage shall not exceed 0.1-gallons per minute per inch diameter, per 1000-feet of sewer main being tested.
   8. If the leakage exceeds the above amount, determine the cause and remedy it prior to retesting.
   9. If the leakage is less than the allowable, but leaks are observed, repair the observed leaks.

D. Air Test:
   1. Test after backfilling to finish grade or pavement structural section subgrade in paved areas.
   2. Apply to each length between adjacent manholes.
   3. Supply pressure gauge with minimum divisions of 0.10-psi and with an accuracy of +/- 0.04-psi. When requested by the Owner, provide certification that the gauge has been tested for accuracy within the last six months by a reliable testing firm.
   4. Pressurize the test section to 3.5-psi, and then hold the pressure above 3.0-psi during a saturation period of at least 5 minutes. At the end of the saturation period, note the pressure, which must be a minimum of 3.0-psi, and begin the timed period. If the pressure drops 0.5-psi in less than the time given in the following table the section of pipe has not passed the test.

PipeSize	**Minimum Time Allowed for Pressure to Drop 0.5-PSI**
4”	125 seconds
6”	185 seconds
8”	245 seconds
10”	310 seconds
12”	370 seconds
15”	460 seconds
18”	555 seconds
21”	10 minutes
24”	12 minutes

27”	14 minutes
30”	16 minutes
36”	18 minutes
42”	20 minutes
48”	23 minutes
54”	26 minutes

5. If the time for the pressure to drop 0.5-psi is 125% or less of the time indicated, the line shall immediately be re-pressurized to 3.0-psi and the test repeated. If, during the 5-minute saturation period, the pressure drops less than 0.5-psi after the initial pressurization and air is not added, the section undergoing the test shall have passed.
6. If the test did not pass, find and repair the leak to the satisfaction of the Owner.
7. When the prevailing ground water is above the line being tested the air pressure shall be increased 0.43-psi for each foot the water table is above the invert of the pipe at the highest manhole.

3.4 TESTING OF LATERALS

A. At the option of the Contractor, either the following hydrostatic or air test shall be performed.

B. Hydrostatic Test:
   1. Test laterals before backfilling.
   2. Plug lateral at its ends and fill with water through the cleanouts.
   3. Maintain the water level in the cleanouts as high as possible throughout the test period.
   4. One hour after filling with water, examine the lateral for leakage.
   5. Repair all leaks to the satisfaction of the Owner.
   6. Do not backfill the trench until testing and repairs of the lateral are complete, and approved by the Owner.
   7. Following approval of the Owner, remove all plugs, dispose of the water and complete the connection to the main.

C. Air Test
   1. Test after backfilling to finish grade or pavement structural section subgrade in paved areas.
   2. Test in accordance with subsection above titled “Testing of Gravity Piping Mains,” paragraph titled “Air Test.”

END OF SECTION 33 30 00

PROJECT MANUAL

APPENDIX

for

Las Positas Temporary Faculty Village Modular Offices

GP PLYTANIUM® PLYWOOD

Specifications–Siding

Plytanium® plywood exterior siding is an exterior-grade panel that is ideal for siding applications from new home construction and remodeling to do-it-yourself projects.

Available Types & Sizes (Sized for 4′ x 8′)

Length (Minimum)	7′-11⅞″ (2.435 m)
Width (Minimum)	3′-11⅞″ (1.216 m)
Siding Types	T1-11 Reverse Board & Batten (RB & B) No Groove
Finish	Rough sawn or scratch sand
Groove Spacing	T1-11 – 4″ on-center or 8″ on-center RB & B – 12″ on-center

Building Code Performance Categories, Panel Thickness

- 11/32 CAT, 0.328″ (8.33 mm)
- 19/32 CAT, 0.578″ (14.68 mm)

Specifications

Length/Width Tolerance	+0, –1/16″ (+0, –1.6 mm), based on 4′ or 8′ value
Straightness Tolerance	±1/16″ (±1.6 mm)
Squareness Tolerance	±⅛″ (±3.2 mm)
Primary Species	Southern Yellow Pine
Testing Agency	APA®-The Engineered Wood Association
Classification	**Exterior** – Plywood suitable for repeated wetting and redrying or long-term exposure to weather and other conditions of similar severity.
Code Fire Classification	Class III or C
Flame Spread Rating	75-200, smoke-developed index <450
Building Code Compliance	PS 1-09

Other Information

Forestry Certification

Plytanium siding panels are made from Sustainable Forestry Initiative® (SFI®) certified responsible wood sources.

SUSTAINABLE FORESTRY INITIATIVE Certified Sourcing www.sfiprogram.org SFI-00007

Formaldehyde Emission

Plytanium siding panels contain no added urea formaldehyde resins. Emission levels for certified PS 1 structural panels are exempt by the California Air Resources Board (CARB) in the Composite Wood Air Toxic Control Measure (ATCM) and phenolic bonded structural panels are exempt from testing or monitoring by HUD in the Manufactured Home Construction and Safety Standards.

PLYTANIUM® PLYWOOD

Specifications–Siding

Manufacturing Locations

Location	APA Mill Number	Zip Code	Harvest Radius
Camden, TX	515	75934	90 miles
Corrigan, TX	516	75939	90 miles
Dudley, NC	348	28333	80 miles
Emporia, VA	230	23847	40 miles
Gurdon, AR	517	71743	60 miles
Madison, GA	404	30650	100 miles
Prosperity, SC	329	29127	80 miles
Taylorsville, MS	282	39168	50 miles

Georgia-Pacific

Georgia-Pacific Wood Products
133 Peachtree St., N.E.
Atlanta, GA 30303
800-284-5347 *www.builditbetter.com*

DSA 103-19: LISTING OF STRUCTURAL TESTS & SPECIAL INSPECTIONS, 2019 CBC

Application Number: 01-119031	**School Name:** Las Positas College	**School District:** Chabot Las Positas Community College District
DSA File Number:	**Increment Number:**	**Date Submitted:** 6/22/2020

2019 CBC

IMPORTANT: This form is only a summary list of structural tests and some of the special inspections required for the project. Generally, the structural tests and special inspections noted on this form are those that will be performed by the Geotechnical Engineer of Record, Laboratory of Record, or Special Inspector. The actual complete test and inspection program must be performed as detailed on the DSA approved documents. The appendix at the bottom of this form identifies work NOT subject to DSA requirements for special inspection or structural testing. The project inspector is responsible for providing inspection of all facets of construction, including but not limited to, special inspections not listed on this form such as structural wood framing, high-load wood diaphragms, cold-formed steel framing, anchorage of non-structural components, etc., per Title 24, Part 2, Chapter 17A (2019 CBC).

KEY TO COLUMNS

1. TYPE	2. PERFORMED BY
Continuous – Indicates that a continuous special inspection is required **Periodic –** Indicates that a periodic special inspection is required **Test –** Indicates that a test is required	**GE –** Indicates that the special inspection shall be performed by a registered geotechnical engineer or his or her authorized representative. **LOR –** Indicates that the test or special inspection shall be performed by a testing laboratory accepted in the DSA Laboratory Evaluation and Acceptance (LEA) Program. See CAC Section 4-335. **PI –** Indicates that the special inspection may be performed by a project inspector when specifically approved by DSA. **SI –** Indicates that the special inspection shall be performed by an appropriately qualified/approved special inspector.

****NOTE:** Undefined section and table references found in this document are from the CBC, or California Building Code.

DSA 103-19: LISTING OF STRUCTURAL TESTS & SPECIAL INSPECTIONS (SOILS), 2019 CBC

Application Number: 01-119031 **School Name:** Las Positas College **School District:** Chabot Las Positas Community College District

DSA File Number: **Increment Number:** **Date Submitted:** 6/22/2020

Geotechnical Reports: Project does NOT have and does NOT require a geotechnical report

	1. GENERAL:	Table 1705A.6		
	Test or Special Inspection	**Type**	**Performed By**	**Code References and Notes**
☑	**a.** Verify that: • Site has been prepared properly prior to placement of controlled fill and/or excavation s for foundations. • Foundation excavations are extended to proper depth and have reached proper material. • Materials below footings are adequate to achieve the design bearing capacity.	**See Notes**	**PI**	Refer to specific items identified in the Appendix listing exemptions for limitations. Placement of controlled fill exceeding 12" depth under foundations is not permitted without a geotechnical report.

	2. SOIL COMPACTION AND FILL:	Table 1705A.6		
	Test or Special Inspection	**Type**	**Performed By**	**Code References and Notes**
☐	**a.** Verify use of proper materials, densities and inspect lift thicknesses, placement and compaction during placement of fill.	**Continuous**	**LOR***	* Under the supervision of a geotechnical engineer or LOR's engineering manager. Refer to specific items identified in the Appendix listing exemptions for limitations.
☐	**b.** Compaction testing.	**Test**	**LOR***	* Under the supervision of a geotechnical engineer or LOR's engineering manager. Refer to specific items identified in the Appendix listing exemptions for limitations.

	3. DRIVEN DEEP FOUNDATIONS (PILES):	Table 1705A.7		
	Test or Special Inspection	**Type**	**Performed By**	**Code References and Notes**
☐	**a.** Verify pile materials, sizes and lengths comply with the requirements.	**Continuous**	**GE***	* By geotechnical engineer or his or her qualified representative.

☐	**b.** Determine capacities of test piles and conduct additional load tests as required.	**Test**	**LOR***	* Under the supervision of the geotechnical engineer.
☐	**c.** Inspect driving operations and maintain complete and accurate records for each pile.	**Continuous**	**GE***	* By geotechnical engineer or his or her qualified representative.
☐	**d.** Verify locations of piles and their plumbness, confirm type and size of hammer, record number of blows per foot of penetration, determine required penetrations to achieve design capacity, record tip and butt elevations and record any pile damage.	**Continuous**	**GE***	* By geotechnical engineer or his or her qualified representative.

	3. DRIVEN DEEP FOUNDATIONS (PILES):	**Table 1705A.7**		
	Test or Special Inspection	**Type**	**Performed By**	**Code References and Notes**
☐	**e.** Steel piles.	Provide tests and inspections per STEEL section below.		
☐	**f.** Concrete piles and concrete filled piles.	Provide tests and inspections per CONCRETE section below.		
☐	**g.** For specialty piles, perform additional inspections as determined by the registered design professional in responsible charge.	*	*	* As defined on drawings or specifications.

	4. CAST-IN-PLACE DEEP FOUNDATIONS (PIERS):	**Table 1705A.8**		
	Test or Special Inspection	**Type**	**Performed By**	**Code References and Notes**
☑	**a.** Inspect drilling operations and maintain complete and accurate records for each pier.	**Continuous**	**PI**	Continuous inspection to be provided by project inspector. Refer to specific items identified in the Appendix listing exemptions for limitations.
☑	**b.** Verify pier locations, diameters, plumbness and lengths. Record concrete or grout volumes.	**Continuous**	**PI**	Continuous inspection to be provided by project inspector. Refer to specific items identified in the Appendix listing exemptions for limitations.
☑	**c.** Concrete piers.	Provide tests and inspections per CONCRETE section below.		

	5. RETAINING WALLS:			
☐	**a.** Segmental retaining walls; inspect placement of units, dowels, connectors, etc.	**Continuous**	**GE***	* By geotechnical engineer or his or her qualified representative. See DSA IR 16-3.
☐	**b.** Placement of soil reinforcement, drainage devices and/or backfill.	**Continuous**	**GE***	Placement, compaction and inspection of backfill per Section **1705A.6.**1 for fills supporting foundations (Section 2 above). * By geotechnical engineer or his or her qualified representative.
☐	**c.** Concrete retaining walls.	Provide tests and inspections per CONCRETE section below.		
☐	**d.** Masonry retaining walls.	Provide tests and inspections per MASONRY section below.		

	6. OTHER SOILS:			
☐	**a.** Soil Improvements	**Test**	**GE***	Submit a comprehensive report documenting final soil improvements constructed, construction observation and the results of the confirmation testing and analysis to CGS for final acceptance. * By geotechnical engineer or his or her qualified representative.
☐	**b.** Inspection of Soil Improvements	**Continuous**	**GE***	* By geotechnical engineer or his or her qualified representative.
☐				

DSA 103-19: LISTING OF STRUCTURAL TESTS & SPECIAL INSPECTIONS (Concrete), 2019 CBC

Table 1705A.3; ACI 318-14 Sections 26.12 & 26.13

Application Number: 01-119031 **School Name:** Las Positas College **School District:** Chabot Las Positas Community College District

DSA File Number: **Increment Number:** **Date Submitted:** 6/22/2020

	7. CAST-IN-PLACE CONCRETE			
Material Verification and Testing:				
	Test or Special Inspection	**Type**	**Performed By**	**Code References and Notes**
☑	**a.** Verify use of required design mix.	**Periodic**	**SI**	**Table 1705A.3 Item 5, 1910A.1.**
☑	**b.** Identifiy, sample, and test reinforcing steel.	**Test**	**LOR**	**1910A.2;** ACI 318-14 Section 26.6.1.2; DSA IR 17-10. (See Appendix for exemptions.)
☑	**c.** During concrete placement, fabricate specimens for strength tests, perform slump and air content tests, and determine the temperature of the concrete.	**Test**	**LOR**	**Table 1705A.3 Item 6**; ACI 318-14 Sections 26.5 & 26.12.
☑	**d.** Test concrete (f'_c).	**Test**	**LOR**	**1905A.1.15;** ACI 318-14 Section 26.12.
Inspection:				
☑	**e.** Batch plant inspection: **Periodic**	**See Notes**	**SI**	Default of **'Continuous'** per **1705A.3.3**. If approved by DSA, batch plant inspection may be reduced to **'Periodic'** subject to requirements in Section **1705A.3.3.1,** or eliminated per **1705A.3.3.2.** (See Appendix for exemptions.)
☑	**f.** Welding of reinforcing steel.	Provide special inspection per STEEL, Category 19.1(d) & (e) and/or 19.2(g) & (h) below.		

	8. PRESTRESSED / POST-TENSIONED CONCRETE (in addition to Cast-in-Place Concrete tests and inspections):			
	Test or Special Inspection	**Type**	**Performed By**	**Code References and Notes**
☐	**a.** Sample and test prestressing tendons and anchorages.	**Test**	**LOR**	**1705A.3.4, 1910A.3**
☐	**b.** Inspect placement of prestressing tendons.	**Periodic**	**SI**	**1705A.3.4, Table 1705A.3 Items 1 & 9.**

☐	**c.** Verify in-situ concrete strength prior to stressing of post-tensioning tendons.	**Periodic**	**SI**	**Table 1705A.3 Item 11.** Special inspector to verify specified concrete strength test prior to stressing.
☐	**d.** Inspect application of post-tensioning or prestressing forces and grouting of bonded prestressing tendons.	**Continuous**	**SI**	**1705A.3.4, Table 1705A.3 Item 9;** ACI 318-14 Section 26.13

	9. PRECAST CONCRETE (in addition to Cast-in-Place Concrete tests and inspections):			
	Test or Special Inspection	**Type**	**Performed By**	**Code References and Notes**
☐	**a.** Inspect fabrication of precast concrete members.	**Continuous**	**SI**	ACI 318-14 Section 26.13.
☐	**b.** Inspect erection of precast concrete members.	**Periodic**	**SI***	**Table 1705A.3 Item 10.** * May be performed by PI when specifically approved by DSA.

	10. SHOTCRETE (in addition to Cast-in-Place Concrete tests and inspections):			
	Test or Special Inspection	**Type**	**Performed By**	**Code References and Notes**
☐	**a.** Inspect shotcrete placement for proper application techniques.	**Continuous**	**SI**	**1705A.19, Table 1705A.3 Item 7, 1908A.6, 1908A.7, 1908A.8, 1908A.9, 1908A.11, 1908A.12.** See ACI 506.2-13 Section 3.4, ACI 506R-16.
☐	**b.** Sample and test shotcrete (f'_c).	**Test**	**LOR**	**1908A.5, 1908A.10.**

	11. POST-INSTALLED ANCHORS:			
	Test or Special Inspection	**Type**	**Performed By**	**Code References and Notes**
☐	**a.** Inspect installation of post-installed anchors	**See Notes**	**SI***	**1617A.1.19, Table 1705A.3 Item 4a (Continuous) & 4b (Periodic), 1705A.3.8** (See Appendix for exemptions). ACI 318-14

				Sections 17.8 & 26.13. * May be performed by the project inspector when specifically approved by DSA.
☐	**b.** Test post-installed anchors.	**Test**	**LOR**	**1910A.5.** (See Appendix for exemptions.)

	12. OTHER CONCRETE:			
	Test or Special Inspection	**Type**	**Performed By**	**Code References and Notes**
☐				

DSA 103-19: LISTING OF STRUCTURAL TESTS & SPECIAL INSPECTIONS (Steel and Aluminum), 2019 CBC

1705A.2.1, Table 1705A.2.1; AISC 303-16, AISC 341-16, AISC 358-16, AISC 360-16; AISI S100-16

Application Number: 01-119031 **School Name:** Las Positas College **School District:** Chabot Las Positas Community College District

DSA File Number: **Increment Number:** **Date Submitted:** 6/22/2020

	17. STRUCTURAL STEEL, COLD-FORMED STEEL AND ALUMINUM USED FOR STRUCTURAL PURPOSES			
Material Verification and Testing:				
	Test or Special Inspection	**Type**	**Performed By**	**Code References and Notes**
☑	**a.** Verify identification of all materials and: • Mill certificates indicate material properties that comply with requirements. • Material sizes, types and grades comply with requirements.	**Periodic**	*	**Table 1705A.2.1 Item 3a–3c.** 2202A.1**;** AISI S100-16 Section A3.1 & A3.2, AISI S240-15 Section A3 & A5, AISI S220-15 Sections A4 & A6. * By special inspector or qualified technician when performed off-site.
☑	**b.** Test unidentified materials	**Test**	**LOR**	**2202A.1.**
☐	**c.** Examine seam welds of HSS shapes	**Periodic**	**SI**	DSA IR 17-3.
Inspection:				
☑	**d.** Verify and document steel fabrication per DSA-approved construction documents.	**Periodic**	**SI**	Not applicable to cold-formed steel light-frame construction, except for trusses (**1705A.2.4**).

	18. HIGH-STRENGTH BOLTS: RCSC 2014			
Material Verification and Testing of High-Strength Bolts, Nuts and Washers:				
	Test or Special Inspection	**Type**	**Performed By**	**Code References and Notes**
☐	**a.** Verify identification markings and manufacturer's certificates of compliance conform to ASTM standards specified in the DSA-approved documents.	**Periodic**	**SI**	**Table 1705A.2.1 Items 1a & 1b, 2202A.1;** AISC 360-16 Section A3.3, J3.1, and N3.2; RCSC 2014 Section 1.5 & 2.1; DSA IR 17-8 & DSA IR 17-9.
☐	**b.** Test high-strength bolts, nuts and washers.	**Test**	**LOR**	**Table 1705A.2.1 Item 1c, 2213A.1**; RCSC 2014 Section 7.2; DSA IR 17-8.
Inspection of High-Strength Bolt Installation:				

☐	**c.** Bearing-type ("snug tight") connections.	**Periodic**	**SI**	**Table 1705A.2.1 Item 2a, 1705A.2.6, 2204A.2**; AISC 360-16 J3.1, J3.2, M2.5 & N5.6; RCSC 2014 Section 9.1; DSA IR 17-9.
☐	**d.** Pretensioned and slip-critical connections.	*	**SI**	**Table 1705A.2.1 Items 2b & 2c, 1705A.2.6, 2204A.2;** AISC 360-16 J3.1, J3.2, M2.5 & N5.6; RCSC 2014 Sections 9.2 & 9.3; DSA IR 17-9. * "Continuous" or "Periodic" depends on the tightening method used.

	19. WELDING:	**1705A.2.5, Table 1705A.2.1 Items 4 & 5;** AWS D1.1 and AWS D1.8 for structural steel; AWS D1.2 for Aluminum; AWS D1.3 for cold-formed steel; AWS D1.4 for reinforcing steel; DSA IR 17-3 (See Appendix for exemptions.)		
Verification of Materials, Equipment, Welders, etc.:				
	Test or Special Inspection	**Type**	**Performed By**	**Code References and Notes**
☑	**a.** Verify weld filler material identification markings per AWS designation listed on the DSA-approved documents and the WPS.	**Periodic**	**SI**	DSA IR 17-3.
☑	**b.** Verify weld filler material manufacturer's certificate of compliance.	**Periodic**	**SI**	DSA IR 17-3.
☑	**c.** Verify WPS, welder qualifications and equipment.	**Periodic**	**SI**	DSA IR 17-3.
	19.1 SHOP WELDING:			
	Test or Special Inspection	**Type**	**Performed By**	**Code References and Notes**
☑	**a.** Inspect groove welds, multi-pass fillet welds, single pass fillet welds > 5/16", plug and slot welds.	**Continuous**	**SI**	**Table 1705A.2.1 Items 5a.1–4;** AISC 360-16 (and AISC 341-16 as applicable); DSA IR 17-3.
☑	**b.** Inspect single-pass fillet welds ≤ 5/16", floor and roof deck welds.	**Periodic**	**SI**	**1705A.2.2, Table 1705A.2.1 Items 5a.5 & 5a.6;** AISC 360-16 (and AISC 341-16 as applicable); DSA IR 17-3.
☐	**c.** Inspect welding of stairs and railing systems.	**Periodic**	**SI**	**1705A.2.1**; AISC 360-16 (and AISC 341-16 as applicable); AWS D1.1 & D1.3; DSA IR 17-3.

☑	**d.** Verification of reinforcing steel weldability other than ASTM A706.	**Periodic**	**SI**	**1705A.3.1**; AWS D1.4; DSA IR 17-3. Verify carbon equivalent reported on mill certificates.
☑	**e.** Inspect welding of reinforcing steel.	**Continuous**	**SI**	**Table 1705A.2.1 Item 5b, 1705A.3.1, Table 1705A.3 Item 2, 1903A.8;** AWS D1.4; DSA IR 17-3.
	19.2 FIELD WELDING:			
	Test or Special Inspection	**Type**	**Performed By**	**Code References and Notes**
☐	**a.** Inspect groove welds, multi-pass fillet welds, single pass fillet welds > 5/16", plug and slot welds.	**Continuous**	**SI**	**Table 1705A.2.1 Items 5a.1–4;** AISC 360-16 (AISC 341-16 as applicable); DSA IR 17-3.
☐	**b.** Inspect single-pass fillet welds ≤ 5/16”.	**Periodic**	**SI**	**Table 1705A.2.1 Item 5a.5;** AISC 360-16 (AISC 341-16 as applicable); DSA IR 17-3.
☐	**c.** Inspect end-welded studs (ASTM A-108) installation (including bend test).	**Periodic**	**SI**	**2213A.2**; AISC 360-16 (AISC 341-16 as applicable); AWS D1.1; DSA IR 17-3.
☐	**d.** Inspect floor and roof deck welds.	**Periodic**	**SI**	**1705A.2.2, Table 1705A.2.1 Item 5a.6;** AISC 360-16 (AISC 341-16 as applicable); AWS D1.3; DSA IR 17-3.
☐	**e.** Inspect welding of structural cold-formed steel.	**Periodic**	**SI***	**1705A.2.5; AWS D1.3; DSA IR 17-3.** The quality control provisions of AISI S240-15 Chapter D shall also apply. * May be performed by the project inspector when specifically approved by DSA.
☐	**f.** Inspect welding of stairs and railing systems.	**Periodic**	**SI***	**1705A.2.1;** AISC 360-16 (AISC 341-16 as applicable); AWS D1.1 & D1.3; DSA IR 17-3. * May be performed by the project inspector when specifically approved by DSA.
☐	**g.** Verification of reinforcing steel weldability.	**Periodic**	**SI**	**1705A.3.1**; AWS D1.4; DSA IR 17-3. Verify carbon equivalent reported on mill certificates.
☐	**h.** Inspect welding of reinforcing steel.	**Continuous**	**SI**	**Table 1705A.2.1 Item 5b, 1705A.3.1, Table 1705A.3 Item 2, 1903A.8;** AWS D1.4; DSA IR 17-3.

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	20. NONDESTRUCTIVE TESTING: 1705A.2.1, Table 1705A.2.1; AISC 303-16, AISC 341-16, AISC 358-16, AISC 360-16; AISI S100-16			
	Test or Special Inspection	**Type**	**Performed By**	**Code References and Notes**
☐	**a.** Ultrasonic	**Test**	**LOR**	**1705A.2.1, 1705A.2.5;** AISC 341-16 J6.2, AISC 360-16 N5.5; ANSI/ASNT CP-189, SNT-TC-1A; AWS D1.1, AWS D1.8; DSA IR 17-2.
☐	**b.** Magnetic Particle	**Test**	**LOR**	**1705A.2.1, 1705A.2.5;** AISC 341-16 J6.2, AISC 360-16 N5.5; ANSI/ASNT CP-189, SNT-TC-1A; AWS D1.1, AWS D1.8; DSA IR 17-2.
☐				

	21. STEEL JOISTS AND TRUSSES: 1705A.2.1, Table 1705A.2.1; AISC 303-16, AISC 341-16, AISC 358-16, AISC 360-16; AISI S100-16			
	Test or Special Inspection	**Type**	**Performed By**	**Code References and Notes**
☐	**a.** Verify size, type and grade for all chord and web members as well as connectors and weld filler material; verify joist profile, dimensions and camber (if applicable); verify all weld locations, lengths and profiles; mark or tag each joist.	**Continuous**	**SI**	**1705A.2.3, Table 1705A.2.3;** AWS D1.1; DSA IR 22-3 for steel joists only. **1705A.2.4;** AWS D1.3 for cold-formed steel trusses.

	22. SPRAY APPLIED FIRE-PROOFING: 1705A.2.1, Table 1705A.2.1; AISC 303-16, AISC 341-16, AISC 358-16, AISC 360-16; AISI S100-16			
	Test or Special Inspection	**Type**	**Performed By**	**Code References and Notes**

☐	**a.** Examine structural steel surface conditions, inspect application, take samples, measure thickness and verify compliance of all aspects of application with DSA-approved documents.	**Periodic**	**SI**	**1705A.14.**
☐	**b.** Test bond strength.	**Test**	**LOR**	**1705A.14.6.**
☐	**c.** Test density.	**Test**	**LOR**	**1705A.14.5.**

	23. ANCHOR BOLTS AND ANCHOR RODS:			
☑	**a.** Anchor Bolts and Anchor Rods	**Test**	**LOR**	Sample and test anchor bolts and anchor rods not readily identifiable per procedures noted in DSA IR 17-11.
☐	**b.** Threaded rod not used for foundation anchorage.	**Test**	**LOR**	Sample and test threaded rods not readily identifiable per procedures noted in DSA IR 17-11.

	23.1 OTHER STEEL:			
	Test or Special Inspection	**Type**	**Performed By**	**Code References and Notes**
☐				

	24. PREFABRICATED WOOD STRUCTURAL ELEMENTS: Section 1705A.5			
	Test or Special Inspection	**Type**	**Performed By**	**Code References and Notes**
☐	a. Inspect fabrication of structural glued-laminated timber.*	Continuous	SI	* See 1705A.5.4 for exceptions
☐	b. Inspect fabrication of manufactured open-web trusses.	Continuous	SI	**1705A.5.5;** DSA IR 23-8.
☐	c. Inspect fabrication of manufactured metal-plate-connected trusses.	Continuous	SI	**1705A.5, 1705A.5.2;** DSA IR 23-4.

	25. OTHER Wood:			
	Test or Special Inspection	**Type**	**Performed By**	**Code References and Notes**
☐				

Appendix: Work Exempt from DSA Requirements for Structural Tests / Special Inspections

Application Number: 01-119031 | **School Name:** Las Positas College | **School District:** Chabot Las Positas Community College District

DSA File Number: | **Increment Number:** | **Date Submitted:** 6/22/2020

Exempt items given in DSA IR A-22 or the 2019 CBC (including DSA amendments) and those items identified below with an "X" by the design professional are NOT subject to DSA requirements for the structural tests / special inspections noted. **Items marked as exempt shall be identified on the approved construction documents**. The project inspector shall verify all construction complies with the approved construction documents.

	SOILS:
☐	1. Deep foundations acting as a cantilever footing designed based on minimum allowable pressures per CBC Table 1806A.2 and having no geotechnical report for the following cases: A) free standing sign or scoreboard, B) cell or antenna towers and poles less than 35'-0" tall (e.g., lighting poles, flag poles, poles supporting open mesh fences, etc.), C) single-story structure with dead load less than 5 psf (e.g., open fabric shade structure), or D) covered walkway structure with an apex height less than 10'-0" above adjacent grade.
☐	2. Shallow foundations, etc. are exempt from special inspections and testing by a Geotechnical Engineer for the following cases: A) buildings without a geotechnical report and meeting the exception Item #1 criteria in CBC Section 1803A.2 supported by native soil (any excavation depth) or fill soil (not exceeding 12" depth per CBC, Section 1804A.6), B) soil scarification/recompaction not exceeding 12" depth, C) native or fill soil supporting exterior non-structural flatwork (e.g., sidewalks, site concrete ramps, site stairs, parking lots, driveways, etc.), D) unpaved landscaping and playground areas, or E) utility trench backfill.

	CONCRETE/MASONRY:
☐	1. Post-installed anchors for the following: A) exempt non-structural components (e.g., mechanical, electrical, plumbing equipment - see Item 7 for "Welding") given in CBC Section 1617A.1.18 (which replaces ASCE 7-16, Section 13.1.4) or B) interior nonstructural wall partitions meeting criteria listed in exempt Item 3 for "Welding."
☑	2. Concrete batch plant inspection is not required for items given in CBC Section 1705A.3.3.2 subject to the requirements and limitations in that section.
☐	3. Non-bearing non-shear masonry walls may be exempt from certain DSA masonry testing and special inspection items as allowed per DSA IR 21-1. Refer to construction documents for specific exemptions accordingly for each applicable wall condition.
☐	4. Epoxy shear dowels in site flatwork and/or other non-structural concrete.
☑	5. Testing of reinforcing bars is not required for items given in CBC Section 1910A.2 subject to the requirements and limitations in that section.

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	Welding:
☐	1. Solid-clad and open-mesh gates with maximum leaf span or rolling section for rolling gates of 10' and apex height less than 8’-0” above lowest adjacent grade. When located above circulation or occupied space below, these gates are not located within 1.5x gate/fence height (max 8'-0") to the edge of floor or roof.
☐	2. Handrails, guardrails and modular or relocatable ramps associated with walking surfaces less than 30” above adjacent grade (excluding post base connections per the 'Exception' language in Section 1705A.2.1); fillet welds shall not be ground flush.
☐	3. Non-structural interior cold-formed steel framing spanning less than 15'-0", such as in interior partitions, interior soffits, etc. supporting only self weight and light-weight finishes or adhered tile, masonry, stone, or terra cotta veneer no more than 5/8" thickness and apex less than 20'-0" in height and not over an exit way. Maximum tributary load to a member shall not exceed the equivalent of that occurring from a 10'x10' opening in a 15' tall wall for a header or king stud.
☐	4. Manufactured support frames and curbs using hot rolled or cold-formed steel (i.e., light gauge) for mechanical, electrical, or plumbing equipment weighing less than 2000# (equipment only) (connections of such frames to superstructure elements using welding will require special inspection as noted in selected item(s) for Sections 19, 19.1 and/or 19.2 of listing above).
☐	5. Manufactured components (e.g., Tolco, B-Line, Afcon, etc.) for mechanical, electrical, or plumbing hanger support and bracing (connections of such components to superstructure elements using welding will require special inspection as noted in selected item(s) for Sections 19, 19.1 and/or 19.2 of listing above).
☐	6. TV Brackets, projector mounts with a valid listing (see DSA IR A-5) and recreational equipment (e.g., playground structures, basketball backstops, etc.) (connections of such elements to superstructure elements using welding will require special inspection as noted in selected item(s) for section 19, 19.1 and/or 19.2 located in the Steel/Aluminum category).
☐	7. Any support for exempt non-structural components given in CBC Section 1617A.1.18 (which replaces ASCE 7-16, Section 13.1.4) meeting the following: A) when supported on a floor/roof, <400# and resulting composite center of mass (including component's center of mass) $\leq$4' above supporting floor/roof, B) when hung from a wall or roof/floor, <20# for discrete units or <5 plf for distributed systems.

DSA 103-19: LISTING OF STRUCTURAL TESTS & SPECIAL INSPECTIONS (SIGNATURE), 2019 CBC

Application Number: 01-119031 **School Name:** Las Positas College **School District:** Chabot Las Positas Community College District

DSA File Number: **Increment Number:** **Date Submitted:** 6/22/2020

Name of Architect or Engineer in general responsible charge:

Name of Structural Engineer (When structural design has been delegated):

Justin Fahey

Signature of Architect or Structural Engineer: Date: 06/22/2020

Note: To facilitate DSA electronic mark-ups and identification stamp application, DSA recommends against using secured electronic or digital signatures.

DSA STAMP

IDENTIFICATION STAMP
DIV. OF THE STATE ARCHITECT
APP: 01-119031 INC:
REVIEWED FOR
SS ☑ FLS ☐ ACS ☐
DATE: 10/22/2020

DSA 103-19: LIST OF REQUIRED VERIFIED REPORTS, 2019 CBC

Application Number: 01-119031	**School Name:** Las Positas College	**School District:** Chabot Las Positas Community College District
DSA File Number:	**Increment Number:**	**Date Submitted:** 6/22/2020

1. Structural Testing and Inspection: Laboratory Verified Report Form DSA 291
2. Concrete Batch Plant Inspection: Laboratory Verified Report Form DSA 291
3. Shop Welding Inspection: Laboratory Verified Report Form DSA 291, or, for independently contracting SI, Special Inspection Verified Report Form DSA 292